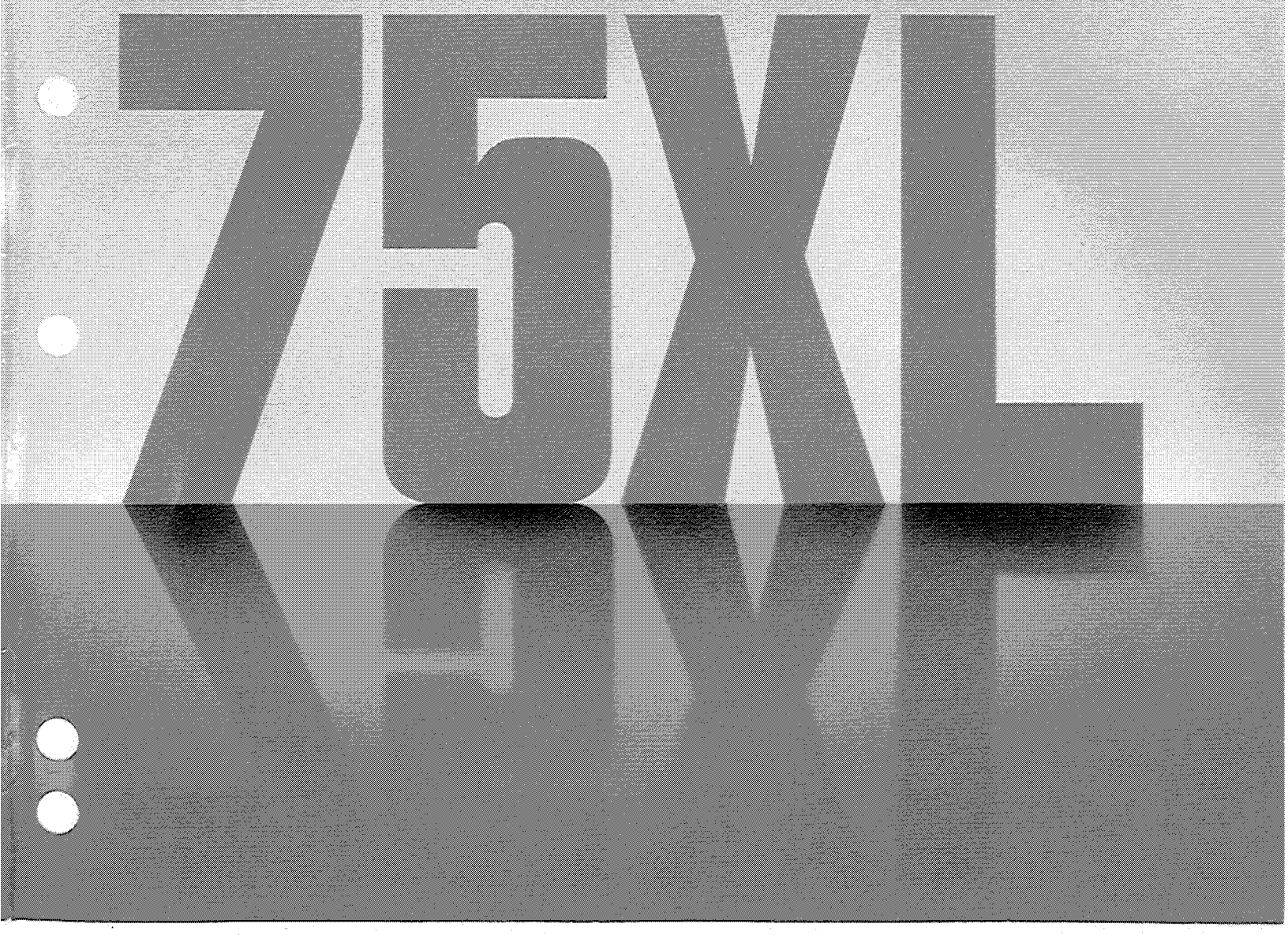
just imagine
NEC MULTIMEDIA

NEC

75XL SERIES

4-BIT SINGLE-CHIP MICROCONTROLLER

Selection Guide, Version 3



The μPD754144, 754244, and 754264 are manufactured and sold under a license contact with CP8 Transac corporation with respect to patents on on-chip EEPROM microprocessors. The μPD754144, 754244, and 754264 cannot be used in IC cards (SMART CARDS).

EEPROM is a trademark of NEC Corporation.
MS-DOS and Windows are either registered trademarks or trademarks of Microsoft Corporation in the United States and/or other countries.
IBM DOS, PC/AT, and PC DOS are trademarks of International Business Machines Corporation.

The export of this product from Japan is regulated by the Japanese government. To export this product may be prohibited without governmental license, the need for which must be judged by the customer. The export or re-export of this product from a country other than Japan may also be prohibited without a license from that country. Please call an NEC sales representative.

The application circuits and their parameters are for references only and are not intended for use in actual design-in's.

The information in this document is based on documents issued in June, 1996 at the latest. The information is subject to change without notice. For actual design-in, refer to the latest publications of data sheet, etc., for the most up-to-date specifications of the device.

No part of this document may be copied or reproduced in any form or by any means without the prior written consent of NEC Corporation. NEC Corporation assumes no responsibility for any errors which may appear in this document.

NEC Corporation does not assume any liability for infringement of patents, copyrights or other intellectual property rights of third parties by or arising from use of a device described herein or any other liability arising from use of such device. No license, either express, implied or otherwise, is granted under any patents, copyrights or other intellectual property rights of NEC Corporation or others.

While NEC Corporation has been making continuous effort to enhance the reliability of its semiconductor devices, the possibility of defects cannot be eliminated entirely. To minimize risks of damage or injury to persons or property arising from a defect in an NEC semiconductor device, customers must incorporate sufficient safety measures in its design, such as redundancy, fire-containment, and anti-failure features.

NEC devices are classified into the following three quality grades:

"Standard", "Special", and "Specific". The Specific quality grade applies only to devices developed based on a customer designated "quality assurance program" for a specific application. The recommended applications of a device depend on its quality grade, as indicated below. Customers must check the quality grade of each device before using it in a particular application.

- Standard: Computers, office equipment, communications equipment, test and measurement equipment, audio and visual equipment, home electronic appliances, machine tools, personal electronic equipment and industrial robots
- Special: Transportation equipment (automobiles, trains, ships, etc.), traffic control systems, anti-disaster systems, anti-crime systems, safety equipment and medical equipment (not specifically designed for life support)
- Specific: Aircrafts, aerospace equipment, submersible repeaters, nuclear reactor control systems, life support systems or medical equipment for life support, etc.

The quality grade of NEC devices is "Standard" unless otherwise specified in NEC's Data Sheets or Data Books. If customers intend to use NEC devices for applications other than those specified for Standard quality grade, they should contact an NEC sales representative in advance.

Anti-radioactive design is not implemented in this product.

PREFACE

Since 1973 when NEC developed μCOM-4, Japan's first 4-bit single-chip microcontroller, NEC has continued to be an industry pioneer by marketing original, higher performance products. We have produced the μCOM-43 Series, μPD7500 Series, and 75X Series. Of these, the 75X Series has product groups covering about 60 products. Moreover, product development and preparation responded to the demands of customers from a variety of fields.

The 75XL Series was marketed as a 4-bit single-chip microcontroller for the future capable of inheriting the software assets used previously by the customers, and as an upward compatible CPU core.

The 75XL Series is a 4-bit microcontroller achieving high speed operation at low voltages and operation functions rivaling those of 8-bit microcontrollers.

This document introduces the features, product line, and development tools of the 75XL Series.

[MEMO]

CONTENTS

1. 75XL SERIES PRODUCT ORGANIZATION 1

2. 75XL SERIES FEATURES 3
   2.1 Hardware Features 4
   2.2 Software Features 5

3. 75XL SERIES PRODUCT DEVELOPMENT 6
   3.1 75XL Series Product List 8
   3.2 Product Map (ROM development) 9

4. APPLICATIONS FIELDS OF 75XL SERIES 10

5. 75XL SERIES PRODUCTS 11
   5.1 General-Purpose Series (μPD7500××) 12
   5.2 General-Purpose Series with RC Oscillator 15
   5.3 General-Purpose Series with On-Chip A/D Converter (μPD75006×) 18
   5.4 LCD Driver Series (μPD7530××, 7530××A) 21
   5.5 LCD Driver Series with On-Chip A/D Converter (μPD75303×) 24
   5.6 LCD Driver Series (Small-size) (μPD7531××) 27
   5.7 LCD Driver Series (Small-size) (μPD7532××) 30
   5.8 Keyless Entry Series (μPD7541××, 7542××) 33
   5.9 General-Purpose Small-Size Series (μPD7543××) 38

6. 75XL SERIES INSTRUCTION SET 41

7. 75XL SERIES APPLICATION EXAMPLES 49

8. 75XL SERIES DEVELOPMENT TOOLS 52
   8.1 Debugging Tools 53
      8.1.1 In-circuit emulator 53
      8.1.2 Development tool list 55
   8.2 Language Processor 57
   8.3 PROM Writing Tools 59
      8.3.1 PROM programmer 59
      8.3.2 PROM programmer adapter list 60
   8.4 Operating Systems for the IBM PC 60

9. 75XL SERIES DOCUMENT LIST 61
   9.1 Common 75XL Series Document 61
   9.2 Individual Document 61
   9.3 Development Tool Related Documents (User's Manual) 64

9.3.1 Hardware 64
9.3.2 Software 64

10. PROCEDURE FOR ORDERING MASK ROMS 65

1. 75XL SERIES PRODUCT ORGANIZATION

Subseries	Type number	Main features
μPD750008 subseries	μPD750004 μPD750006 μPD750008 μPD75P0016	General-purpose products in 42/44-pin package • μPD75008 subseries upward compatible One timer channel added Watchdog timer can be used High-speed operation at low voltages Improved operating functions and data lookup functions, etc.
μPD750068 subseries	μPD750064 μPD750066 μPD750068 μPD75P0076	General-purpose product with on-chip A/D converter in 42-pin package • μPD75068 subseries upward compatible One timer channel added Watchdog timer can be used High-speed operation at low-voltage Improved operating functions and data lookup functions, etc. • A/D converter = 8-bit resolution × 8 channels
μPD750108 subseries	μPD750104 μPD750106 μPD750108 μPD75P0116	General-purpose products in 42/44-pin package • μPD75008 subseries upward compatible On-chip RC oscillation circuit One timer channel added Watchdog timer can be used High speed operation at low voltages Improved operating functions and data lookup functions, etc.
μPD753017 subseries	μPD753012 μPD753016 μPD753017 μPD75P3018 μPD753012A μPD753016A μPD753017A μPD75P3018A	On-chip LCD controller/driver in 80-pin package • μPD75316B subseries upward compatible Two timer channels added Watchdog timer can be used High-speed operation at low voltages Improved operating functions and data lookup functions, etc. • LCD panel (maximum size) = 32 segments × 4 commons
μPD753036 subseries	μPD753036 μPD75P3036	Product with on-chip LCD controller/driver and A/D converter in 80-pin package • μPD75336 subseries upward compatible One timer channel added Watchdog timer can be used High-speed operation at low-voltage Improved operating functions and data lookup functions, etc. • LCD panel (maximum size) = 20 segments × 4 commons • A/D converter = 8-bit resolution × 8 channels
μPD753108 subseries	μPD753104 μPD753106 μPD753108 μPD75P3116	On-chip LCD controller/driver in 64-pin package • Timer: 5 channels • Watchdog timer can be used • Power-supply voltage: V_{DD} = 1.8 to 5.5 V • 8-bit addition, subtraction, transfer, comparison, increment, and decrement possible • LCD panel (maximum size) = 24 segments × 4 commons

Subseries	Type number	Main features
μPD753208 subseries	μPD753204 μPD753206 μPD753208 μPD75P3216	Product with on-chip LCD controller/driver in 48-pin package • Timer: 5 channels • Watchdog timer can be used • Power-supply voltage: V_{DD} = 1.8 to 5.5 V • 8-bit addition, subtraction, transfer, comparison, increment, and decrement possible • LCD panel (maximum size) = 12 segments × 4 commons
μPD754244 subseries	μPD754144 μPD754244 μPD754264 **Note** μPD754202	Product for keyless entries in 20-pin package • Timer: 4 channels • Watchdog timer can be used • Power-supply voltage: V_{DD} = 1.8 to 6.0 V • 8-bit addition, subtraction, transfer, comparison, increment, and decrement possible • EEPROM™ : 16 bytes (μPD754144, 754244) 32 bytes (μPD754264)
μPD754304 subseries	μPD754302 μPD754304 μPD75P4308	General-purpose small-size product in 36-pin package • Timer: 3 channels • Watchdog timer can be used • Power-supply voltage: V_{DD} = 1.8 to 5.5 V • 8-bit addition, subtraction, transfer, comparison, increment, and decrement possible

Note Under development

2. 75XL SERIES FEATURES

(1) High-speed operation at low voltages

The CPU core of the 75XL Series can operate in the wide power-supply voltage range of V_{DD} = 1.8 to 5.5 V. One instruction execution times are fast as shown below.

- 0.95 μs (V_{DD} = 1.8 V, @ 4.19 MHz operation)
- 0.67 μs (V_{DD} = 2.7 V, @ 6.0 MHz operation)

(2) Maintaining software compatibility with 75X Series

The 75X Series had three CPU cores, one each for low end, standard, and high end use. Porting software between these CPUs demanded attention be given to the instruction set supported by each CPU. In the 75XL Series, however, the high end CPU core in the 75X Series became the only CPU core. Therefore, compatibility with the array of 75X Series software developed previously is maintained in the 75XL Series.

(3) Systematization of memory having outstanding cost/performance

The ROM capacity can be selected based on the program size.

(4) Dual clock operation

Two oscillators are provided on the chip for the main system clock (max. 6.0 MHz) capable of high-speed operation similar to a portion of 75X Series products and the subsystem clock (32.768 kHz) for low-power consumption operation. Therefore, the system clock can be switched by the program to match the use. (However, this is limited to products with the subsystem clock.)

2.1 Hardware Features

<1> Program memory

Program memory can be expanded to a maximum of 64K × 8 bits. In addition, table data can be referenced using the table lookup instruction (MOVT).

<2> Data memory

Data memory can be expanded to a maximum of 16 banks, where one bank is 256 × 4 bits. As with program memory, this is planned in designing the Series. The data memory space is allocated into the following 5 regions.

a. Static RAM
b. General purpose registers
c. Stack area
d. I/O ports
e. Peripheral hardware (timers, SIO, interrupts, etc.)

<3> General-purpose registers

General-purpose registers in the 75XL can be configured on chip into a maximum of 4 banks from the eight 4-bit registers of X, A, B, C, D, E, H, and L. They are mapped into the data memory and can be operated by general -purpose register manipulation instructions and data memory manipulation instructions.

XA, BC, DE, and HL form register pairs and can be manipulated as 8-bit data. In addition to the DE and HL register pairs, a DL register pair can also be formed. These three groups can be used as data pointers.

The optimum number of register banks are configured on chip in each product.

<4> High-speed operation and low-power consumption

In the 75XL Series, an instruction cycle of 0.67 μs can be achieved as the fastest processing speed. Since an instruction cycle can be changed by program control, applications like switching during low-speed operation when the power-supply voltage drops become possible.

The two standby modes are HALT and STOP. Intermittent operation becomes possible because CPU operation is stopped by either mode in a program and can be resumed by an interrupt signal.

In products with an on-chip subsystem clock, intermittent operation is also possible in the low-power consumption mode.

<5> Interrupt functions

The interrupt vector table in the 75XL Series can specify a maximum of 7 interrupts. Each one can have two interrupt sources. Thus, a maximum of 14 interrupt sources can be installed. The optimum interrupt sources are configured in each product.

In models loaded with multiple on-chip register banks, a function is provided to automatically switch register banks during vectored interrupt operations. Register save and return do not have to be performed in an interrupt processing routine.

In the 75XL Series, the number of interrupt sources and the responsiveness to interrupts are improved.

<6> Expandability of on-chip peripheral hardware

By adopting memory-mapped I/O in the 75XL Series, the CPU and the peripheral hardware are independent. Therefore, peripheral hardware having a variety of functions can be installed only when needed.

2.2 Software Features

<1> Addressing modes and accumulators

Since peripheral hardware is mapped to the data memory space in the 75XL Series, instruction descriptions center on general-purpose registers and data memory. General-purpose registers can be specified in 4-bit units or 8-bit units as described earlier. In contrast, data memory can be addressed in 1-bit, 4-bit, or 8-bit units.

As for accumulators, where data processing is concentrated, three types each of the CY flag (bit accumulator), the A register (4-bit accumulator), and the XA (8-bit accumulator) are provided for each bit lengths. Therefore, the program can be freely described to match the bit length of the processed data.

<2> Instruction set features

a. 8-bit processing instructions

Transfers, comparisons, operations, incrementing, and decrementing are the available 8-bit instructions in the 75XL Series. The data processing can rival that of 8-bit microcontroller.

b. 1-bit processing instructions

In the 75XL Series, a bit address is directly specified and can be set, cleared, and tested. Therefore, programs are easy to understand and can be concisely described. In addition, by using the carry flag as a bit accumulator, the Boolean operations of AND, OR, and XOR can be performed between specified bits. As a result, concise descriptions are possible in accordance with logic even in complex decision processing. Simultaneously, the load on the program is lessened and program execution becomes efficient.

c. GETI instruction

The GETI instruction in the 75XL Series pre-defines any 2-byte or 3-byte instruction in a table and then executes them by reading a 1-byte GETI instruction. A total of 48 instructions can be defined. If this GETI instruction is effectively used, the program size can be dramatically decreased.

3. 75XL SERIES PRODUCT DEVELOPMENT

- General-purpose series (μPD7500××)
- General-purpose series with on-chip RC oscillation circuit (μPD7501××)
- General-purpose series with on-chip A/D converter (μPD75006×)
- LCD driver series(μPD7530××, 7530××A)
- LCD driver series with on-chip A/D converter (μPD75303×)
- LCD driver series (small-size) (μPD7531××)
- LCD driver series (small-size) (μPD7532××)
- Keyless entry series (μPD7541××, 7542××)
- General-purpose small-size series (μPD7543××)

Figure 3-1. Development of General-Purpose Products

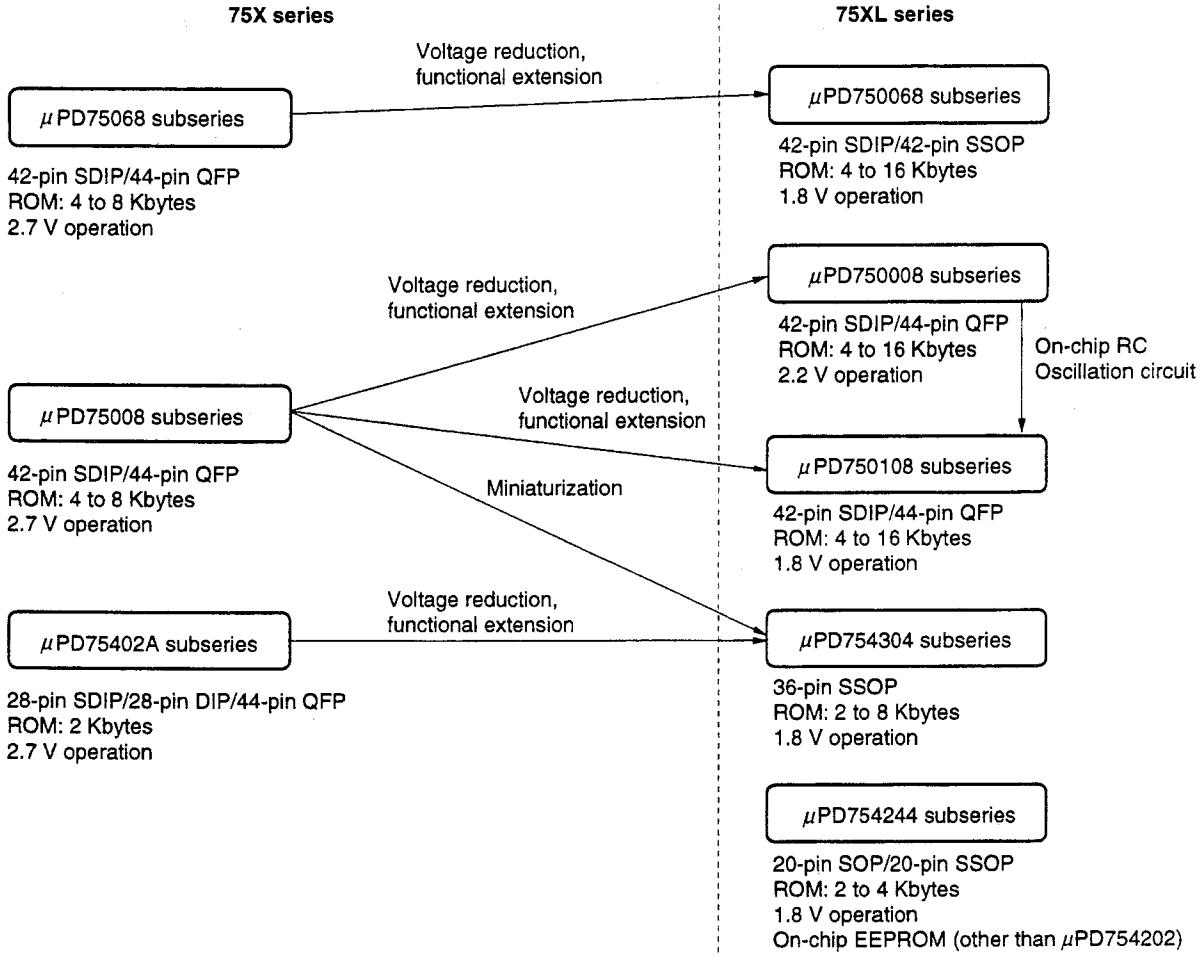
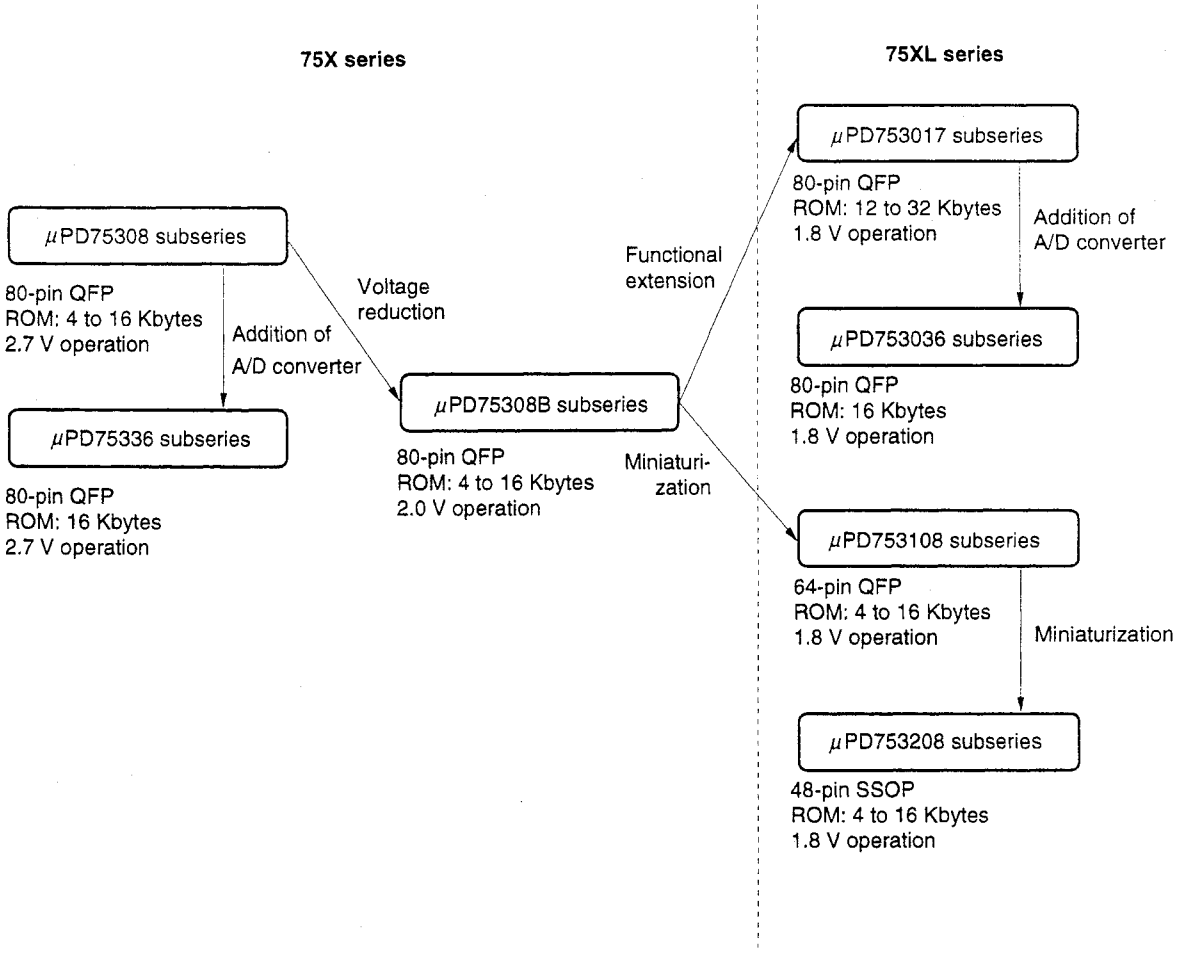


Figure 3-2. Development of LCD Panel Products



3.1 75XL Series Product List

- **General-purpose series (μPD7500××)**

Type number	ROM × 8	RAM × 4	I/O	Package	PROM version
μPD750004	4 K	512	34	42-pin SDIP (600 mil)	μPD75P0016
μPD750006	6 K			44-pin QFP (10 × 10 mm)	
μPD750008	8 K				

- **General-purpose series with on-chip RC oscillation circuit (μPD7501××)**

Type number	ROM × 8	RAM × 4	I/O	Package	PROM version
μPD750104	4 K	512	34	42-pin SDIP (600 mil)	μPD75P0116
μPD750106	6 K			44-pin QFP (10 × 10 mm)	
μPD750108	8 K				

- **General-purpose series with on-chip A/D converter (μPD75006×)**

Type number	ROM × 8	RAM × 4	I/O	Package	PROM version
μPD750064	4 K	512	32	42-pin SSOP (375 mil)	μPD75P0076
μPD750066	6 K			42-pin SDIP (600 mm)	
μPD750068	8 K				

- **LCD drive series (μPD7530××, 7530××A)**

Type number	ROM × 8	RAM × 4	I/O	Package	PROM version
μPD753012, 753012A	12 K	1024	40	80-pin QFP (14 × 14 mm)	μPD75P3018
μPD753016, 753016A	16 K			80-pin TQFP (12 × 12 mm)	μPD75P3018A
μPD753017, 753017A	24 K				

- **LCD drive with on-chip A/D converter (μPD75303×)**

Type number	ROM × 8	RAM × 4	I/O	Package	PROM version
μPD753036	16 K	768	44	80-pin QFP (14 × 14 mm)	μPD75P3036
				80-pin TQFP (12 × 12 mm)	

- **LCD drive series (small-size) (μPD7531××)**

Type number	ROM × 8	RAM × 4	I/O	Package	PROM version
μPD753104	4 K	512	32	64-pin QFP (14 × 14 mm)	μPD75P3116
μPD753106	6 K			64-pin QFP (12 × 12 mm)	
μPD753108	8 K				

- **LCD drive series (small-size) (μPD7532××)**

Type number	ROM × 8	RAM × 4	I/O	Package	PROM version
μPD753204	4 K	512	30	48-pin SSOP (375 mil)	μPD75P3216 Note
μPD753206	6 K				
μPD753208	8 K				

Note Under development

- **Keyless entry series (μPD7541××, 7542××)**

Type number	ROM × 8	RAM × 4	I/O	Package	EEPROM × 8
μPD754144	4 K	128	13	20-pin SSOP (300 mil)	16
μPD754244				20-pin SOP (300 mil)	
μPD754264 Note				20-pin SOP (300 mil)	32
μPD754202	2 K			20-pin SSOP (300 mil) 20-pin SOP (300 mil)	None

Note Under development

- **General-purpose small-size series (μPD7543××)**

Type number	ROM × 8	RAM × 4	I/O	Package	PROM version
μPD754302	2 K	256	30	36-pin SSOP (300 mil)	μPD75P4308
μPD754304	4 K				

3.2 Product Map (ROM development)

Subseries	ROM / Representative product	2K	4 K	6 K	8 K	12 K	16 K	24 K	32 K
General-purpose (μPD7500××)	μPD750008		○	○	○		△		
General-purpose with on-chip RC oscillator (μPD7501××)	μPD750108		○	○	○		△		
General-purpose with on-chip A/D converter (μPD75006×)	μPD750068		○	○	○		△		
LCD drive (μPD7530××, 7530××A)	μPD753017					○	○	○	△
LCD drive with on-chip A/D converter (μPD75303×)	μPD753036						◎		
LCD drive (small-size) (μPD7531××)	μPD753108		○	○	○		△		
LCD drive (small-size) (μPD7532××)	μPD753208		○	○	○		△		
Keyless entry (μPD7541××, 7542××)	μPD754244	○	○						
General-purpose small-size (μPD7543××)	μPD754304	○	○		△				

Remark ○: Only mask version
△: Only PROM version
◎: Mask version and PROM version

4. APPLICATION FIELDS OF 75XL SERIES

Applications \ Series		General-purpose series μPD7500xx	General-purpose series with on-chip RC oscillation circuit μPD7501xx	General-purpose series + on-chip A/D converter μPD75006x	LCD drive series μPD7530xx, μPD7530xxA	LCD drive series + on-chip A/D converter μPD75303x	LCD drive series (Small-size) μPD7531xx	LCD drive series (Small-size) μPD7532xx	Keyless entry μPD7541xx μPD7542xx	General-purpose small-size series μPD7543xx
AV equipment	CD players	○	○		○					
	CD radio cassette players							○		
	Camcorders				○					
	TVs									○
	VCRs	○	○							○
	AV equipment general			○		○				○
Communi-cation	Cordless telephones	○	○	○		○				○
	Telephones				○		○			
	Radio equipment	○	○							
	Pagers				○					
Home electric appliances	Electric rice cookers					○				
	Home bakery					○				
	Home electric appliances in general	○	○	○		○				○
Others	Health equipment			○		○				
	Sphygmomanometer						○	○		
	Gas meters						○	○		
	Meters			○		○				
	Remote controllers				○		○	○		
	Cameras	○	○		○		○	○		
	Electronic scales						○			
	OA equipment			○		○				○
	Gas tables			○		○				
	Keyless entry								○	
	Data carriers								○	
	Car electrics	○ Note	○ Note	○ Note						○ Note

Note For only (A) products

5. 75XL SERIES PRODUCTS

Subseries	Title	Applicable products	Page
General-purpose	General-purpose series	μPD750004, 750006, 750008, 75P0016	p. 12
	General-purpose with RC oscillation circuit	μPD750104, 750106, 750108, 75P0116	p. 15
	General-purpose + A/D converter	μPD750064, 750066, 750068, 75P0076	p. 18
LCD drive series	LCD drive series	μPD753012, 753016, 753017, 75P3018, μPD753012A, 753016A, 753017A, 75P3018A	p. 21
	LCD drive + A/D converter	μPD753036, 75P3036	p. 24
	LCD drive series (small-size)	μPD753104, 753106, 753108, 75P3116	p. 27
		μPD753204, 753206, 753208, 75P3216	p. 30
Keyless entry		μPD754144, 754244, 754264[Note], 754202	p. 33
General-purpose (small-size)		μPD754302, 754304, 75P4308	p. 38

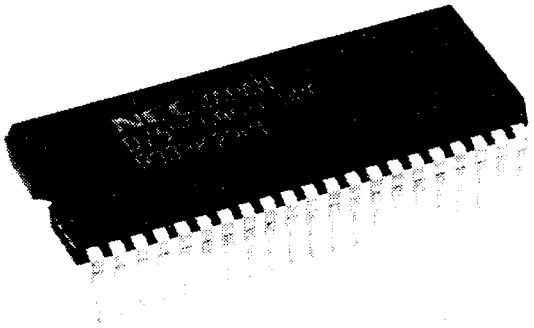
Note Under development

5.1 General-Purpose Series (μPD7500××)

Applicable products: μPD750004, 750006, 750008, 75P0016, 750004(A), 750006(A), 750008(A)

This subseries consists of microcontrollers possessing a high level of generality and equipped with I/O ports, serial interfaces, watch timers, interrupt functions, watch subsystem clock generators. These products extend CPU functions beyond the conventional μPD75008 subseries (75X Series product) and are capable of high-speed operation at the low voltage of 2.2 V. Not only does this microcontroller replace conventional products, it is optimal for battery-operated applications and can be used as the standard microcontroller in all fields.

The μPD750004(A), 750006(A), and 750008(A) are "special" quality grades for the μPD750004, 750006, and 750008, respectively.



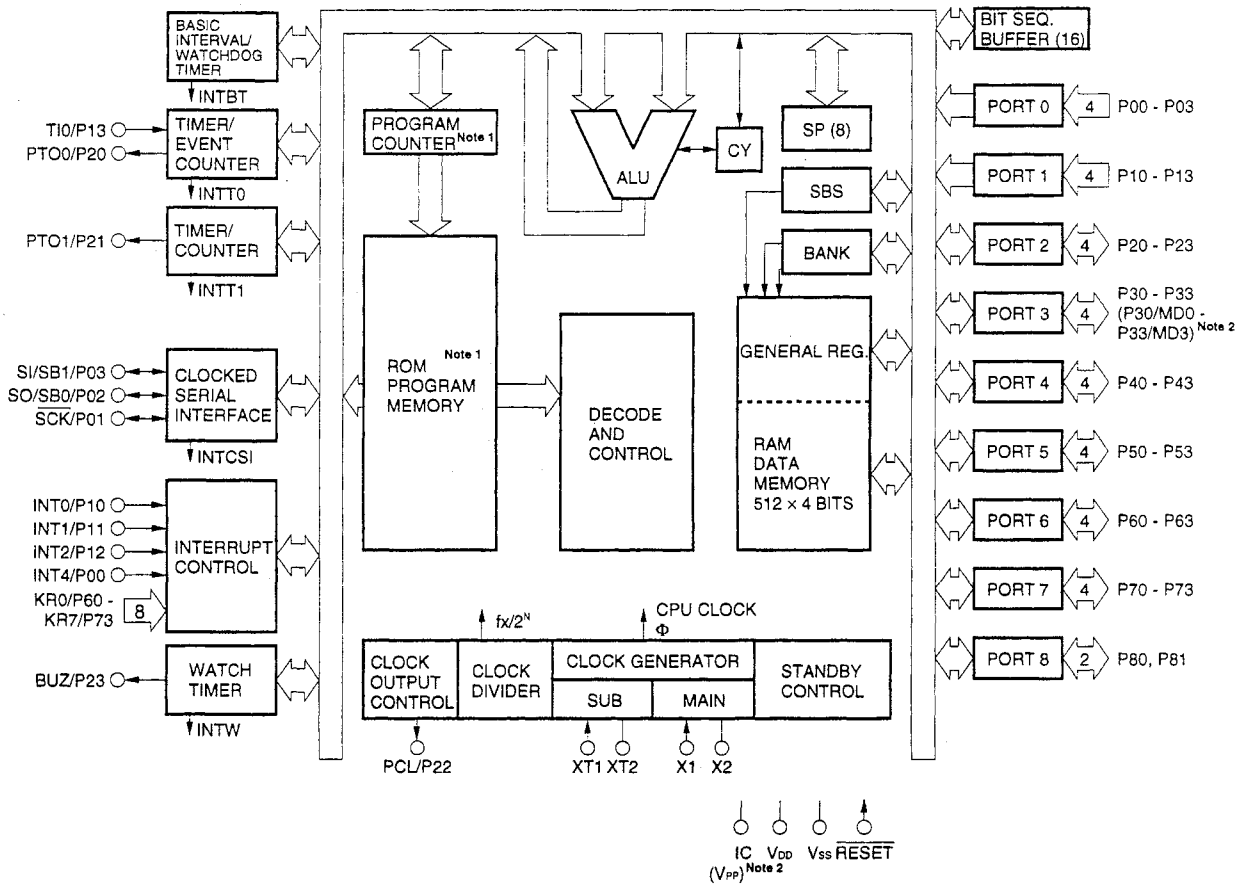
[Features]

- Low voltage, high-speed operation possible: 0.85 μs (V_{DD} = 2.2 V, @ 4.19 MHz)
  0.67 μs (V_{DD} = 2.7 V, @ 6.0 MHz)
- Enhanced timer function: 4 channels
  - Basic interval timer usable as a watchdog timer
- Can have on-chip pull-up resistors in the 33 I/O lines
  - Medium voltage, N-channel open-drain I/O ports: 8
- Enhanced interrupt functions such as standby release by key input, interrupt at termination of serial data transfer, multiple interrupts, etc.
- Replacement is easy because the functions and instructions of the conventional μPD75008 subseries are inherited
- PROM version available
  - μPD75P0016 (one-time PROM)

[Applications]

Standard : VCRs, CD players, cordless telephones, radios, cameras, home electric appliances, etc.
Special : Car electrics

Block Diagram



Notes 1. Differs with the model.

2. Data in the parentheses are for μPD75P0016.

[Function List]

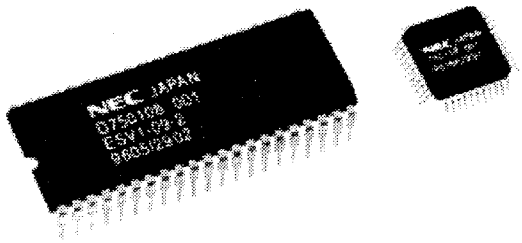
Item		μPD750004, 750004(A)	μPD750006, 750006(A)	μPD750008, 750008(A)	μPD75P0016
ROM (bytes)		4096 (mask ROM)	6144 (mask ROM)	8192 (mask ROM)	16384 (one-time PROM)
RAM (× 4 bits)		512			
General-purpose registers		(4 bits × 8) × 4 banks or (8 bits × 4) × 4 banks			
Instruction execution time		• 0.95, 1.91, 3.81, 15.3 μs (main system clock: 4.19 MHz) • 0.67, 1.33, 2.67, 10.7 μs (main system clock: 6.0 MHz) • 122 μs (subsystem clock: 32.768 kHz)			
I/O ports	CMOS inputs	8	Connection of on-chip pull-up resistors can be specified by software; 7		
	CMOS I/O	18	Can directly drive LEDs Connection of on-chip pull-up resistors can be specified by software		
	N-channel open-drain I/O	8	Can directly drive LEDs Pull-up resistors can be made on chip with mask option		Can drive LEDs, no pull-up resistor
	Total	34			
Timer		4 channels • 8-bit timer counter: 1 channel • 8-bit timer/event counter: 1 channel • Basic interval timer/watchdog timer: 1 channel • Watch timer: 1 channel			
Serial interface		3 selectable modes • 3-wire serial I/O mode ··· Switching between MSB first and LSB first • 2-wire serial I/O mode • SBI mode			
Vectored interrupt		External: 3; Internal: 4			
Test input		External: 1; Internal: 1			
Clock output (PCL)		• Φ, 524, 262, 65.5 kHz (main system clock: 4.19 MHz) • Φ, 750, 375, 93.7 kHz (main system clock: 6.0 MHz)			
Buzzer output (BUZ)		• 2, 4, 32 kHz (main system clock: 4.19 MHz or subsystem clock: 32.768 kHz) • 2.86, 5.72, 45.8 kHz (main system clock: 6.0 MHz)			
Power-supply voltage		V_{DD} = 2.2 to 5.5 V			
Operating ambient temperature		T_A = –40 to +85 °C			
Package		• 42-pin plastic shrink DIP (600 mil) • 44-pin plastic QFP (10 × 10 mm)			

5.2 General-Purpose Series with RC Oscillator (μPD7501××)

Applicable products: μPD750104, 750106, 750108, 75P0116, 750104(A), 750106(A), 750108(A)

This subseries incorporates input/output ports, serial interface, watch timer, interrupt functions, and watch subsystem clock oscillation circuit, in addition an RC oscillation circuit as a main system clock oscillation circuit. It has extended CPU functions with respect to the conventional μPD75008 subseries, that is, products of the 75X Series. In addition, a high-speed operation in 1.8V of low voltage is allowed. Therefore it is ideal for the applications using a battery as well as the replacement of the previous products, and it can be used as a standard microcontroller in every field.

The μPD750104(A), 750106(A), and 750108(A) are "special" quality grades for the μPD750104, 750106, and 750108, respectively.



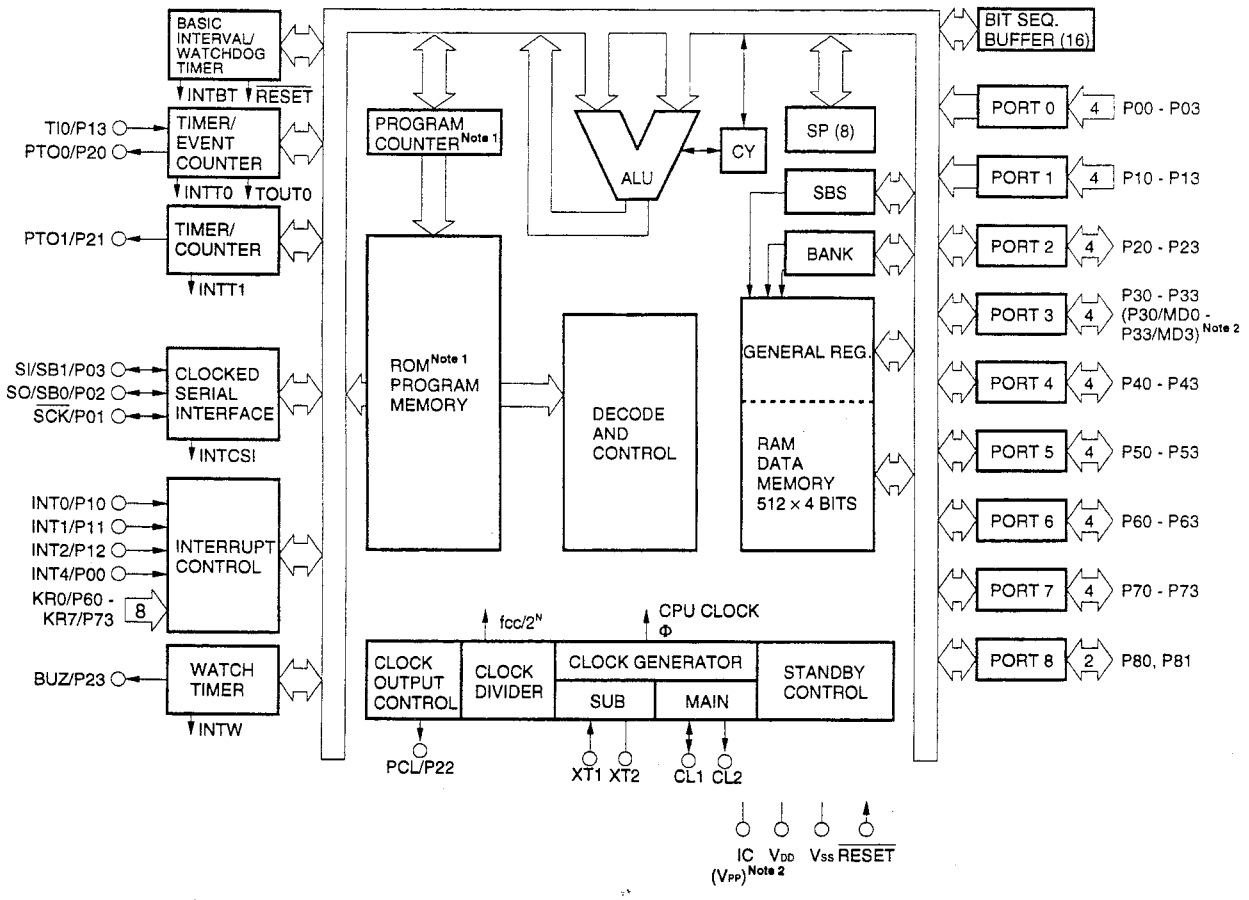
[Features]

- Low-voltage, high-speed operation possible: 4 μs(V_{DD} = 1.8V, @ 1 MHz)
  2 μs(V_{DD} = 1.8V, @ 2 MHz)
- On-chip RC oscillation circuit as a main system clock oscillation circuit
  - A processing starts immediately after the standby mode releases
- Enhanced function: 4 channels
  - Basic interval timer usable as a watchdog timer
- On-chip pull-up resistors in the 33 I/O lines enable
  - Medium voltage, N-channel open-drain I/O ports: 8
- Enhanced interrupt functions such as standby release by key input, interrupt at termination of serial data transfer, and multiple interrupts.
- Easy replacement due to the inherited functions and instructions of the conventional uPD75008 and 750008 subseries.
- PROM version available
  - μPD75P0116 (one-time PROM)

[Applications]

Standard : VCRs, CD players, cordless telephones, radios, cameras, home electric appliances, etc.
Special : Car electrics

Block Diagram



Notes 1. Differs with the model.

2. Data in the parentheses are for μPD75P0116.

[Function List]

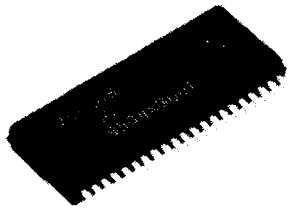
Item		μPD750104, 750104(A)	μPD750106, 750106(A)	μPD750108, 750108(A)	μPD75P0116
ROM (bytes)		4096 (mask ROM)	6144 (mask ROM)	8192 (mask ROM)	16384 (one-time PROM)
RAM (× 4 bits)		512			
General-purpose registers		(4 bits × 8) × 4 banks or (8 bits × 4) × 4 banks			
Instruction execution time		• 4, 8, 16, 64 μs (main system clock: @1 MHz) • 2, 4, 8, 32 μs (main system clock: @2 MHz) • 122 μs (subsystem clock: @32.768 kHz)			
I/O ports	CMOS inputs	8 Specifiable connection of on-chip pull-up resistors by software: 7			
	CMOS I/O	18 LEDs direct drives enable, specifiable connection of on-chip pull-up resistors by software			
	N-channel open-drain I/O	8 LEDs direct drives enable, on-chip pull-up resistors with mask option available			LEDs direct drives enable, on-chip pull-up resistors not available
	Total	34			
Timer		4 channels • 8-bit timer counter: 1 channel • 8-bit timer/event counter: 1 channel • Basic interval timer/Watching timer: 1 channel • Watch timer: 1 channel			
Serial interface		3 selectable modes • 3-wire serial I/O mode ... switching between MSB first and LSB first • 2-wire serial I/O mode • SBI mode			
Vectored interrupt		External: 3; Internal: 4			
Test input		External: 1; Internal: 1			
Clock output (PCL)		• ϕ, 125, 62.5, 15.6 kHz (main system clock: @1 MHz) • ϕ, 250, 125, 31.3 kHz (main system clock: @2 MHz)			
System clock oscillation circuit		• On-chip RC oscillation circuit for main system clock oscillation • Crystal oscillation circuit for subsystem clock oscillation			
Power-supply voltage		V_{DD} = 1.8 to 5.5 V			
Operating ambient temperature		T_A = −40 to +85°C			
Package		• 42-pin plastic shrink DIP (600mil) • 44-pin plastic QFP (10 × 10 mm)			

5.3 General-Purpose Series with On-Chip A/D Converter (μPD75006×)

Applicable products: μPD750064, 750066, 750068, 75P0076, 750064(A), 750066(A), 750068(A)

This subseries incorporates not only input/output ports, serial interface, watch timer, interrupt functions, watch subsystem clock oscillation circuit, but also an A/D converter with low-voltage operation capability. It has extended CPU functions with respect to the μPD75068 subseries, that is, the previous 75X series products, allowing you to create more efficient programs. In addition, use of a small 42-pin package allows for high-speed, low-voltage (1.8 V) operation. It is therefore ideal for sets using batteries as well as mechanisms-control applications.

The μPD750064(A), 750066(A), and 750068(A) are "special" quality grades for the μPD750064, 750066, and 750068, respectively.



[Features]

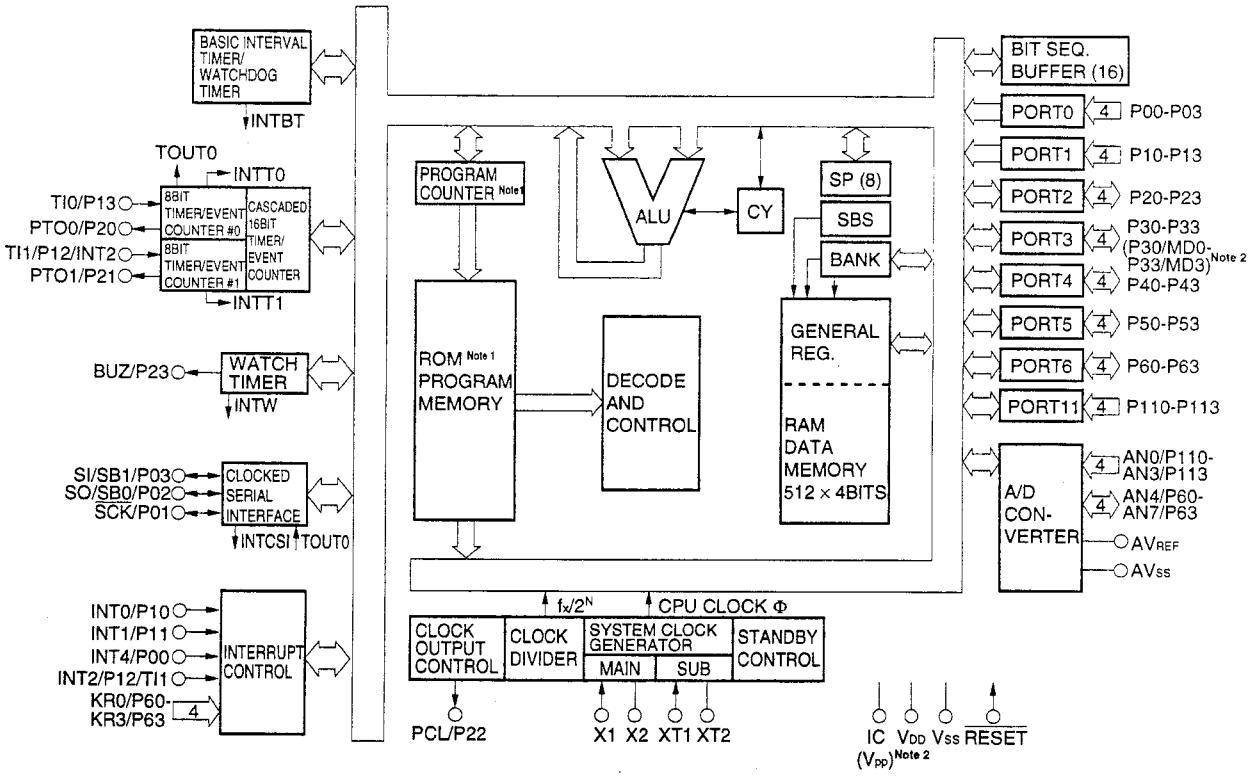
- Low-voltage, high-speed operation possible: 0.95 μs (V_{DD} = 1.8 V, @ 4.19 MHz)
  0.67 μs (V_{DD} = 2.7 V, @ 6.0 MHz)
- On-chip A/D converter with low-voltage operation possible (V_{DD} = 1.8 to 5.5 V)
  - 8-bit resolution × 8 channels (absolute accuracy ±1.5 LSB)
- Enhanced timer function: 4 channels
  - Usable as a 16-bit timer/event counter
  - On-chip remote control carrier frequency generator
  - Basic interval timer usable as a watchdog timer
- Enhanced interrupt functions such as standby release by key input, interrupt at termination of serial data transfer, multiple interrupts, etc.
- Use of small SOP package facilitates wiring.
- Replacement is easy because the functions and instructions of the conventional μPD75068 subseries are inherited
- PROM version available
  - μPD75P0076 (one-time PROM)

[Applications]

Standard: Cordless telephones, AV equipment, home electric appliances, OA equipment, health equipment, meters, gas tables, etc.

Special: Car electrics

Block Diagram



Notes 1. Differs with the model.

2. Data in the parentheses are for μPD75P0076.

[Function List]

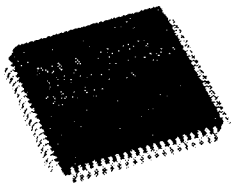
Item		μPD750064, 750064(A)	μPD750066, 750066(A)	μPD750068, 750068(A)	μPD75P0076
ROM (bytes)		4096 (mask ROM)	6144 (mask ROM)	8192 (mask ROM)	16384 (one-time PROM)
RAM (× 4 bits)		512			
General-purpose registers		(4 bits × 8) × 4 banks or (8 bits × 4) × 4 banks			
Instruction execution time		• 0.95, 1.91, 3.81, 15.3 μs (main system clock: 4.19 MHz) • 0.67, 1.33, 2.67, 10.7 μs (main system clock: 6.0 MHz) • 122 μs (subsystem clock: 32.768 kHz)			
I/O ports	CMOS inputs	12	Connection of on-chip pull-up resistors can be specified by software; 7 Shared analog input pin: 4		
	CMOS I/O	12	Can directly drive LEDs Connection of on-chip pull-up resistors can be specified by software Shared analog input pin: 4		
	N-channel open-drain I/O	8	Can directly drive LEDs Pull-up resistors can be made on chip with mask option	Can drive LEDs, no pull-up resistor	
	Total	32			
Timer		4 channels • 8-bit timer counter: 2 channels (used as 16-bit timer/event counter) • Basic interval timer/watchdog timer: 1 channel • Watch timer: 1 channel			
Serial interface		2 selectable modes • 3-wire serial I/O mode ··· Switching between MSB first and LSB first • 2-wire serial I/O mode			
A/D converter		8-bit resolution × 8 channels			
Vectored interrupt		External: 3; Internal: 4			
Test input		External: 1; Internal: 1			
Clock output (PCL)		• Φ, 1.05 MHz, 262, 65.5 kHz (main system clock: 4.19 MHz) • Φ, 1.5 MHz, 375, 93.7 kHz (main system clock: 6.0 MHz)			
Buzzer output (BUZ)		• 2, 4, 32 kHz (main system clock: 4.19 MHz or subsystem clock: 32.768 kHz) • 2.86, 5.72, 45.8 kHz (main system clock: 6.0 MHz)			
Power-supply voltage		V_{DD} = 1.8 to 5.5 V			
Package		• 42-pin plastic shrink DIP (600 mil, 1.778 mm pitch) • 42-pin plastic shrink SOP (375 mil, 0.8 mm pitch)			

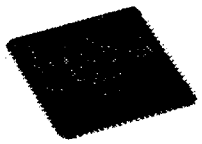
5.4 LCD Drive Series (μPD7530××, 7530××A)

Applicable products: μPD753012, 753016, 753017, 75P3018, 753012A, 753016A, 753017A, 75P3018A

This subseries has an on-chip LCD panel controller/driver and is suitable for equipment using LCD panels. Not only does it inherit functions and instructions of the μPD75308 subseries, that is a product of the conventional 75X Series, it can be used as a 16-bit timer/event counter by using 2 channels of the 8-bit timer/event counter, and expands the functions like generating a carrier frequency for remote controllers.

The μPD753012A, 753016A, 753017A, and 75P3018A are low voltage versions for the μPD753012, 753016, 753017, and 75P3018, respectively.





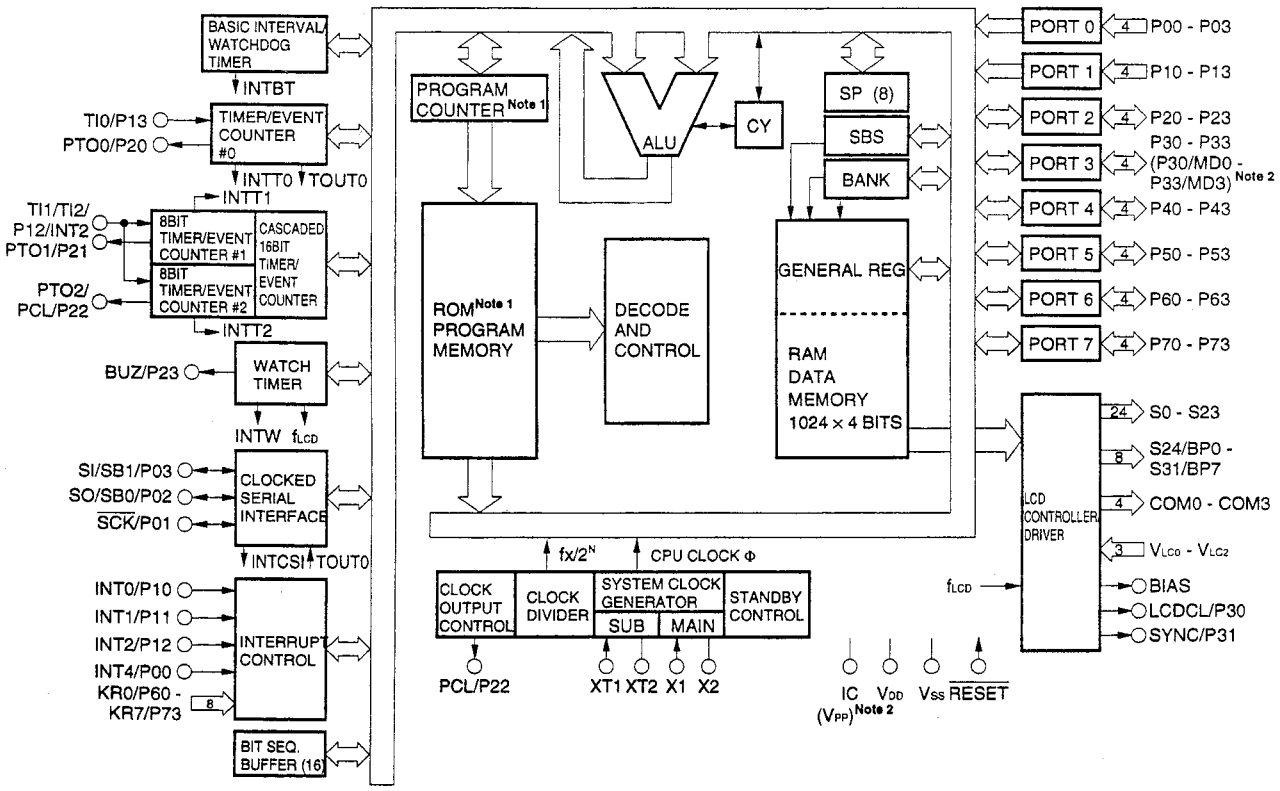
[Features]

- Low voltage, high-speed operation possible: 0.95 μs (V_{DD} = 1.8 V, @ 4.19 MHz)
  0.67 μs (V_{DD} = 2.7 V, @ 6.0 MHz)
- On-chip programmable LCD controller/driver
  - LCD panel can have a maximum of 128 segments
- Enhanced timer function: 5 channels
  - Usable as a 16-bit timer/event counter
  - On-chip remote control carrier frequency generator
  - Basic interval timer usable as a watchdog timer
- Can have on-chip pull-up resistors in the 31 I/O lines
  - Medium voltage, N-channel, open-drain I/O ports: 8
- Enhanced interrupt functions such as standby release by key input, interrupt at termination of serial data transfer, multiple interrupts, etc.
- Replacement is easy because the functions and instructions of the conventional μPD75308 subseries are inherited
- PROM version available
  - μPD75P3018 and 75P3018A (one-time PROM)

[Applications]

Camcorders, CD players, telephones, cameras, pagers, remote controllers, etc.

Block Diagram



Notes 1. Differs with the model.

2. Data in the parentheses are for μPD75P3018 and 75P3018A.

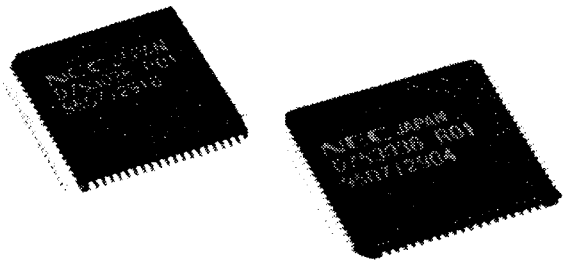
[Function List]

Item		μPD753012, 753012A	μPD753016, 753016A	μPD753017, 753017A	μPD75P3018, 75P3018A
ROM (bytes)		12288 (mask ROM)	16384 (mask ROM)	24576 (mask ROM)	32768 (one-time PROM)
RAM (× 4 bits)		1024			
General-purpose registers		(4 bits × 8) × 4 banks or (8 bits × 4) × 4 banks			
Instruction execution time		• 0.95, 1.91, 3.81, 15.3 μs (main system clock: 4.19 MHz) • 0.67, 1.33, 2.67, 10.7 μs (main system clock: 6.0 MHz) • 122 μs (subsystem clock: 32.768 kHz)			
I/O ports	CMOS inputs	8	Connection of on-chip pull-up resistors can be specified by software: 7		
	CMOS I/O	16	Can directly drive LEDs Connection of on-chip pull-up resistors can be specified by software		
	Bit port output	8	Shared segment pins		
	N-channel open-drain I/O	8	Can directly drive LEDs Pull-up resistors can be made on chip with mask option		No pull-up resistor
	Total	40			
LCD controller/driver		• Selectable segment numbers : 24/28/32 segments (Can switch in bit port output in units of 4, maximum of 8) • Selectable display modes : Static, 1/2 duty (1/2 bias), 1/3 duty (1/2 bias), 1/3 duty (1/3 bias), 1/4 duty (1/3 bias)			
		Split resistors for LCD driver can be made on chip with mask option			No split resistor for LCD drive
Timer		5 channels • 8-bit timer/event counter: 3 channels (usable as 16-bit timer/event counter) • Basic interval timer/watchdog timer: 1 channel • Watch timer: 1 channel			
Serial interface		3 selectable modes • 3-wire serial I/O mode ··· Switching between MSB first and LSB first • 2-wire serial I/O mode: 1 channel • SBI mode: 1 channel			
Vectored interrupt		External: 3; Internal: 5			
Test input		External: 1; Internal: 1			
Clock output (PCL)		• Φ, 524, 262, 65.5 kHz (main system clock: 4.19 MHz) • Φ, 750, 375, 93.7 kHz (main system clock: 6.0 MHz)			
Buzzer output (BUZ)		• 2, 4, 32 kHz (main system clock: 4.19 MHz or subsystem clock: 32.768 kHz) • 2.86, 5.72, 45.8 kHz (main system clock: 6.0 MHz)			
Power-supply voltage		V_{DD} = 1.8 to 5.5 V			
Package		• 80-pin plastic QFP (14 × 14 mm) • 80-pin plastic TQFP (fine pitch) (12 × 12 mm)			

5.5 LCD Drive Series with On-Chip A/D Converter (μPD75303×)

Applicable products: μPD753036, 75P3036

This subseries consists of the μPD753017 subseries containing an on-chip LCD panel controller/driver with an additional on-chip A/D converter capable of low voltage operation. Not only does it inherite the functions and instructions of the μPD75336 subseries, the previous 75X series products, but it also provides two 8-bit timer/event counter channels, allowing it to be used as a 16-bit timer/event counter, with extended functions such as generation of remote control carrier frequency. Its low-voltage (1.8 V), high-speed operation widens the range of applicable applications.



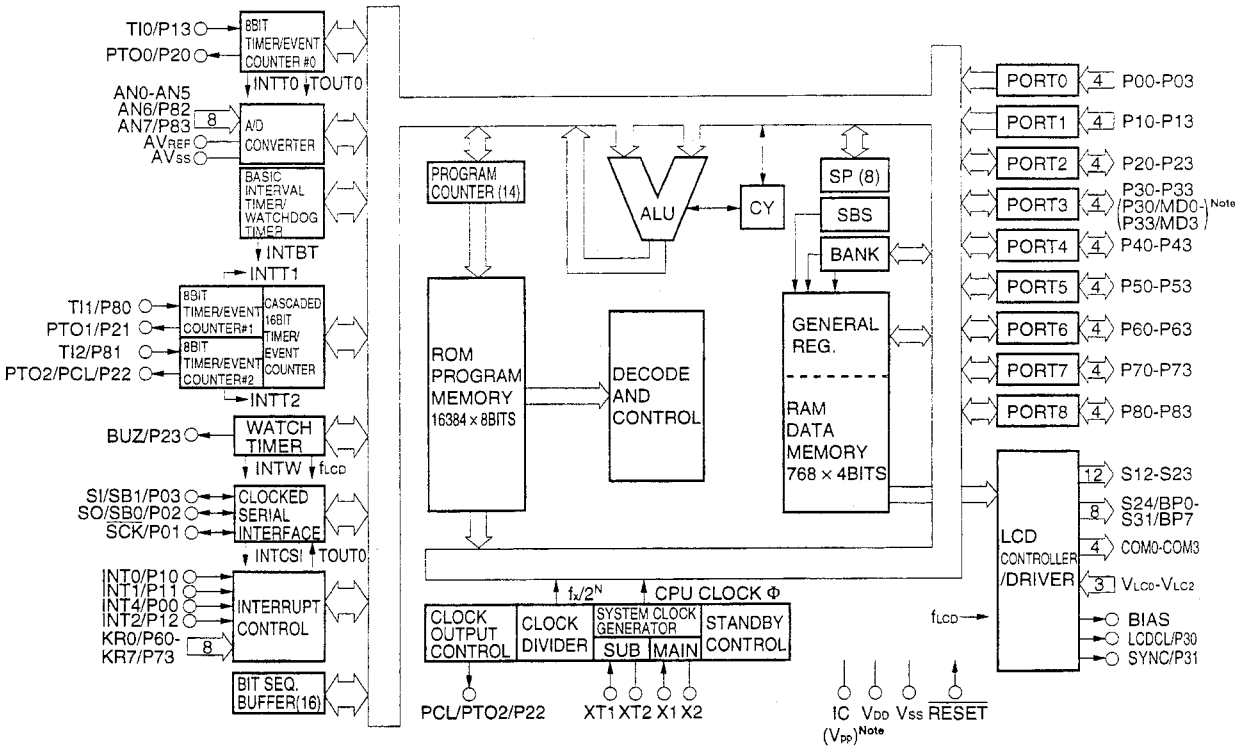
[Features]

- Low-voltage, high-speed operation possible: 0.95 μs (V_{DD} = 1.8 V, @ 4.19 MHz)
  0.67 μs (V_{DD} = 2.7 V, @ 6.0 MHz)
- On-chip programmable LCD controller/driver
  - LCD panel can have a maximum of 128 segments
- On-chip A/D converter with low-voltage operation possible (V_{DD} = 1.8 to 5.5 V)
  - 8-bit resolution × 8 channels (absolute accuracy 1.5 LSB)
- Enhanced timer function: 5 channels
  - Usable as a 16-bit timer/event counter
  - On-chip remote control carrier frequency generator
  - Basic interval timer usable as a watchdog timer
  - Long-time timer setting is possible
- Enhanced interrupt functions such as standby release by key input, interrupt at termination of serial data transfer, multiple interrupts, etc.
- Replacement is easy because the functions and instructions of the conventional μPD75336 subseries are inherited
- PROM version available
  - μPD75P3036 (one-time PROM)

[Applications]

Cordless telephones, AV equipment, home electric appliances, OA equipment, health equipment, meters, gas tables, etc.

Block Diagram



Note Data in the parentheses are for μPD75P3036.

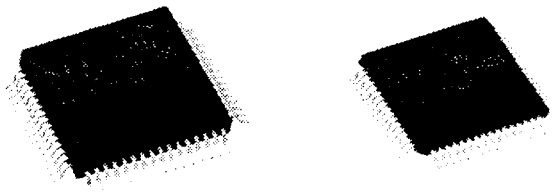
[Function List]

Item		μPD753036		μPD75P3036
ROM (bytes)		16384 (mask ROM)		16384 (one-time PROM)
RAM (× 4 bits)		768		
General-purpose registers		(4 bits × 8) × 4 banks or (8 bits × 4) × 4 banks		
Instruction execution time		• 0.95, 1.91, 3.81, 15.3 μs (main system clock: 4.19 MHz) • 0.67, 1.33, 2.67, 10.7 μs (main system clock: 6.0 MHz) • 122 μs (subsystem clock: 32.768 kHz)		
I/O ports	CMOS inputs	8	Connection of on-chip pull-up resistors can be specified by software: 7	
	CMOS I/O	20	Can directly drive LEDs Connection of on-chip pull-up resistors can be specified by software	
	Bit port output	8	Shared segment pins	
	N-channel open-drain I/O	8	Can directly drive LEDs Pull-up resistors can be made on chip with mask option	Can directly drive LEDs No pull-up resistor
	Total	44		
LCD controller/driver		• Selectable segment numbers : 12/16/20 segments (Can switch in bit port output in units of 4, maximum of 8) • Selectable display modes : Static, 1/2 duty (1/2 bias), 1/3 duty (1/2 bias), 1/3 duty (1/3 bias), 1/4 duty (1/3 bias)		
		Split resistors for LCD driver can be made on chip with mask option		No split resistor for LCD drive
Timer		5 channels • 8-bit timer/event counter: 3 channels (usable as 16-bit timer/event counter) • Basic interval timer/watchdog timer: 1 channel • Watch timer: 1 channel		
Serial interface		3 selectable modes • 3-wire serial I/O mode ··· Switching between MSB first and LSB first • 2-wire serial I/O mode • SBI mode		
A/D converter		8-bit resolution × 8 channels		
Vectored interrupt		External: 3; Internal: 5		
Test input		External: 1; Internal: 1		
Clock output (PCL)		• Φ, 524, 262, 65.5 kHz (main system clock: 4.19 MHz) • Φ, 750, 375, 93.7 kHz (main system clock: 6.0 MHz)		
Buzzer output (BUZ)		• 2, 4, 32 kHz (main system clock: 4.19 MHz or subsystem clock: 32.768 kHz) • 2.86, 5.72, 45.8 kHz (main system clock: 6.0 MHz)		
Power-supply voltage		V_{DD} = 1.8 to 5.5 V		
Package		• 80-pin plastic QFP (14 × 14 mm) • 80-pin plastic TQFP (fine pitch) (12 × 12 mm)		

5.6 LCD Drive Series (Small-size) (μPD7531××)

Applicable products: μPD753104, 753106, 753108, 75P3116

This subseries has an on-chip LCD panel controller/driver and is suitable for equipment using LCD panels. This has a 64-pin package and is a small-size version of the μPD753017 subseries. Not only does it inherit functions and instructions of the μPD75308 subseries, that is a product of the conventional 75X Series, it can be used as a 16-bit timer/event counter by using 2 channels of the 8-bit timer/event counter, and expands the functions like generating a carrier frequency for remote controllers.



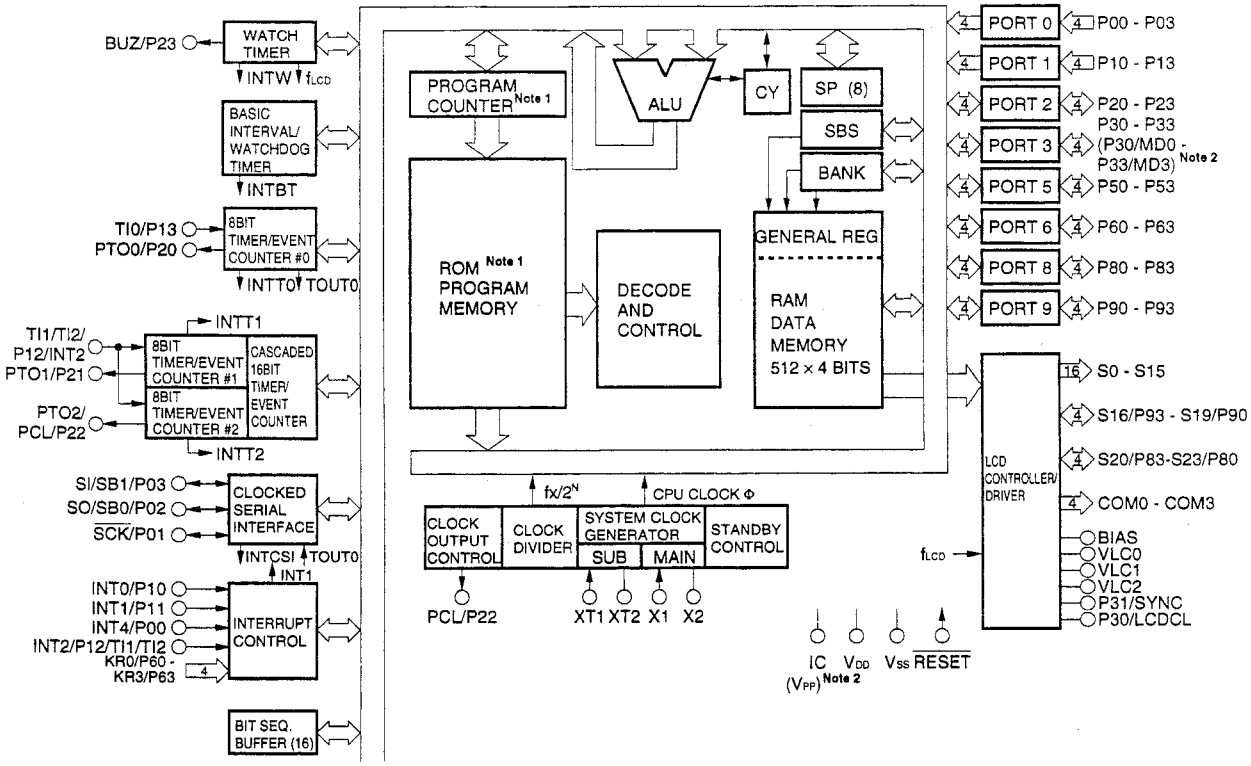
[Features]

- Low voltage, high-speed operation possible: 0.95 μs (V_{DD} = 1.8 V, @ 4.19 MHz)
  0.67 μs (V_{DD} = 2.7 V, @ 6.0 MHz)
- On-chip programmable LCD controller/driver
  - LCD panel can have a maximum of 96 segments
- Enhanced timer function: 5 channels
  - Usable as a 16-bit timer/event counter
  - On-chip remote control carrier frequency generator
  - Basic interval timer usable as a watchdog timer
- Can have on-chip pull-up resistors in the 31 I/O lines
  - Medium voltage, N-channel, open-drain I/O ports: 4
- Enhanced interrupt functions such as standby srelease by key input, interrupt at termination of serial data transfer, multiple interrupts, etc.
- Replacement is easy because the functions and instructions of the conventional μPD75308 subseries are inherited
- PROM version available
  - μPD75P3116 (one-time PROM)

[Applications]

Telephones, cameras, sphygmomanometers, gas meters, electronic scales, remote controllers, etc.

Block Diagram



Notes 1. Differs with the model.

2. Data in the parentheses are for μPD75P3116.

[Function List]

Item		μPD753104	μPD753106	μPD753108	μPD75P3116
ROM (bytes)		4096 (mask ROM)	6144 (mask ROM)	8192 (mask ROM)	16384 (one-time PROM)
RAM (× 4 bits)		512			
General-purpose registers		(4 bits × 8) × 4 banks or (8 bits × 4) × 4 banks			
Instruction execution time		• 0.95, 1.91, 3.81, 15.3 μs (main system clock: 4.19 MHz) • 0.67, 1.33, 2.67, 10.7 μs (main system clock: 6.0 MHz) • 122 μs (subsystem clock: 32.768 kHz)			
I/O ports	CMOS inputs	8	Connection of on-chip pull-up resistors can be specified by software: 7		
	CMOS I/O	20	Can directly drive LEDs Connection of on-chip pull-up resistors can be specified by software Shared segment pins: 8		
	N-channel open-drain I/O	4	Can directly drive LEDs Pull-up resistors can be made on chip with mask option		No pull-up resistor
	Total	32			
LCD controller/driver		• Selectable segment numbers : 16/20/24 segments (Can switch in CMOS input/output port in units of 4, maximum of 8) • Selectable display modes : Static, 1/2 duty (1/2 bias), 1/3 duty (1/2 bias), 1/3 duty (1/3 bias), 1/4 duty (1/3 bias)			
		Split resistors for LCD drive can be made on chip with mask option			No split resistor for LCD drive
Timer		5 channels • 8-bit timer/event counter: 3 channels (usable as 16-bit timer/event counter) • Basic interval timer/watchdog timer: 1 channel • Watch timer: 1 channel			
Serial interface		3 selectable modes • 3-wire serial I/O mode ··· Switching between MSB first and LSB first • 2-wire serial I/O mode • SBI mode			
Vectored interrupt		External: 3; Internal: 5			
Test input		External: 1; Internal: 1			
Clock output (PCL)		• Φ, 524, 262, 65.5 kHz (main system clock: 4.19 MHz) • Φ, 750, 375, 93.7 kHz (main system clock: 6.0 MHz)			
Buzzer output (BUZ)		• 2, 4, 32 kHz (main system clock: 4.19 MHz or subsystem clock: 32.768 kHz) • 2.86, 5.72, 45.8 kHz (main system clock: 6.0 MHz)			
Power-supply voltage		V_{DD} = 1.8 to 5.5 V			
Package		• 64-pin plastic QFP (14 × 14 mm) • 64-pin plastic TQFP (12 × 12 mm)			

5.7 LCD Drive Series (Small-Size) (μPD7532××)

Applicable products: μPD753204, 753206, 753208, 75P3216

This subseries is a small-size version of the μPD753108 subseries with reduced on-chip LCD panel controller/driver and without the subsystem clock. It uses in common the same CPU functions and instructions as those used in the 75XL series. Furthermore, the small 48-pin package and low-voltage (1.8 V), high-speed operation capability make it suitable for small set applications using batteries.

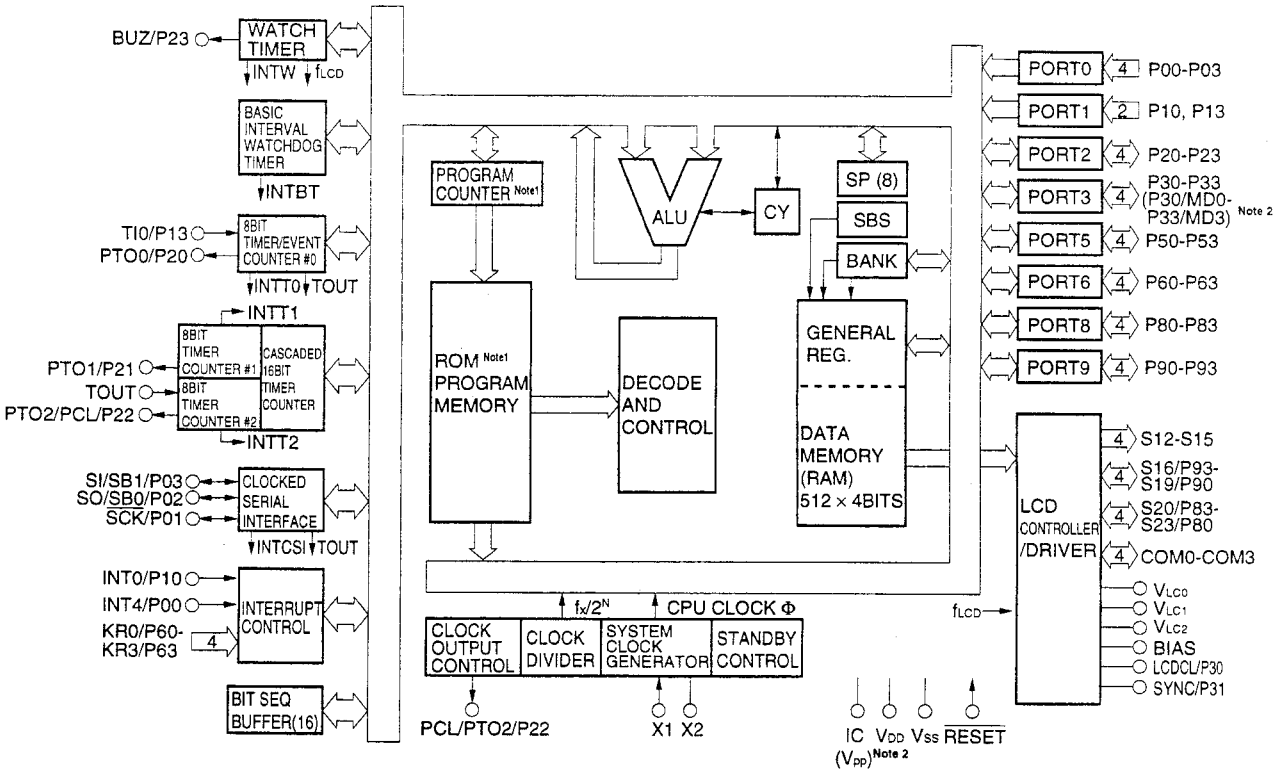
[Features]

- Low-voltage, high-speed operation possible: 0.95 μs (V_{DD} = 1.8 V, @ 4.19 MHz)
  0.67 μs (V_{DD} = 2.7 V, @ 6.0 MHz)
- Enhanced timer function: 5 channels
  - Usable as a 16-bit timer/event counter
  - On-chip remote control carrier frequency generator
  - Basic interval timer usable as a watchdog timer
- Enhanced interrupt functions such as standby release by key input, interrupt at termination of serial data transfer, multiple interrupts, etc.
- Replacement is easy because the functions and instructions of the conventional μPD75308 subseries are inherited
- PROM version available.
  - μPD75P3216 (one-time PROM)

[Applications]

Remote control, cameras, sphygmomanometers, CD radio cassette players, gas meters, etc.

Block Diagram



Notes 1. Differs with the model.

2. Data in the parentheses are for μPD75P3216.

[Function List]

Item		μPD753204	μPD753206	μPD753208	μPD75P3216
ROM (bytes)		4096 (mask ROM)	6144 (mask ROM)	8192 (mask ROM)	16384 (one-time PROM)
RAM (× 4 bits)		512			
General-purpose registers		(4 bits × 8) × 4 banks or (8 bits × 4) × 4 banks			
Instruction execution time		• 0.95, 1.91, 3.81, 15.3 μs (main system clock: 4.19 MHz) • 0.67, 1.33, 2.67, 10.7 μs (main system clock: 6.0 MHz)			
I/O ports	CMOS inputs	6	Connection of on-chip pull-up resistors can be specified by software: 5		
	CMOS I/O	20	Can directly drive LEDs Connection of on-chip pull-up resistors can be specified by software Shared segment pins: 8		
	N-channel open-drain I/O	4	Can directly drive LEDs Pull-up resistors can be made on chip with mask option		No pull-up resistor
	Total	30			
LCD controller/driver		• Selectable segment numbers : 4/8/12 segments (Can switch in CMOS input/output port in units of 4, maximum of 8) • Selectable display modes : Static, 1/2 duty (1/2 bias), 1/3 duty (1/2 bias), 1/3 duty (1/3 bias), 1/4 duty (1/3 bias)			
		Split resistors for LCD drive can be made on chip with mask option			No split resistor for LCD drive
Timer		5 channels • 8-bit timer/event counter: 1 channel • 8-bit timer/counter: 2 channels (usable as 16-bit timer counter) • Basic interval timer/watchdog timer: 1 channel • Watch timer: 1 channel			
Serial interface		3 selectable modes • 3-wire serial I/O mode ··· Switching between MSB first and LSB first • 2-wire serial I/O mode • SBI mode			
Vectored interrupt		External: 2; Internal: 5			
Test input		External: 1; Internal: 1			
Clock output (PCL)		• Φ, 524, 262, 65.5 kHz (system clock: 4.19 MHz) • Φ, 750, 375, 93.7 kHz (system clock: 6.0 MHz)			
Buzzer output (BUZ)		• 2, 4, 32 kHz (system clock: 4.19 MHz) • 2.86, 5.72, 45.8 kHz (system clock: 6.0 MHz)			
Power-supply voltage		V_{DD} = 1.8 to 5.5 V			
Package		• 48-pin plastic shrink SOP (375 mil, 0.65 mm pitch)			

5.8 Keyless Entry Series (μPD7541××,7542××)

Applicable products: μPD754144, 754244, 754264 [Note] (On-chip EEPROM version), μPD754202

Note Under development

This subseries consists of microcontrollers that incorporate stand-by release function by the key input, as well as EEPROM in data memory (except μPD754202). Also an on-chip carrier generator that can easily output infrared remote control waveforms allows it to be used as a data carrier. It uses in common the same CPU and instructions as those used for the 75XL series. Furthermore, the small 20-pin package and low-voltage (1.8 V), high-speed operation capability make it suitable for small set applications using batteries.

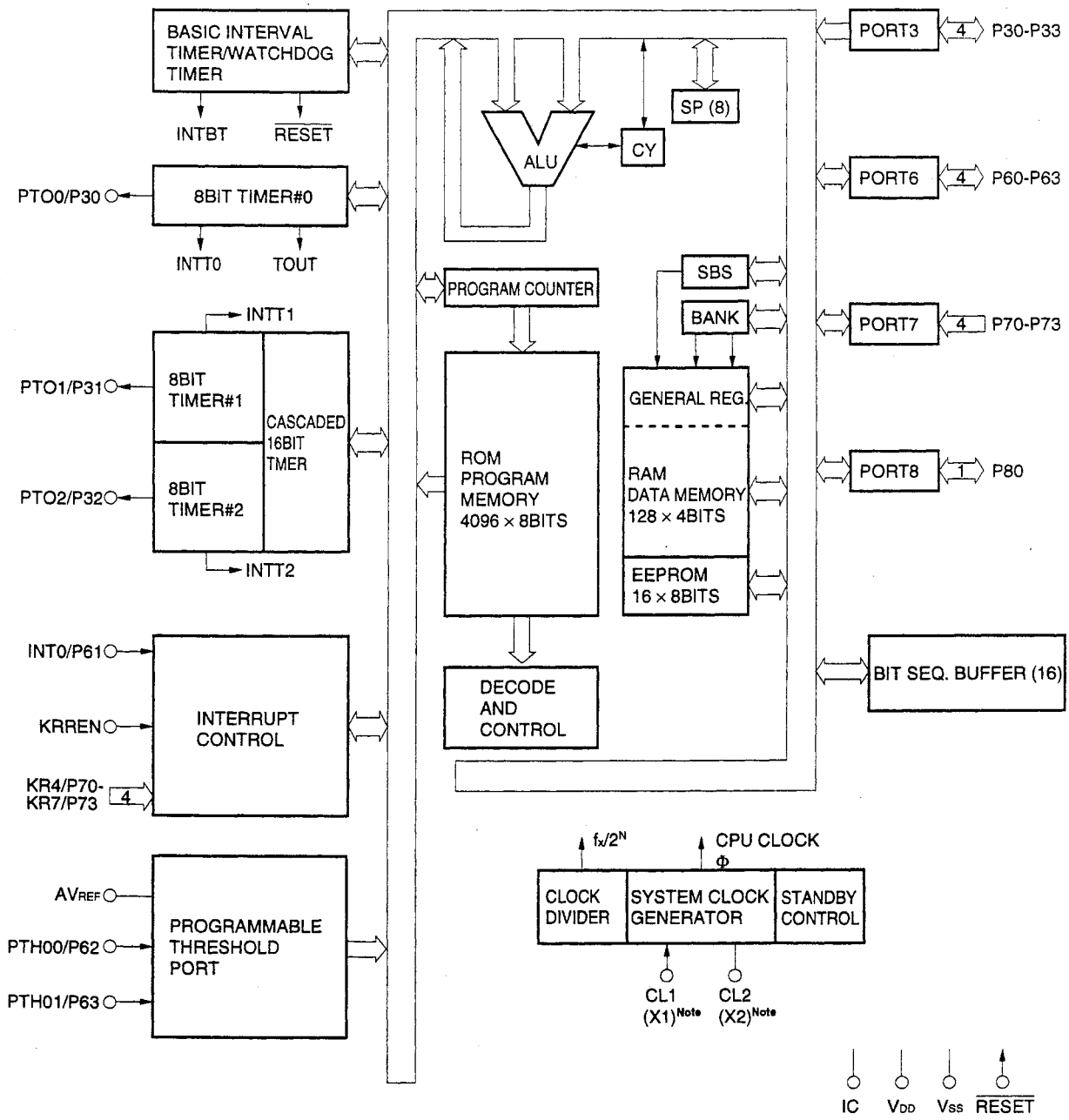
[Features]

- Low-voltage, high-speed operation possible:
  - μPD754144: 4 μs (V_{DD} = 1.8 V, @ 1 MHz)
  - μPD754244, 754264, 754202 : 0.95 μs (V_{DD} = 1.8 V, @ 4.19 MHz)
    0.67 μs (V_{DD} = 2.7 V, @ 6.0 MHz)
- On-chip EEPROM capable of retaining data even in event of power failure (data memory area) (except μPD754202)
  - μPD754144, 754244: 16 bytes
  - μPD754264: 32 bytes
- Enhanced timer function: 4 channels
  - Usable as a 16-bit timer counter
  - On-chip remote control carrier frequency generator
  - Basic interval timer usable as a watchdog timer
- Enhanced interrupt functions such as standby release by key input, interrupt at termination of serial data transfer, multiple interrupts, etc.
- Replacement is easy because the functions and instructions of the conventional 75XL series are inherited

[Applications]

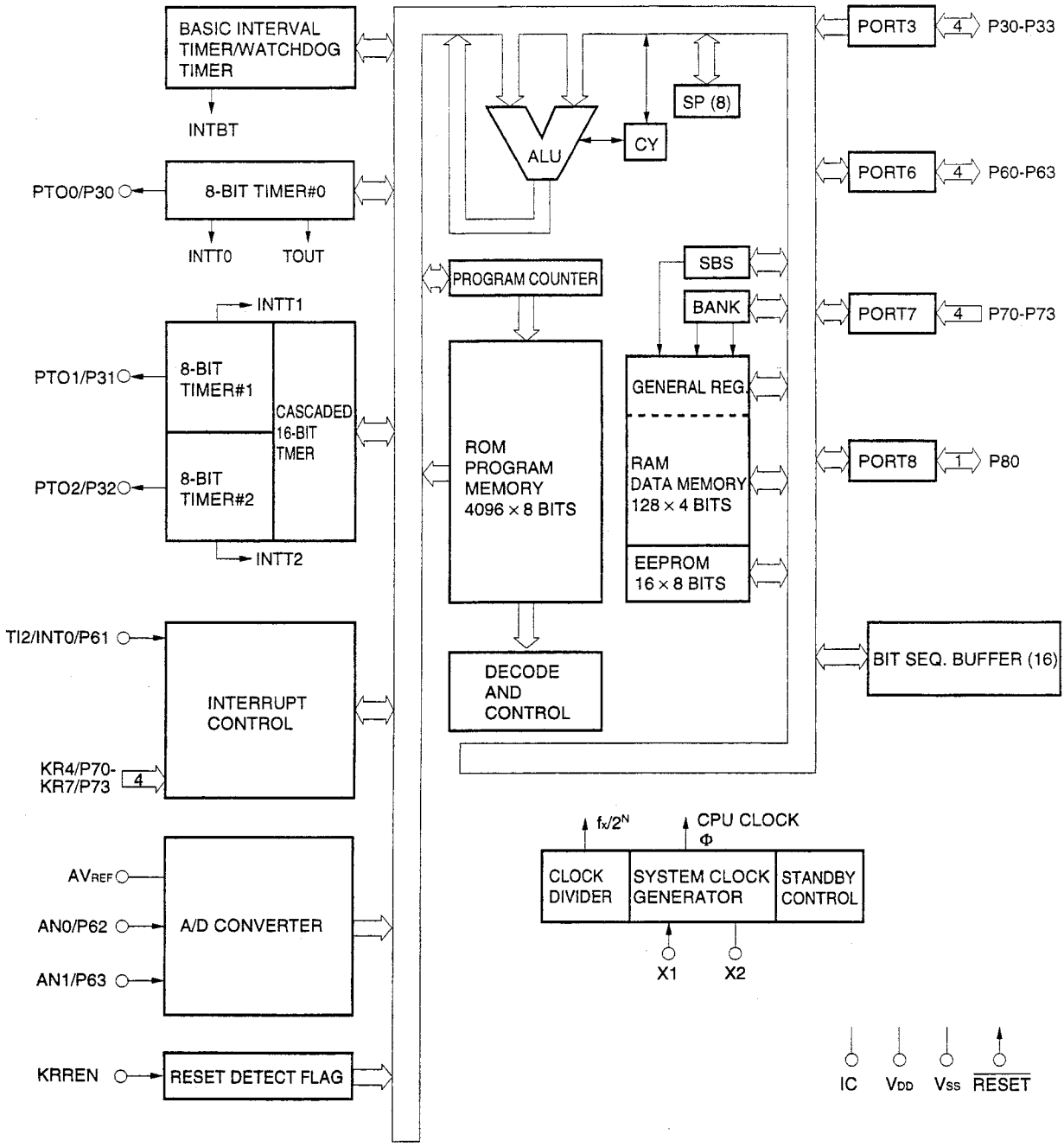
Keyless entries, data carriers

Block Diagram (μPD754144, 754244)

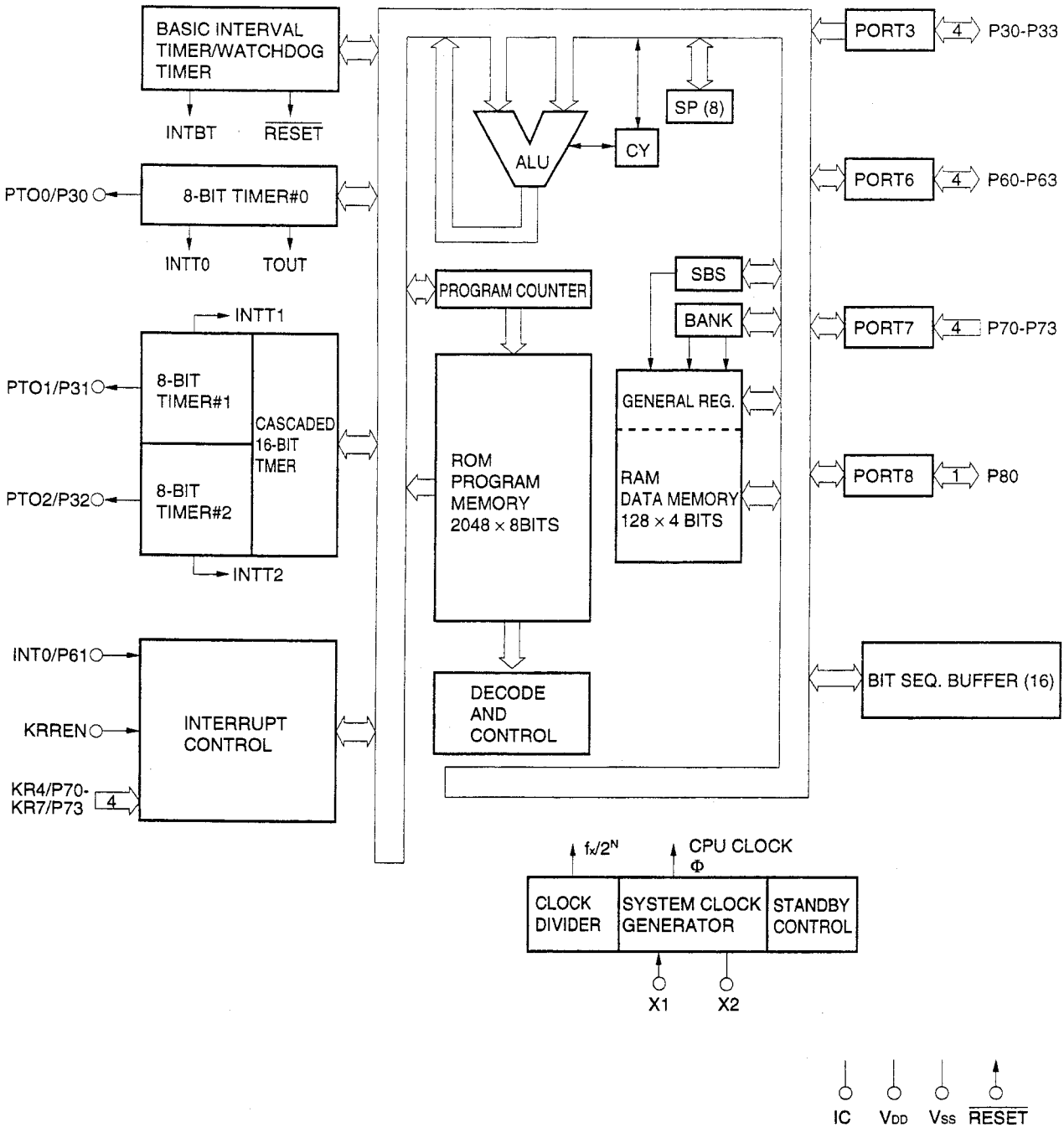


Note Data in the parentheses are for μPD754244.

Block Diagram (μPD754264)



Block Diagram (μPD754202)



[Function List]

Item		μPD754144	μPD754244	μPD754202	μPD754264
ROM (bytes)		4096 (mask ROM)		2048 (mask ROM)	4096 (mask ROM)
RAM (× 4 bits)		128			
EEPROM (bytes)		16		None	32
General-purpose registers		(4 bits × 8) × 4 banks or (8 bits × 4) × 4 banks			
Instruction execution time		• 4, 8, 16, 64 μs (system clock: @ 1 MHz)		• 0.95, 1.91, 3.81, 15.3 μs (system clock: @ 4.19 MHz) • 0.67, 1.33, 2.67, 10.7 μs (system clock: @ 6.0 MHz)	
I/O ports	CMOS inputs	4	Pull-up resistors can be made on chip with mask option		
	CMOS I/O	9	Can directly drive LEDs Connection of on-chip pull-up resistors can be specified by software		
	Total	13			
System clock oscillation circuit		RC oscillation circuit (external resistor and capacitor)		Crystal/ceramic oscillation circuit	
Timer		4 channels • 8-bit timer: 3 channels (usable as 16-bit timer) • Basic interval timer/watchdog timer: 1 channel			
Vectored interrupt		External: 1, Internal: 5			
Test input		External: 1			
Power-supply voltage		V_{DD} = 1.8 to 6.0 V			
Package		• 20-pin plastic SOP (300 mil, 1.27 mm pitch) • 20-pin plastic shrink SOP (300 mil, 0.65 mm pitch)			• 20-pin plastic SOP (300 mil, 1.27 mm pitch)

5.9 General-Purpose Small-Size Series (μPD7543××)

Applicable products: μPD754302, 754304, 75P4308, 754302(A), 754304(A)

This subseries consists of general-purpose small-size microcontrollers with on-chip general-purpose input/output ports as well as serial bus interface. It not only inherits the functions and instructions of the previous 75X series products, but also has extended functions such as incorporation of 3 timer channels. Furthermore, the small 36-pin package and low-voltage (1.8 V), high-speed operation capability make it suitable for small set applications using a submicrocontroller and batteries.

The μPD754302(A) and 754304(A) are "special" quality grades for the μPD754302 and 754304, respectively.

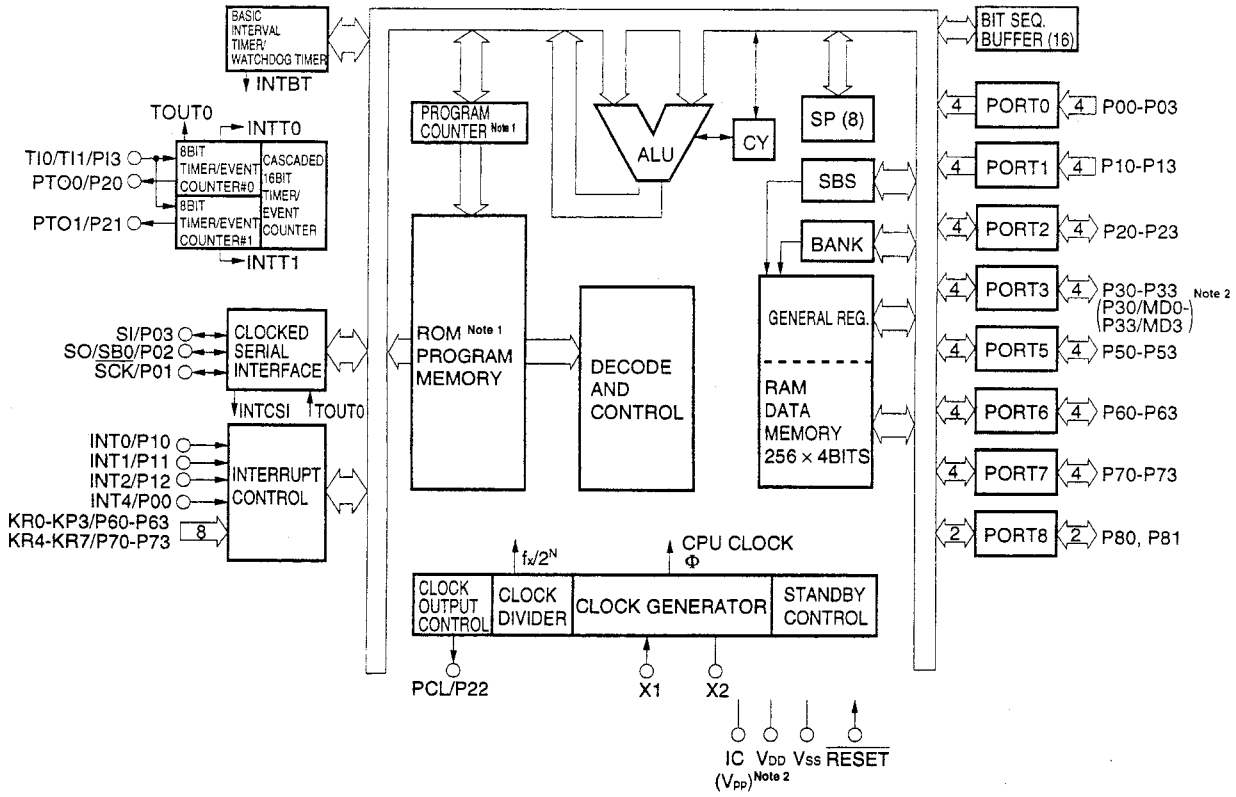
[Features]

- Low-voltage, high-speed operation possible: 0.95 μs (V_{DD} = 1.8 V, @ 4.19 MHz)
  0.67 μs (V_{DD} = 2.7 V, @ 6.0 MHz)
- Enhanced timer function: 3 channels
  - Usable as a 16-bit timer/event counter
  - On-chip remote control carrier frequency generator
  - Basic interval timer usable as a watchdog timer
- On-chip serial interface allows it to be used as a submicrocontroller for various kinds of application equipment
- Enhanced interrupt functions such as standby release by key input, interrupt at termination of serial data transfer, multiple interrupts, etc.
- Replacement is easy because the functions and instructions of the conventional 75XL series are inherited
- PROM version available
  - μPD75P4308 (one-time PROM)

[Applications]

Standard: Cordless telephones, TVs, VCRs, audio equipment, home electric appliances, OA equipment, etc.
Special: Car electronics

Block Diagram



Notes 1. Differs with the model.

2. Data in the parentheses are for μPD75P4308.

[Function List]

Item		μPD754302, 754302(A)	μPD754304, 754304(A)	μPD75P4308
ROM (bytes)		2048 (mask ROM)	4096 (mask ROM)	8192 (one-time PROM)
RAM (× 4 bits)		256		
General-purpose registers		(4 bits × 8) × 4 banks or (8 bits × 4) × 4 banks		
Instruction execution time		• 0.95, 1.91, 3.81, 15.3 μs (system clock: 4.19 MHz) • 0.67, 1.33, 2.67, 10.7 μs (system clock: 6.0 MHz)		
I/O ports	CMOS inputs	8	Connection of on-chip pull-up resistors can be specified by software: 7	
	CMOS I/O	18	Can directly drive LEDs Connection of on-chip pull-up resistors can be specified by software	
	N-channel open-drain I/O	4	Can directly drive LEDs Pull-up resistors can be made on chip with mask option	No pull-up resistor
	Total	30		
Timer		3 channels • 8-bit timer/event counter: 2 channels (usable as 16-bit timer/event counter) • Basic interval timer/watchdog timer: 1 channel		
Serial interface		2 selectable modes • 3-wire serial I/O mode ··· Switching between MSB first and LSB first • 2-wire serial I/O mode		
Vectored interrupt		External: 3, Internal: 4		
Test input		External: 1		
Clock output (PCL)		• Φ, 524, 262, 65.5 kHz (system clock: 4.19 MHz) • Φ, 750, 375, 93.7 kHz (system clock: 6.0 MHz)		
Power-supply voltage		V_{DD} = 1.8 to 5.5 V		
Package		• 36-pin plastic shrink SOP (300 mil, 0.8 mm pitch)		

6. 75XL SERIES INSTRUCTION SET

The 75XL Series instruction set combines the top level models of the 75X Series that is the predecessor of the 75XL Series. Consequently, upward compatibility is maintained in the 75XL Series with the array of 75X Series software developed previously.

The features of the 75XL Series instruction set are presented next.

(1) Bit manipulation instructions capable of a variety of applications
(2) 4-bit manipulation instructions with excellent efficiency
(3) 8-bit manipulation instructions rivaling those in an 8-bit microcontroller
(4) GETI instruction to reduce the program size
(5) String effect instructions and decimal adjust instructions to improve program efficiency
(6) Table lookup instructions suited to continuous references
(7) One-byte branch relative instructions
(8) NEC standard mnemonics organized for easy understanding

The operand column of each instruction is described as shown in the table below (For details, see the **RA75X ASSEMBLER PACKAGE USER'S MANUAL - Language (EEU-1343)**).

- When there are multiple description methods, select one.

Example reg in the operand column means one of the registers from X to L. Therefore, specify one register from registers X to L.

- Write uppercase letters, and the + and – symbols as shown.
- For immediate data, use numerics.
- Definition as a symbol is possible.

Table 6-1. Operand Description Method

Representation format	Description method
reg reg1	X, A, B, C, D, E, H, L X, B, C, D, E, H, L
rp rp1 rp2 rp' rp'1	XA, BC, DE, HL BC, DE, HL BC, DE XA, BC, DE, HL, XA', BC', DE', HL' BC, DE, HL, XA', BC', DE', HL'
rpa rpa1	HL, HL+, HL–, DE, DL DE, DL
n4 n8	4-bit immediate data or label 8-bit immediate data or label
mem bit	8-bit immediate data or label Note 1 2-bit immediate data or label
fmem pmem	FB0H - FBFH, FF0H - FFFH immediate data or label FC0H - FFFH immediate data or label
addr Note 2 addr1 Note 2 caddr faddr	0000H - 3FFFH immediate data or label 0000H - 7FFFH immediate data or label (MK II mode only) 12-bit immediate data or label 11-bit immediate data or label
taddr	20H - 7FH immediate data (where bit0 = 0) or label
PORTn Note 3 IExxx Note 3 RBn Note 2 MBn Note 2	PORT0 - PORT11 IEBT, IET0 - IET2, IE0 - IE2, IE4, IECSI, IEW, IEEE RB0 - RB3 MB0 - MB4, MB15

Notes 1. mem can only use an even address in 8-bit processing.

2. The ranges of addr, addr1, RBn, and MBn differ with the product.

3. The number of PORTn and IExxx differs with the product.

Instruction group	Mnemonic	Operand	Number of bytes	Machine cycle	Operation	Skip condition
Transfer	MOV	A, #n4	1	1	A ← n4	String effect A
		reg1, #n4	2	2	reg1 ← n4	
		XA, #n8	2	2	XA ← n8	String effect A
		HL, #n8	2	2	HL ← n8	String effect B
		rp2, #n8	2	2	rp2 ← n8	
		A, @HL	1	1	A ← (HL)	
		A, @HL+	1	2 + S	A ← (HL), then L ← L + 1	L = 0
		A, @HL–	1	2 + S	A ← (HL), then L ← L – 1	L = FH
		A, @rpa1	1	1	A ← (rpa1)	
		XA, @HL	2	2	XA ← (HL)	
		@HL, A	1	1	(HL) ← A	
		@HL, XA	2	2	(HL) ← XA	
		A, mem	2	2	A ← (mem)	
		XA, mem	2	2	XA ← (mem)	
		mem, A	2	2	(mem) ← A	
		mem, XA	2	2	(mem) ← XA	
		A, reg1	2	2	A ← reg1	
		XA, rp'	2	2	XA ← rp'	
		reg1, A	2	2	reg1 ← A	
		rp'1, XA	2	2	rp'1 ← XA	
	XCH	A, @HL	1	1	A ↔ (HL)	
		A, @HL+	1	2 + S	A ↔ (HL), then L ← L + 1	L = 0
		A, @HL–	1	2 + S	A ↔ (HL), then L ← L – 1	L = FH
		A, @rpa1	1	1	A ↔ (rpa1)	
		XA, @HL	2	2	XA ↔ (HL)	
		A, mem	2	2	A ↔ (mem)	
		XA, mem	2	2	XA ↔ (mem)	
		A, reg1	1	1	A ↔ reg1	
		XA, rp'	2	2	XA ↔ rp'	
Table lookup	MOVT Note 1	XA, @PCDE	1	3	XA ← $(PC_{13-8} + DE)_{ROM}$	
					XA ← $(PC_{14-8} + DE)_{ROM}$	
		XA, @PCXA	1	3	XA ← $(PC_{13-8} + XA)_{ROM}$	
					XA ← $(PC_{14-8} + XA)_{ROM}$	
		XA, @BCDE Note 2	1	3	XA ← $(B_{1,0} + CDE)_{ROM}$	
					XA ← $(B_{2-0} + CDE)_{ROM}$	
		XA, @BCXA Note 2	1	3	XA ← $(B_{1,0} + CXA)_{ROM}$	
					XA ← $(B_{2-0} + CXA)_{ROM}$	

Notes 1. The operations in the shaded boxes only apply in the MkII mode. The others can apply only in the MkI mode.

2. Only the following bits are valid for the B register.

During MkI mode : low-order 2 bits

During MkII mode: low-order 3 bits

Instruction group	Mnemonic	Operand	Number of bytes	Machine cycle	Operation	Skip condition
Bit transfer	MOV1	CY, fmem.bit	2	2	CY ← (fmem.bit)	
		CY, pmem.@L	2	2	CY ← (pmem$_{7-2}$ + L$_{3-2}$.bit(L$_{1-0}$))	
		CY, @H + mem.bit	2	2	CY ← (H + mem$_{3-0}$.bit)	
		fmem.bit, CY	2	2	(fmem.bit) ← CY	
		pmem.@L, CY	2	2	(pmem$_{7-2}$ + L$_{3-2}$.bit(L$_{1-0}$)) ← CY	
		@H + mem.bit, CY	2	2	(H + mem$_{3-0}$.bit) ← CY	
Operation	ADDS	A, #n4	1	1 + S	A ← A + n4	carry
		XA, #n8	2	2 + S	XA ← XA + n8	carry
		A, @HL	1	1 + S	A ← A + (HL)	carry
		XA, rp'	2	2 + S	XA ← XA + rp'	carry
		rp'1, XA	2	2 + S	rp'1 ← rp'1 + XA	carry
	ADDC	A, @HL	1	1	A, CY ← A + (HL) + CY	
		XA, rp'	2	2	XA, CY ← XA + rp' + CY	
		rp'1, XA	2	2	rp'1, CY ← rp'1 + XA + CY	
	SUBS	A, @HL	1	1 + S	A ← A − (HL)	borrow
		XA, rp'	2	2 + S	XA ← XA − rp'	borrow
		rp'1, XA	2	2 + S	rp'1 ← rp'1 − XA	borrow
	SUBC	A, @HL	1	1	A, CY ← A − (HL) − CY	
		XA, rp'	2	2	XA, CY ← XA − rp' − CY	
		rp'1, XA	2	2	rp'1, CY ← rp'1 − XA − CY	
	AND	A, #n4	2	2	A ← A ∧ n4	
		A, @HL	1	1	A ← A ∧ (HL)	
		XA, rp'	2	2	XA ← XA ∧ rp'	
		rp'1, XA	2	2	rp'1 ← rp'1 ∧ XA	
	OR	A, #n4	2	2	A ← A ∨ n4	
		A, @HL	1	1	A ← A ∨ (HL)	
		XA, rp'	2	2	XA ← XA ∨ rp'	
		rp'1, XA	2	2	rp'1 ← rp'1 ∨ XA	
	XOR	A, #n4	2	2	A ← A ⊻ n4	
		A, @HL	1	1	A ← A ⊻ (HL)	
		XA, rp'	2	2	XA ← XA ⊻ rp'	
		rp'1, XA	2	2	rp'1 ← rp'1 ⊻ XA	
Accumulator manipulation	RORC	A	1	1	CY ← A$_0$, A$_3$ ← CY, A$_{n-1}$ ← A$_n$	
	NOT	A	2	2	A ← $\overline{A}$	

Instruction group	Mnemonic	Operand	Number of bytes	Machine cycle	Operation	Skip condition
Increment and decrement	INCS	reg	1	1 + S	reg ← reg + 1	reg = 0
		rp1	1	1 + S	rp1 ← rp1 + 1	rp1 = 00H
		@HL	2	2 + S	(HL) ← (HL) + 1	(HL) = 0
		mem	2	2 + S	(mem) ← (mem) + 1	(mem) = 0
	DECS	reg	1	1 + S	reg ← reg − 1	reg = FH
		rp'	2	2 + S	rp' ← rp' − 1	rp' = FFH
Comparison	SKE	reg, #n4	2	2 + S	Skip if reg = n4	reg = n4
		@HL, #n4	2	2 + S	Skip if (HL) = n4	(HL) = n4
		A, @HL	1	1 + S	Skip if A = (HL)	A = (HL)
		XA, @HL	2	2 + S	Skip if XA = (HL)	XA = (HL)
		A, reg	2	2 + S	Skip if A = reg	A = reg
		XA, rp'	2	2 + S	Skip if XA = rp'	XA = rp'
Carry flag manipulation	SET1	CY	1	1	CY ← 1	
	CLR1	CY	1	1	CY ← 0	
	SKT	CY	1	1 + S	Skip if CY = 1	CY = 1
	NOT1	CY	1	1	CY ← $\overline{CY}$	
Memory bit manipulation	SET1	mem.bit	2	2	(mem.bit) ← 1	
		fmem.bit	2	2	(fmem.bit) ← 1	
		pmem.@L	2	2	(pmem$_{7-2}$ + L$_{3-2}$.bit(L$_{1-0}$)) ← 1	
		@H + mem.bit	2	2	(H + mem$_{3-0}$.bit) ← 1	
	CLR1	mem.bit	2	2	(mem.bit) ← 0	
		fmem.bit	2	2	(fmem.bit) ← 0	
		pmem.@L	2	2	(pmem$_{7-2}$ + L$_{3-2}$.bit(L$_{1-0}$)) ← 0	
		@H + mem.bit	2	2	(H + mem$_{3-0}$.bit) ← 0	
	SKT	mem.bit	2	2 + S	Skip if (mem.bit) = 1	(mem.bit) = 1
		fmem.bit	2	2 + S	Skip if (fmem.bit) = 1	(fmem.bit) = 1
		pmem.@L	2	2 + S	Skip if (pmem$_{7-2}$ + L$_{3-2}$.bit(L$_{1-0}$)) = 1	(pmem.@L) = 1
		@H + mem.bit	2	2 + S	Skip if (H + mem$_{3-0}$.bit) = 1	(@H + mem.bit) = 1
	SKF	mem.bit	2	2 + S	Skip if (mem.bit) = 0	(mem.bit) = 0
		fmem.bit	2	2 + S	Skip if (fmem.bit) = 0	(fmem.bit) = 0
		pmen.@L	2	2 + S	Skip if (pmem$_{7-2}$ + L$_{3-2}$.bit(L$_{1-0}$)) = 0	(pmem.@L) = 0
		@H + mem.bit	2	2 + S	Skip if (H + mem$_{3-0}$.bit) = 0	(@H + mem.bit) = 0
	SKTCLR	fmem.bit	2	2 + S	Skip if (fmem.bit) = 1 and clear	(fmem.bit) = 1
		pmem.@L	2	2 + S	Skip if (pmem$_{7-2}$ + L$_{3-2}$.bit(L$_{1-0}$)) = 1 and clear	(pmem.@L) = 1
		@H + mem.bit	2	2 + S	Skip if (H + mem$_{3-0}$.bit) = 1 and clear	(@H + mem.bit) = 1
	AND1	CY, fmem.bit	2	2	CY ← CY ∧ (fmem.bit)	
		CY, pmem.@L	2	2	CY ← CY ∧ (pmem$_{7-2}$ + L$_{3-2}$.bit(L$_{1-0}$))	
		CY, @H + mem.bit	2	2	CY ← CY ∧ (H + mem$_{3-0}$.bit)	

Instruction group	Mnemonic	Operand	Number of bytes	Machine cycle	Operation	Skip condition
Memory bit manipulation	OR1	CY, fmem.bit	2	2	CY ← CY ∨ (fmem.bit)	
		CY, pmem.@L	2	2	CY ← CY ∨ (pmem$_{7-2}$ + L$_{3-2}$.bit(L$_{1-0}$))	
		CY, @H + mem.bit	2	2	CY ← CY ∨ (H + mem$_{3-0}$.bit)	
	XOR1	CY, fmem.bit	2	2	CY ← CY ⊽ (fmem.bit)	
		CY, pmem.@L	2	2	CY ← CY ⊽ (pmem$_{7-2}$ + L$_{3-2}$.bit(L$_{1-0}$))	
		CY, @H + mem.bit	2	2	CY ← CY ⊽ (H + mem$_{3-0}$.bit)	
Branch	BR Note 1	addr	–	–	PC$_{13-0}$ ← addr (Select the optimum instruction from the following depending on the assembler. BR !addr BRCB !caddr BR $addr)	
		addr1	–	–	PC$_{14-0}$ ← addr1 (Select the optimum instruction from the following depending on the assembler. BR !addr BRA !addr1 BRCB !caddr BR $addr1)	
		!addr	3	3	PC$_{13-0}$ ← addr	
					PC$_{14}$ ← 0, PC$_{13-0}$ ← addr	
		$addr	1	2	PC$_{13-0}$ ← addr	
		$addr1	1	2	PC$_{14-0}$ ← addr1	
		PCDE	2	3	PC$_{13-0}$ ← PC$_{13-8}$ + DE	
					PC$_{14-0}$ ← PC$_{14-8}$ + DE	
		PCXA	2	3	PC$_{13-0}$ ← PC$_{13-8}$ + XA	
					PC$_{14-0}$ ← PC$_{14-8}$ + XA	
		BCDE Note 2	2	3	PC$_{13-0}$ ← B CDE	
					PC$_{14-0}$ ← B CDE	
		BCXA Note 2	2	3	PC$_{13-0}$ ← B CXA	
					PC$_{14-0}$ ← B CXA	
	BRA Note 1	!addr1	3	3	PC$_{14-0}$ ← addr1	
	BRCB Note 1	!caddr	2	2	PC$_{13-0}$ ← PC$_{13,12}$ + caddr$_{11-0}$	
					PC$_{14-0}$ ← PC$_{14-12}$ + caddr$_{11-0}$	

Notes 1. The operations in the shaded boxes only apply in the MkII mode. The others can apply only in the MkI mode.

2. Only the following bits are valid for the B register.
During MkI mode : low-order 2 bits
During MkII mode: low-order 3 bits

Instruction group	Mnemonic	Operand	Number of bytes	Machine cycle	Operation	Skip condition
Subroutine stack control	CALLA Note	!addr1	3	3	(SP – 6) (SP – 3) (SP – 4) ← PC_{11-0} (SP – 5) ← 0, PC_{14}, PC_{13}, PC_{12} (SP – 2) ← ×, ×, MBE, RBE PC_{14-0} ← addr1, SP ← SP – 6	
	CALL Note	!addr	3	3	(SP – 4) (SP – 1) (SP – 2) ← PC_{11-0} (SP – 3) ← MBE, RBE, PC_{13}, PC_{12} PC_{13-0} ← addr, SP ← SP – 4	
				4	(SP – 6) (SP – 3) (SP – 4) ← PC_{11-0} (SP – 5) ← 0, PC_{14}, PC_{13}, PC_{12} (SP – 2) ← ×, ×, MBE, RBE PC_{14} ← 0, PC_{13-0} ← addr, SP ← SP – 6	
	CALLF Note	!faddr	2	2	(SP – 4) (SP – 1) (SP – 2) ← PC_{11-0} (SP – 3) ← MBE, RBE, PC_{13}, PC_{12} PC_{13-0} ← 000 + faddr, SP ← SP – 4	
				3	(SP – 6) (SP – 3) (SP – 4) ← PC_{11-0} (SP – 5) ← 0, PC_{14}, PC_{13}, PC_{12} (SP – 2) ← ×, ×, MBE, RBE PC_{14-0} ← 0000 + faddr, SP ← SP – 6	
	RET Note		1	3	MBE, RBE, PC_{13}, PC_{12} ← (SP + 1) PC_{11-0} ← (SP) (SP + 3) (SP + 2), SP ← SP + 4	
					×, ×, MBE, RBE ← (SP + 4) 0, PC_{14}, PC_{13}, PC_{12} ← (SP + 1) PC_{11-0} ← (SP) (SP + 3) (SP + 2), SP ← SP + 6	
	RETS Note		1	3 + S	MBE, RBE, PC_{13}, PC_{12} ← (SP + 1) PC_{11-0} ← (SP) (SP + 3) (SP + 2), SP ← SP + 4 then skip unconditionally	No condition
					×, ×, MBE, RBE ← (SP + 4) 0, PC_{14}, PC_{13}, PC_{12} ← (SP + 1) PC_{11-0} ← (SP) (SP + 3) (SP + 2), SP ← SP + 6 then skip unconditionally	
	RETI Note		1	3	MBE, RBE, PC_{13}, PC_{12} ← (SP + 1) PC_{11-0} ← (SP) (SP + 3) (SP + 2) PSW ← (SP + 4) (SP + 5), SP ← SP + 6	
					0, PC_{14}, PC_{13}, PC_{12} ← (SP + 1) PC_{11-0} ← (SP) (SP + 3) (SP + 2) PSW ← (SP + 4) (SP + 5), SP ← SP + 6	
	PUSH	rp	1	1	(SP – 1) (SP – 2) ← rp, SP ← SP – 2	
		BS	2	2	(SP – 1) ← MBS, (SP – 2) ← RBS, SP ← SP – 2	
	POP	rp	1	1	rp ← (SP + 1) (SP), SP ← SP + 2	
		BS	2	2	MBS ← (SP + 1), RBS ← (SP), SP ← SP + 2	

Note The operations in the shaded boxes only apply in the MkII mode. The others can apply only in the MkI mode.

Instruction group	Mnemonic	Operand	Number of bytes	Machine cycle	Operation	Skip condition
Interrupt control	EI		2	2	IME (IPS.3) ← 1	
		IExxx	2	2	IExxx ← 1	
	DI		2	2	IME (IPS.3) ← 0	
		IExxx	2	2	IExxx ← 0	
Input/output	IN Note 1	A, PORTn	2	2	A ← PORTn (n = 0 - 7)	
		XA, PORTn	2	2	XA ← PORTn + 1, PORTn (n = 4, 6)	
	OUT Note 1	PORTn, A	2	2	PORTn ← A (n = 2 - 7)	
		PORTn, XA	2	2	PORTn + 1, PORTn ← XA (n = 4, 6)	
CPU control	HALT		2	2	Set HALT Mode (PCC.2 ← 1)	
	STOP		2	2	Set STOP Mode (PCC.3 ← 1)	
	NOP		1	1	No Operation	
Special	SEL	RBn	2	2	RBS ← n (n = 0 - 3)	
		MBn	2	2	MBS ← n (n = 0 - 3, 15)	
	GETI Note 2, 3	taddr	1	3	• When TBR instruction $PC_{13-0} \leftarrow (taddr)_{5-0} + (taddr + 1)$	
					• When TCALL instruction (SP – 4) (SP – 1) (SP – 2) ← PC_{11-0} (SP – 3) ← MBE, RBE, PC_{13}, PC_{12} $PC_{13-0} \leftarrow (taddr)_{5-0} + (taddr + 1)$ SP ← SP – 4	
					• When instruction is not TBR or TCALL (taddr) (taddr + 1) instruction is executed	Depending on the referenced instruction
			1	3	• When TBR instruction $PC_{13-0} \leftarrow (taddr)_{5-0} + (taddr + 1)$ $PC_{14} \leftarrow 0$	
				4	• When TCALL instruction (SP – 6) (SP – 3) (SP – 4) ← PC_{11-0} (SP – 5) ← 0, 0, 0, 0, (SP – 2) ← ×, ×, MBE, RBE $PC_{13-0} \leftarrow (taddr)_{5-0} + (taddr + 1)$ SP ← SP – 6, $PC_{14} \leftarrow 0$	
				3	• When instruction is not TBR or TCALL (taddr) (taddr + 1) instruction is executed	Depending on the referenced instruction

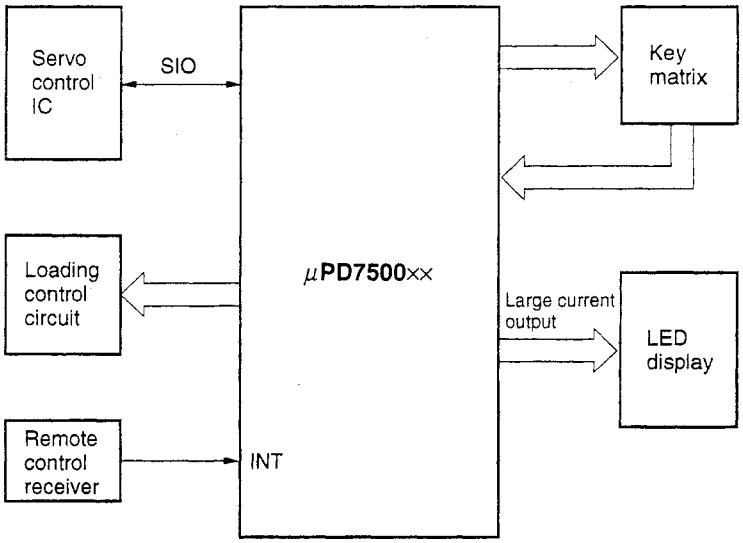
Notes 1. When the IN or OUT instruction is executed, MBE must be set to 0 or 1 and MBS must be set to 15.

2. The operations in the shaded boxes only apply in the MkII mode. The others can apply only in the MkI mode.

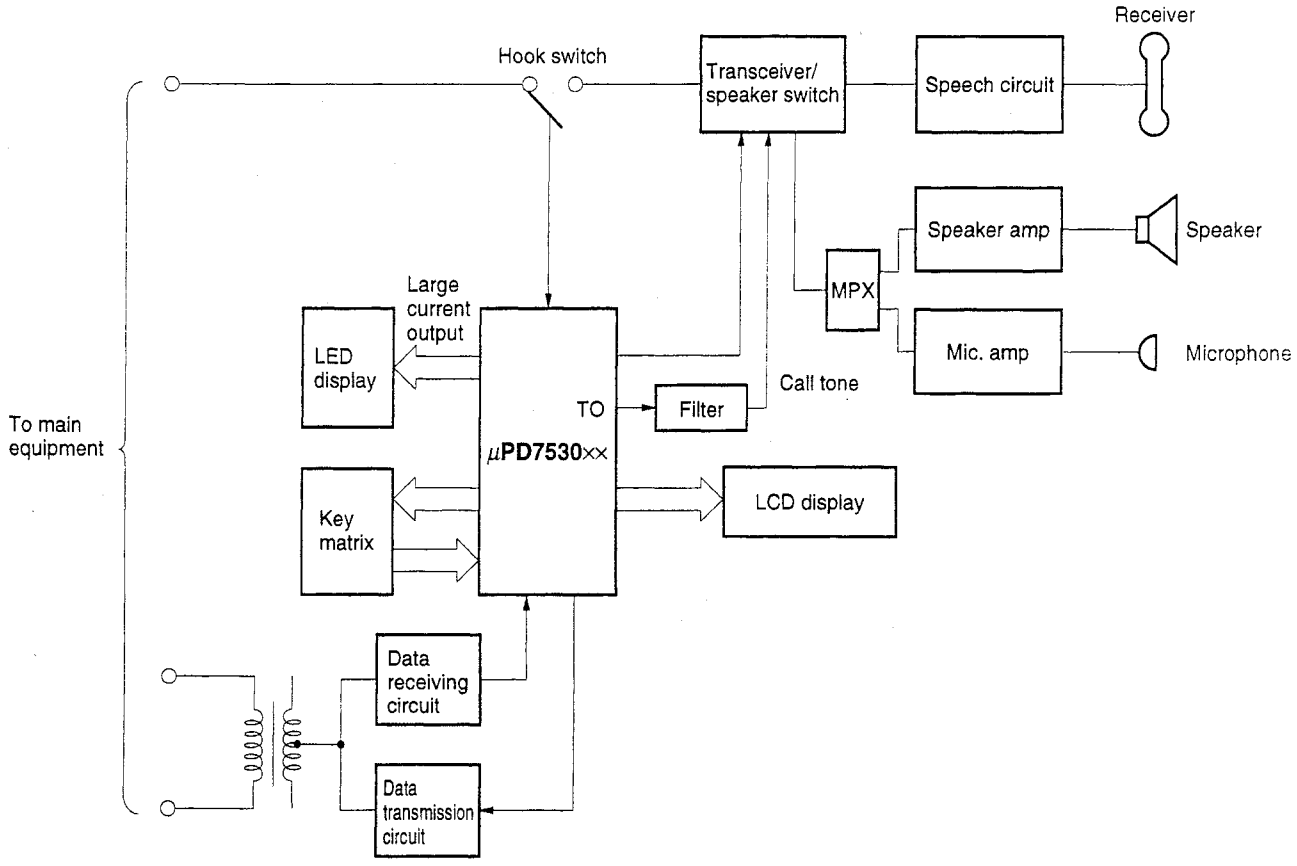
3. The TBR and TCALL instructions are the table definition assembler pseudo instructions of the GETI instruction.

7. 75XL SERIES APPLICATION EXAMPLES

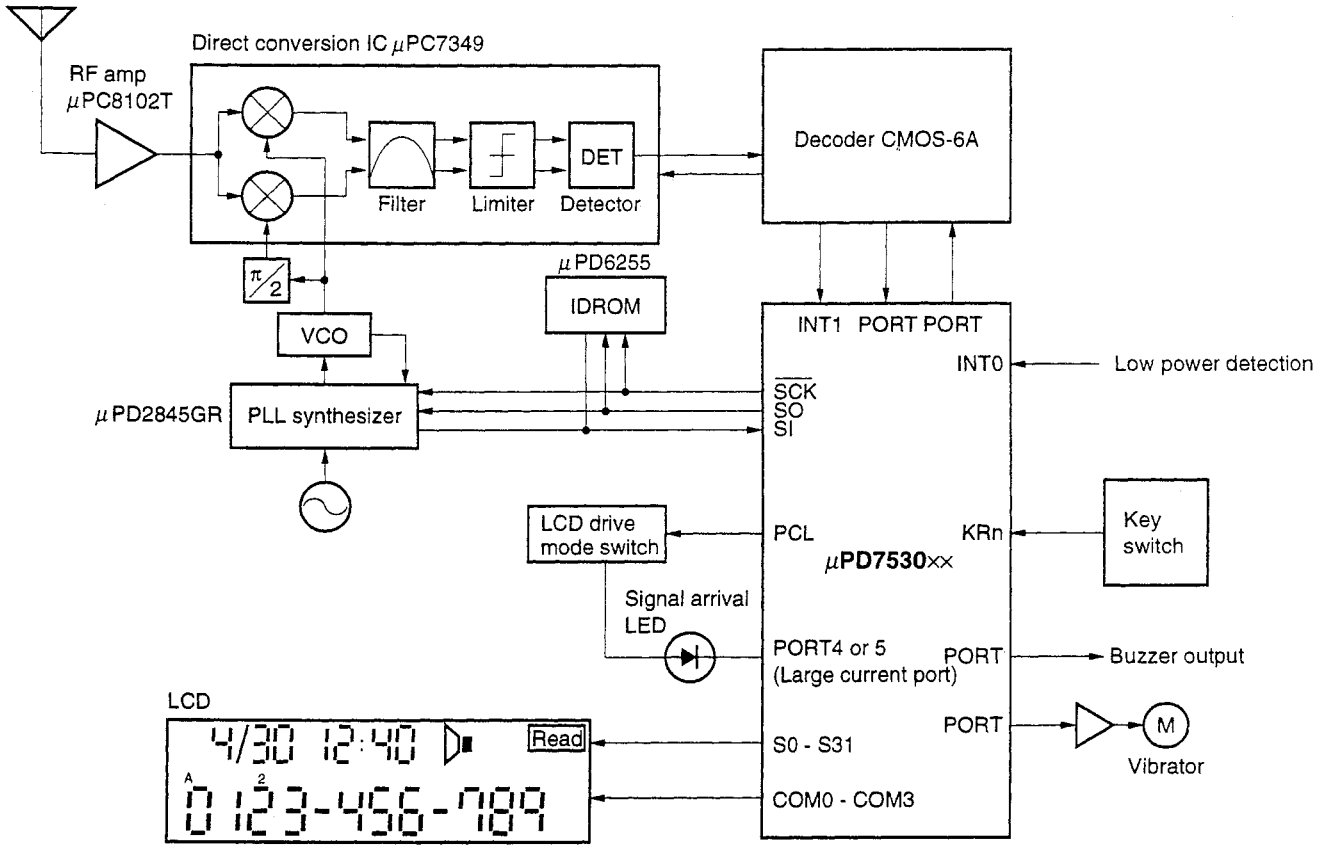
Compact disk player (low end model)



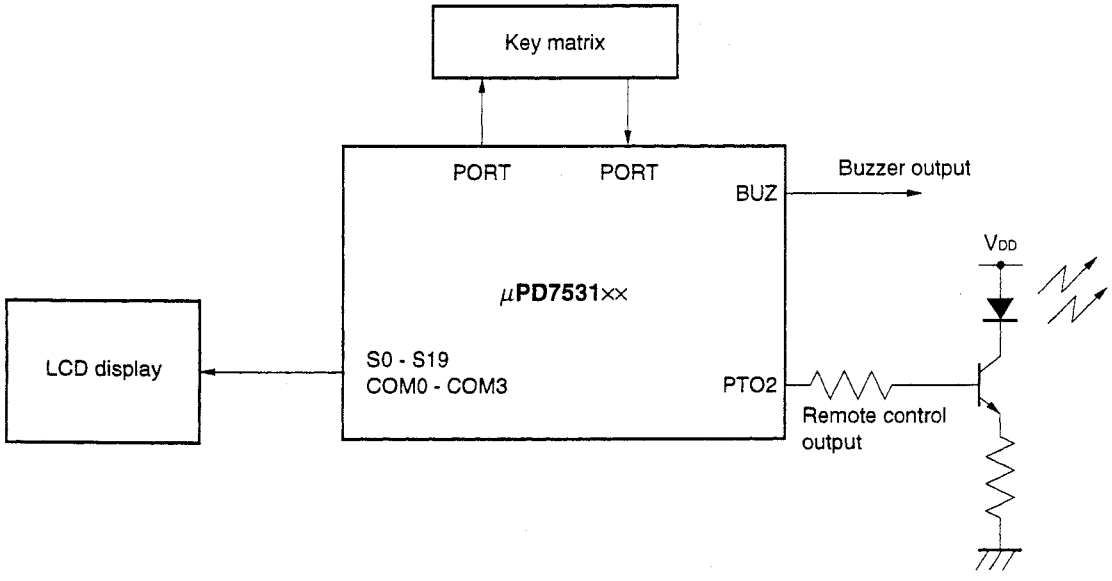
Touchtone telephone (telephone)



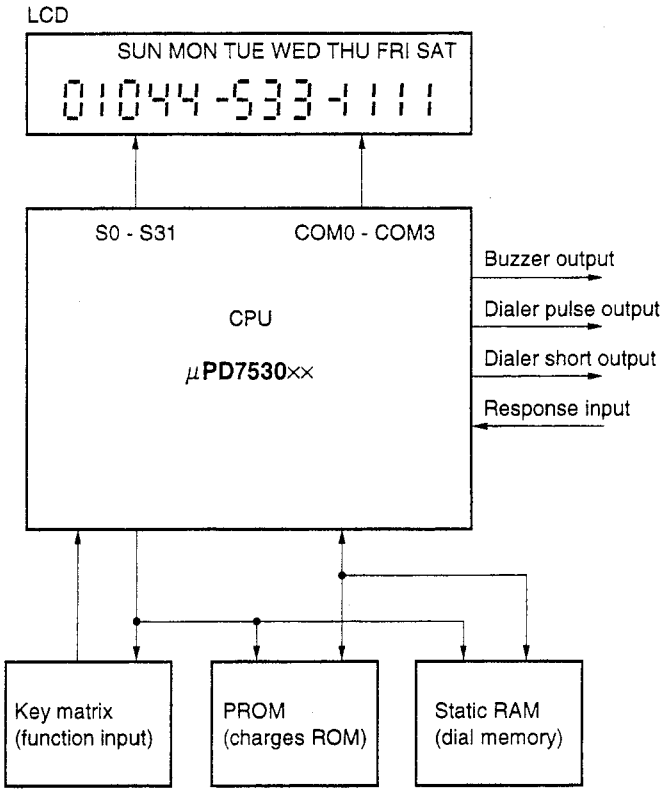
Pager receiver (numerical display model)



Remote control



Auto dialer


LCD
SUN MON TUE WED THU FRI SAT
01044-533-4111
S0 - S31
COM0 - COM3
CPU
μPD7530××
Buzzer output
Dialer pulse output
Dialer short output
Response input
Key matrix
(function input)
PROM
(charges ROM)
Static RAM
(dial memory)

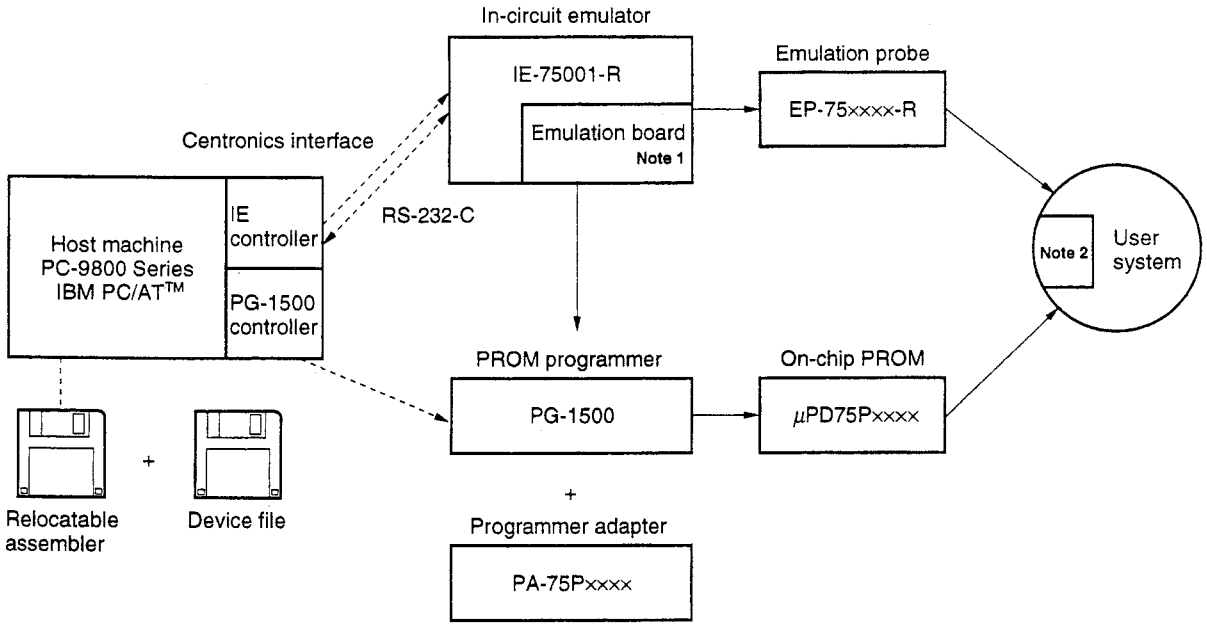
8. 75XL SERIES DEVELOPMENT TOOLS

The following development tools are prepared for program development for the 75XL Series.

- Debugging tools
- Language processor
- PROM writing tools

Figure 8-1 shows the configuration of the development tools.

Figure 8-1. Development Tools Configuration



Notes 1. IE-75001-R does not have an on-chip emulation board. IE-75300-R-EM (option) is required.

2. A conversion socket (product names beginning with EV-9200), or a conversion adapter or flexible board (product names beginning with EV-950) for connecting the emulation probe to the user system.

Remark xxxx: The product name differs with the target device and package.

8.1 Debugging Tools

The following tool is prepared as program debugging tool in the 75XL Series.

- In-circuit emulator: IE-75001-R

8.1.1 In-circuit emulator

The IE-75001-R is used as the in-circuit emulator.

IE-75001-R does not have an on-chip emulation board. When the IE-75001-R is used, the IE-75300-R-EM, which is an option, is required.

<table>
<tr><td rowspan="5">Hardware</td><td>IE-75001-R</td><td colspan="4">When an application system using the 75XL Series is developed, IE-75001-R is the in-circuit emulator for debugging the hardware and software. When developing the 75XL Series, the IE-75001-R, the emulation board (option), and the emulation probe are used together. The host machine and PROM programmer are connected and debugging can be effectively performed.</td></tr>
<tr><td>IE-75300-R-EM</td><td colspan="4">An emulation board for evaluating the application system using the 75XL Series, used in combination with the IE-75001-R.</td></tr>
<tr><td>EP-75xxxx-R</td><td colspan="4">An emulation probe for the 75XL Series. It is connected to IE-75001-R and IE-75300-R-EM.</td></tr>
<tr><td rowspan="5">Software</td><td rowspan="5">IE control program</td><td colspan="4">IE-75001-R and the host machine are connected with the RS-232-C and Centronics interface. The IE-75001-R is controlled by the host machine.</td></tr>
<tr><td rowspan="2">Host machine</td><td rowspan="2">OS</td><td rowspan="2">Supply media</td><td rowspan="2">Part No. (product name)</td></tr>
<tr></tr>
<tr><td>PC-9800 Series</td><td rowspan="2">MS-DOS™ (Ver. 3.30 to Ver. 6.2 Note)</td><td>3.5-inch, 2HD</td><td>μS5A13IE75X</td></tr>
<tr><td>5-inch, 2HD</td><td>μS5A10IE75X</td></tr>
<tr><td>IBM PC/AT and compatible machines</td><td>See 8.4.</td><td>3.5-inch, 2HC</td><td>μS7B13IE75X</td></tr>
<tr><td></td><td></td><td></td><td>5-inch, 2HC</td><td>μS7B10IE75X</td></tr>
</table>

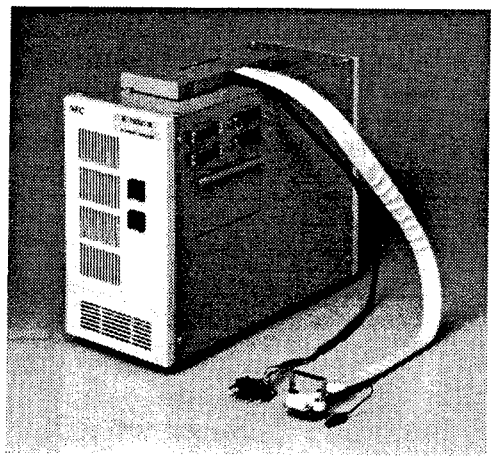
Note Although there is a task swap function in Ver. 5.0 or later, the task swap function cannot be used in this software.

Remarks 1. xxxx: The product name differs with the target device and package.

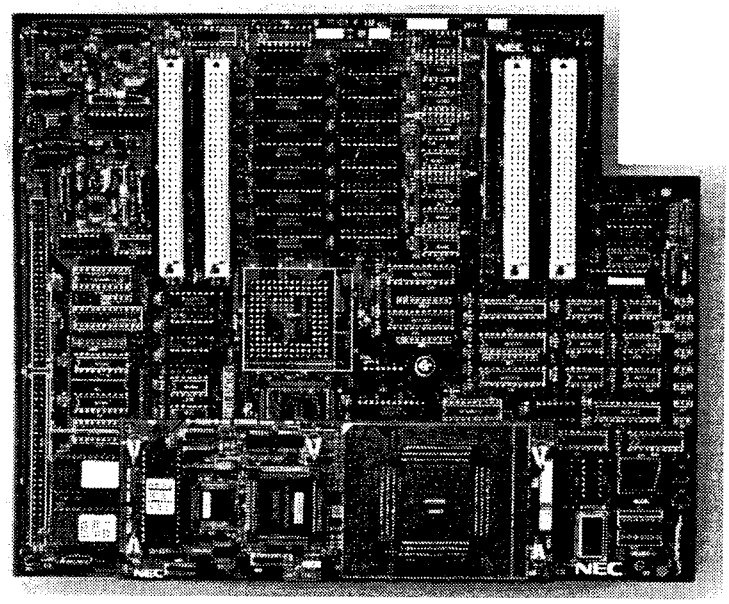
2. IE control program operation is guaranteed only for the operating systems and host machines described above.

[Features]

- Real-time emulation possible at 6 MHz
- Memory capacity
  - Program memory: 64K bytes
  - Data memory: 4K nibbles
- Trace display possible during execution
- Wealth of break functions
  - Sequential break, parallel break, break by guard external signal
- Check trace, qualify trace, section trace
- Coverage function
- High-speed download function using a parallel interface
- On-line assembler, reverse assembler function
- Symbolic debugging function
- Data memory, internal register real-time output



IE-75001-R



IE-75300-R-EM

8.1.2 Development tool list

The development tools for each target device are listed below.

(1/5)

Series / Item	General-purpose series μPD7500xx		General-purpose series with on-chip oscillation circuit μPD7501xx		General-purpose series with on-chip A/D converter μPD75006x	
Target device	μPD750004CU μPD750006CU μPD750008CU	μPD750004GB μPD750006GB μPD750008GB	μPD750104CU μPD750106CU μPD750108CU	μPD750104GB μPD750106GB μPD750108GB	μPD750064CU μPD750066CU μPD750068CU	μPD750064GT μPD750066GT μPD750068GT
Package	42-pin SDIP (600 mil)	44-pin QFP (10 × 10 mm)	42-pin SDIP (600 mil)	42-pin QFP (10 × 10 mm)	42-pin SDIP (600 mil)	42-pin SSOP (375 mil)
Emulator	IE-75001-R					
Emulation board (sold separately)	IE-75300-R-EM					
Emulation probe	EP-75008CU-R	EP-75008GB-R	EP-75008CU-R	EP-75008GB-R	EP-750068CU-R	EP-750068GT-R
Conversion socket	-	EV-9200G-44	-	EV-9200G-44	-	EV-9500GT-42 (Flexible board)
Device file	DF750008				DF750068	

(2/5)

Series / Item	LCD drive series uPD7530xx		LCD drive series with on-chip A/D converter μPD7530xx		LCD drive series (small-size) μPD7531xx	
Target device	μPD753012GC μPD753016GC μPD753017GC μPD753012AGC μPD753016AGC μPD753017AGC	μPD753012GK μPD753016GK μPD753017Gk μPD753012AGK μPD753016AGK μPD753017AGK	μPD753036GC	μPD753036GK	μPD753104GC μPD753106GC μPD753108GC	μPD753104GK μPD753106GK μPD753108GK
Package	80-pin QFP (14 × 14 mm)	80-pin TQFP (12 × 12 mm)	80-pin QFP (14 × 14 mm)	80-pin TQFP (12 × 12 mm)	64-pin QFP (14 × 14 mm)	64-pin TQFP (12 × 12 mm)
Emulator	IE-75001-R					
Emulation board (sold separately)	IE-75300-R-EM					
Emulation probe	EP-753017GC-R or EP-75308BGC-R Note1	EP-753017GK-R or EP-75308BGK R Note1	EP-75336GC-R	EP-75336GK-R	EP-753108GC-R	EP-753108GK-R
Conversion socket	EV-9200GC-80	TGK-080SDW Note2 (conversion adapter)	EV-9200GC-80	TGK-080SDW Note2 (conversion adapter)	EV-9200GC-64	TGK-064SBW Note2 (conversion adapter)
Device file	DF753017		DF753036		DF753018	

Notes 1. The EP-75308BGC-R and EP-75308BGK-R are limited in functions that can be used.

2. This is a product manufactured by TOKYO ELETECH Corp. Consult your local representative for purchasing.

(3/5)

Item \ Series	LCD driver series (small-size) μPD7532xx	Keyless entry series μPD7541xx, 7542xx	
Target device	μPD753204GT μPD753206GT μPD753208GT	μPD754144GS-xxx-BA5 μPD754244GS-xxx-BA5	μPD754144GS-xxx-GJG μPD754244GS-xxx-GJG
Package	48-pin SSOP (375 mil)	20-pin SOP (300 mil)	20-pin SSOP (300 mil)
Emulator	IE-75001-R		
Emulation board (sold separately)	IE-75300-R-EM		
Emulation probe	EP-753208GT-R	EP-754144GS-R	
Flexible board	EV-9500GT-48	EV-9501GS-20	EV-9500GS-20
Device file	DF753208	DF754244	

(4/5)

Item \ Series	Keyless entry series μPD7542xx		
Target device	μPD754202GS-xxx-BA5	μPD754202GS-xxx-GJG	μPD754264GS
Package	20-pin SOP (300mil)	20-pin SSOP (300 mil)	20-pin SOP (300 mil)
Emulator	IE-75001-R		
Emulation board (sold separately)	IE-75300-R-EM		
Emulation probe	EP-754144GS-R		
Flexible board	EV-9501GS-20	EV-9500GS-20	EV-9501GS-20
Device file	DF754202		DF754264

(5/5)

Item \ Series	General-purpose small-size series μPD7543xx
Target device	μPD754302GS μPD754304GS
Package	36-pin SSOP (300mil)
Emulator	IE-75001-R
Emulation board (sold separately)	IE-75300-R-EM
Emulation probe	EP-754304GS-R
Flexible board	EV-9500GS-36
Device file	DF754304

8.2 Language Processor

<table>
<tr><td rowspan="4">RA75X relocatable assembler</td><td colspan="4">This is a relocatable assembler for efficient 75XL Series program development.</td></tr>
<tr><td rowspan="2">Host machine</td><td colspan="2" rowspan="2"></td><td rowspan="2">Part No.
(product name)</td></tr>
<tr><td>OS</td><td>Supply media</td></tr>
<tr><td>PC-9800 Series</td><td>MS-DOS
(Ver. 3.30 to Ver. 6.2 Note)</td><td>3.5-inch, 2HD</td><td>μS5A13RA75X</td></tr>
<tr><td></td><td></td><td>5-inch, 2HD</td><td>μS5A10RA75X</td></tr>
<tr><td>IBM PC/AT and compatible machines</td><td>See 8.4.</td><td>3.5-inch, 2HC</td><td>μS7B13RA75X</td></tr>
<tr><td></td><td></td><td>5-inch, 2HC</td><td>μS7B10RA75X</td></tr>
</table>

Note Although there is a task swap function in Ver. 5.00 or later, the task swap function cannot be used in this software.

Remark Operation of relocatable assembler is guaranteed only for the operating systems and host machines described above.

- RA75X relocatable assembler

  In the 75XL Series, the relocatable assembler common to the series is combined and used with the device file of each product. By using the relocatable assembler, the program is divided into the modules for each function and developed. Programs having common elements can be used as a library. Thus, development efficiency can be substantially improved. By using a structured assembler attached to the RA75X, C like structured programming becomes possible.

[Features]

- Optimization function for branch instructions
- Useful pseudo instructions
  - Vector table definition pseudo instructions
  - Table definition pseudo instructions for GETI instruction
- Relocation attributes of CSEG pseudo instruction
- Wealth of application utilities (attached to RA75X)
  - Structured assembler (ST75X)
  - Macro processor (MP)
  - Librarian (LB75X)
  - List converter (LCNV75X)

- **Device file list**

Target device	Device file
μPD750004	DF750008
μPD750006	
μPD750008	
μPD75P0016	
μPD750104	
μPD750106	
μPD750108	
μPD75P0116	
μPD750064	DF750068
μPD750066	
μPD750068	
μPD75P0076	
μPD753012	DF753017
μPD753016	
μPD753017	
μPD75P3018	
μPD753012A	
μPD753016A	
μPD753017A	
μPD75P3018A	

Target device	Device file
μPD753036	DF753036
μPD75P3036	
μPD753104	DF753108
μPD753106	
μPD753108	
μPD75P3116	
μPD753204	DF753208
μPD753206	
μPD753208	
μPD75P3216	
μPD754144	DF754244
μPD754244	
μPD754264	DF754264
μPD754202	DF754202
μPD754302	DF754304
μPD754304	
μPD75P4308	

Remark The operation of the device files is guaranteed only for the operating systems and host machines that correspond to the relocatable assembler.

8.3 PROM Writing Tools

8.3.1 PROM programmer

<table>
<tr><td rowspan="2">Hardware</td><td>PG-1500</td><td colspan="4">A PROM programmer that can program a single-chip microcontroller with an on-chip PROM as stand alone or with the manipulation from a host machine by connecting the attached board and optional programmer adapter.</td></tr>
<tr><td>PA-75Pxxxx</td><td colspan="4">A PROM programmer adapter for the 75XL Series used by connecting a PG-1500.</td></tr>
<tr><td rowspan="5">Software</td><td rowspan="5">PG-1500
controller</td><td colspan="4">The PG-1500 and host machine are connected with the serial and parallel interface.
The PG-1500 is controlled by PG-1500 controller on the host machine.</td></tr>
<tr><td rowspan="2">Host machine</td><td rowspan="2">OS</td><td rowspan="2">Supply media</td><td rowspan="2">Part No.
(product name)</td></tr>
<tr></tr>
<tr><td>PC-9800 Series</td><td>MS-DOS
(Ver. 3.30 to Ver. 6.2 Note)</td><td>3.5-inch, 2HD</td><td>μS5A13PG1500</td></tr>
<tr><td>IBM PC/AT and compatible machines</td><td>See 8.4.</td><td>5-inch, 2HD</td><td>μS5A10PG1500</td></tr>
<tr><td></td><td></td><td>3.5-inch, 2HD</td><td>μS7B13PG1500</td></tr>
<tr><td></td><td></td><td>5-inch, 2HC</td><td>μS7B10PG1500</td></tr>
</table>

Note Although there is a task swap function in Ver. 5.00 or later, the task swap function cannot be used in this software.

Remarks 1. xxxx: The product name differs with the target device and package.

2. PG-1500 controller operation is guaranteed only for the operating systems and host machines described above.

8.3.2 PROM programmer adapter list

Target device	Package	PROM programmer	PROM programmer adapter
μPD75P0016CU, μPD75P0116CU	42-pin SDIP (600 mil)	PG-1500	PA-75P008CU
μPD75P0016GB, μPD75P0116GB	44-pin QFP (10 × 10 mm)		
μPD75P0076CU	42-pin SDIP (600 mil)		PA-75P0076CU
μPD75P0076GT	42-pin SSOP (375 mil)		
μPD75P3018GC, μPD75P3018AGC	80-pin QFP (14 × 14 mm)		PA-75P316BGC
μPD75P3018GK, μPD75P3018AGK	80-pin TQFP (12 × 12 mm)		PA-75P316BGK
μPD75P3036GC	80-pin QFP (14 × 14 mm)		PA-75P328GC
μPD75P3036GK	80-pin TQFP (12 × 12 mm)		PA-75P336GK
μPD75P3116GC	64-pin QFP (14 × 14 mm)		PA-75P3116GC
μPD75P3116GK	64-pin TQFP (12 × 12 mm)		PA-75P3116GK
μPD75P3216GT	48-pin SSOP (375 mil)		PA-75P3216GT
μPD75P4308GS	36-pin SSOP (300 mil)		PA-75P4308GS

8.4 Operating Systems for the IBM PC

The following operating systems are supported for IBM PCs.

OS	Version
PC DOS™	Ver. 3.1 - Ver 6.3, J6.1/V Note - J6.3/V Note
MS-DOS	Ver. 5.0 - Ver 6.22 5.0/V Note - 6.2/V Note
IBM DOS™	J5.02/V Note

Note Only the English mode is supported.

Caution Although there is a task swap function in Ver. 5.00 or later versions, the task swap function cannot be used in this software.

9. 75XL SERIES DOCUMENT LIST

The related documents indicated in this publication may include preliminary versions. However, preliminary versions are not marked as such.

9.1 Common 75XL Series Document

75XL Series and 75X Series Pamphlet	IF-1161
75XL Series Selection Guide	U10453E (This document)
75XL Series and 75X Series Development Tools Pamphlet	EF-1110
Single-chip Microcomputer Development Tools Selection Guide	U11069E
SBI User's Manual	IEM-1303

9.2 Individual Document

- **General-purpose series (μPD7500××)**

Type Number	Pamphlet	Data Sheet	User's Manual	Instruction Usage Table	Application Note
μPD750004	IF-1161	U10738E	U10740E	–	U10452E
μPD750006					
μPD750008					
μPD75P0016		U10328E			

- **General-purpose series with on-chip RC oscillation circuit (uPD7501xx)**

Type Number	Pamphlet	Data Sheet	User's Manual	Instruction Usage Table	Application Note
μPD750104	–	Planned	U11330E	–	Planned
μPD750106					
μPD750108					
μPD75P0116					

- **General-purpose series with on-chip A/D converter (μPD75006×)**

Type Number	Pamphlet	Data Sheet	User's Manual	Instruction Usage Table	Application Note
μPD750064	–	IP-9172 Note	U10670E	–	Planned
μPD750066					
μPD750068					
μPD75P0076		U10232E Note			

Note Preliminary Product Information

- **LCD drive series (μPD7530××)**

Type Number	Pamphlet	Data Sheet	User's Manual	Instruction Usage Table	Application Note
μPD753012	–	U10140E	U11282E	–	Planned
μPD753016					
μPD753017					
μPD75P3018		U10956E			
μPD753012A	–	U11662E			
μPD753016A					
μPD753017A					
μPD75P3018A		Planned			

Note Preliminary Product Information

- **LCD drive series with on-chip A/D converter (μPD75303×)**

Type Number	Pamphlet	Data Sheet	User's Manual	Instruction Usage Table	Application Note
μPD753036	–	U11353E	U10201E	–	Planned
μPD75P3036		U11575E			

Note Preliminary Product Information

- **LCD drive series (small-size) (μPD7531××)**

Type Number	Pamphlet	Data Sheet	User's Manual	Instruction Usage Table	Application Note
μPD753104	–	U10086E	U10890E	–	Planned
μPD753106					
μPD753108					
μPD75P3116		U11369E			

Note Preliminary Product Information

- **LCD drive series (small-size) (μPD7532××)**

Type Number	Pamphlet	Data Sheet	User's Manual	Instruction Usage Table	Application Note
μPD753204	–	U10166E	U10158E	–	Planned
μPD753206					
μPD753208					
μPD75P3216		IP-9181[Note]			

Note Preliminary Product Information

- **Keyless entry series (μPD7541××, 7542××)**

Type Number	Pamphlet	Data Sheet	User's Manual	Instruction Usage Table	Application Note
μPD754144	–	U10040E Note	Planned	–	Planned
μPD754244					
μPD754202		Planned	U11132E		
μPD754264		Planned	Planned		

Note Preliminary Product Information

- **General-purpose small-size series (μPD7543××)**

Type Number	Pamphlet	Data Sheet	User's Manual	Instruction Usage Table	Application Note
μPD754302	–	U10797E	U10123E	–	Planned
μPD754304					
μPD75P4308		U10909J			

9.3 Development Tool Related Documents (User's Manual)

9.3.1 Hardware

- **Common to the 75XL series**

Document	Number
IE-75000-R/IE-75001-R	EEU-1455
IE-75300-R-EM	U11354E
PG-1500	EEU-1335

- **Individual document**

Document	Number
EP-75008CU-R	EEU-1317
EP-75008GB-R	EEU-1305
EP-750068CU-R, EP-750068GT-R	U10950E
EP-753017GC-R, EP-753017GK-R	EEU-1494
EP-75336GC-R, EP-75336GK-R	U10644E
EP-753108GC-R, EP-753108GK-R	EEU-968
EP-753208GT-R	U10739E
EP-754144GS-R	U10695E
EP-754304GS-R	U10677E

9.3.2 Software

Document		Number
RA75X Assembler Package	Operation	EEU-1346
	Language	EEU-1363
PG-1500 controller	PC-9800 series (MS-DOS) base	EEU-1291
	IBM PC series (PC DOS) base	U10540E

Remark The description of the IE control program is given in **IE-75000-R/IE-75001-R User's Manual (EEU-1455)**.

10. PROCEDURE FOR ORDERING MASK ROMS

Follow the procedure given below when program development ends and the mask ROM is ordered.

<1> Contracting mask ROM order

Contact your local representative or the NEC sales department to schedule a mask ROM order. (If not, arrangements may be late.)

<2> Creating the order media

The following three media are available for the mask ROM order.

- UV-EPROM [Note]
- 3.5 inch IBM formatted floppy diskettes (only overseas)
- 5-inch IBM formatted floppy diskettes (only overseas)

Note When you order the media in UV-EPROM, create the three same UV-EPROM. Fill in the mask option data in the mask option data sheet.

<3> Creating the required documents

Enter the following documents to order a mask ROM.

A. Mask ROM order form
B. Mask ROM order check sheet
C. Mask option data sheet

<4> Order

The media created in <2> and the documents filled out in <3> are collected and given to the local representative or sales department by the reserved order date.

Remark For details, see the information document ROM Code Ordering Procedure (C10302E).

Regional Information

Some information contained in this document may vary from country to country. Before using any NEC product in your application, please contact the NEC office in your country to obtain a list of authorized representatives and distributors. They will verify:

- Device availability
- Ordering information
- Product release schedule
- Availability of related technical literature
- Development environment specifications (for example, specifications for third-party tools and components, host computers, power plugs, AC supply voltages, and so forth)
- Network requirements

In addition, trademarks, registered trademarks, export restrictions, and other legal issues may also vary from country to country.

NEC Electronics Inc. (U.S.)
Santa Clara, California
Tel: 800-366-9782
Fax: 800-729-9288

NEC Electronics (Germany) GmbH
Duesseldorf, Germany
Tel: 0211-65 03 02
Fax: 0211-65 03 490

NEC Electronics (UK) Ltd.
Milton Keynes, UK
Tel: 01908-691-133
Fax: 01908-670-290

NEC Electronics Italiana s.r.1.
Milano, Italy
Tel: 02-66 75 41
Fax: 02-66 75 42 99

NEC Electronics (Germany) GmbH
Benelux Office
Eindhoven, The Netherlands
Tel: 040-2445845
Fax: 040-2444580

NEC Electronics (France) S.A.
Velizy-Villacoublay, France
Tel: 01-30-67 58 00
Fax: 01-30-67 58 99

NEC Electronics (France) S.A.
Spain Office
Madrid, Spain
Tel: 01-504-2787
Fax: 01-504-2860

NEC Electronics (Germany) GmbH
Scandinavia Office
Taeby, Sweden
Tel: 08-63 80 820
Fax: 08-63 80 388

NEC Electronics Hong Kong Ltd.
Hong Kong
Tel: 2886-9318
Fax: 2886-9022/9044

NEC Electronics Hong Kong Ltd.
Seoul Branch
Seoul, Korea
Tel: 02-528-0303
Fax: 02-528-4411

NEC Electronics Singapore Pte. Ltd.
United Square, Singapore 1130
Tel: 253-8311
Fax: 250-3583

NEC Electronics Taiwan Ltd.
Taipei, Taiwan
Tel: 02-719-2377
Fax: 02-719-5951

NEC do Brasil S.A.
Sao Paulo-SP, Brasil
Tel: 011-889-1680
Fax: 011-889-1689

J96. 8

Document No. U10453EJ3V1SG00(3rd edition)
Date Published September 1997 N
Printed in Japan

© NEC Corporation 1995