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FUJITSU SEMICONDUCTOR
DATA SHEET

DS07–16901–9E

32-bit Microcontrollers

FR Family FR60

MB91470/480 Series

MB91482/486/487/F475/F478/F479/F482/F486/ MB91F487/FV470

■ DESCRIPTION

The MB91470/480 series is Fujitsu semiconductor's general-purpose 32-bit RISC microcontroller, which is designed for embedded control applications that require high-speed processing performance.

This series uses the FR60 CPU, which is compatible with the FR* family of CPUs.

* : FR, the abbreviation of FUJITSU RISC controller, is a line of products of Fujitsu Semiconductor Limited.

■ FEATURES

- FR60 CPU
  - 32-bit RISC, load/store architecture, five-stage pipeline
  - Operating frequency of 80 MHz (PLL clock multiplied)
  - 16-bit fixed-length instructions (basic instructions)
  - Instruction execution speed : one instruction per cycle
  - Memory-to-memory transfer, bit processing, barrel shift instructions, etc. : instructions suitable for embedded applications
  - Function entry and exit instructions, multi load/store instructions of register contents: instructions compatible with C language.
  - Register interlock function to facilitate assembly-language coding
  - Built-in multiplier/instruction-level support
    - Signed 32-bit multiplication : 5 cycles
    - Signed 16-bit multiplication : 3 cycles
  - Interrupts (save PC and PS) : 6 cycles, 16 priority levels
  - Harvard architecture allowing program access and data access to be executed simultaneously
  - Instructions compatible with the FR family

(Continued)

For the information for microcontroller supports, see the following web site.
This web site includes the **"Customer Design Review Supplement"** which provides the latest cautions on system development and the minimal requirements to be checked to prevent problems before the system development.

http://edevice.fujitsu.com/micom/en-support/

2011.6

FUJITSU

- Built-in Peripheral functions
  - Combinations of built-in Flash/ROM and RAM capacities

	MB91470 series		MB91480 series	
	144 pins		100 pins	
	Flash memory product	MASK ROM product	Flash memory product	MASK ROM product
256 Kbytes/16 Kbytes	MB91F475	—	MB91F482	MB91482
384 Kbytes/24 Kbytes	MB91F478	—	MB91F486	MB91486
512 Kbytes/32 Kbytes	MB91F479	—	MB91F487	MB91487

  - I/O ports
  - NMI (Non Maskable Interrupt)
  - External interrupts
  - Bit search module (for REALOS*)
    Function to search for the position of the first bit that has changed from 1 to 0 in a word starting from the MSB
  - 16-bit reload timers
  - Timing generator
  - 8/16-bit PPG timers
  - Multi-function timer
    - 16-bit free-run timer
    - Input capture (Linked to free-run timer)
    - Output compare (Linked to free-run timer)
    - A/D start up compare (Linked to free-run timer)
    - Wave form generator
      Various wave forms are generated by using output compare output, 16-bit PPG timer and 16-bit dead timer.
  - Base timer
    Only one timer function can be selected from the 16-bit PWM timer, 16-bit PPG timer, 16/32-bit reload timer, and 16/32-bit PWC timer.
  - 8/16-bit up/down counter
  - Multi-function serial interface
    - Full-duplex double buffer
    - With 16-byte FIFO
    - Asynchronous (start-stop synchronization) communication, clock synchronous communication, I²C standard mode (Max 100 kbps), I²C high-speed mode (selectable various modes at maximum of 400 kbps)
    - Selectable parity On/Off
    - Each channel has built-in baud rate generator
    - Error detection function for parity, frame and overrun errors
    - External clock can be used as transfer clock
    - With I²C function
  - 8/10-bit A/D Converter (Successive comparison type)
    - Resolution : 8-bit or 10-bit resolution selectable
    - Conversion time : 1.2 µs (minimum conversion time for 33 MHz peripheral clock (CLKP))
      1.2 µs (minimum conversion time for 40 MHz peripheral clock (CLKP))

(Continued)

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- 12-bit A/D Converter (successive approximation type)
  - Resolution : 12 bits
  - Conversion Time : 2.0 μs (minimum conversion time for 33 MHz peripheral clock (CLKP))
    2.2 μs (minimum conversion time for 40 MHz peripheral clock (CLKP))
  - Differential input mode is available.
- Clock monitor
  - Peripheral clock (CLKP) divided by 2/4/8/16/32/64/128/256 can be output.
- Multiplication and Addition Calculator
  - RAM : Instruction RAM (I-RAM) 256 × 16-bit
    Factor RAM (X-RAM) 64 × 32-bit
    Variable RAM (Y-RAM) 64 × 32-bit
  - High-speed multiplication and addition (seven-stage pipeline processing)
  - Product addition (32-bit × 32-bit + 72-bit)
  - Operation result is extracted rounded from 72 bits to 32 bits or 72-bit result data reading.
- DMAC (DMA Controller)
  - Transfers can be started by software or by interrupts from the built-in peripherals.
- Wild register
  - Instructions or data located at a target address can be replaced (in the built-in Flash/ROM area only) .

- External bus interface
  - Maximum operating frequency of 40 MHz
  - 16-bit address full output (64 Kbytes space) capability
  - 8/16-bit data output
  - Use of unused data/address pins as general-purpose I/O ports
  - Totally independent 3-area chip select outputs that can be set at minimum of 64 Kbytes.
  - Support of interface for various memory (SRAM, ROM/Flash)
  - Basic bus cycle : 2 cycles
  - Automatic wait cycle generator that can be programmed for each area and can insert waits
  - External wait cycle using RDY input

- Other Features
  - Watchdog timer
  - Low-power consumption modes
    - Sleep/stop function
  - CMOS technologies : 0.18 μm
  - Power supply : Single power supply (V_{CC} = 4.0 V to 5.5 V)

* : REALOS is a trademark of Fujitsu Semiconductor Limited, Japan.

■ PRODUCT LINEUP

Characteristics	MB91470/480 series common EVA	MB91470 series			MB91480 series		
	MB91FV470	MB91F475	MB91F478	MB91F479	MB91F487 MB91487	MB91F486 MB91486	MB91F482 MB91482
Pin number	224 pins	144 pins			100 pins		
Built-in Flash/ ROM capacity	512 Kbytes (Flash)	256 Kbytes (Flash)	384 Kbytes (Flash)	512 Kbytes (Flash)	512 Kbytes (Flash/ ROM)	384 Kbytes (Flash/ ROM)	256 Kbytes (Flash/ ROM)
Built-in RAM capacity	40 Kbytes	16 Kbytes	24 Kbytes	32 Kbytes	32 Kbytes	24 Kbytes	16 Kbytes
External bus	Yes	Yes			—		
I/O ports	160	113			77		
External interrupts	NMI 16 channels	NMI 10 channels			NMI 10 channels		
Reload timer	2 channels	2 channels			2 channels		
Timing generator	2 units	1 unit			2 units		
PPG	8-bit × 16 channels 16-bit × 8 channels	8-bit × 8 channels 16-bit × 4 channels (PPG output:8 channels)			8-bit × 16 channels 16-bit × 8 channels (PPG output:10 channels)		
Multi-function timer	2 units	1 unit			2 units		
Free-run timer	6 channels	3 channels			6 channels		
OCU	12 channels	6 channels			12 channels		
ICU	8 channels	4 channels			8 channels		
A/D activation compare	6 channels	3 channels			6 channels		
Wave form generator	12 channels	6 channels			12 channels		
Base timer	6 channels	4 channels			4 channels		
Up/down counter	2 channels	1 channel			—		
Multi-function serial interface	6 units	6 units			3 units		
8/10-bit A/D converter	4 channels × 2 units 16 channels × 1 unit	12 channels × 1 unit			4 channels × 2 units 10 channels × 1 unit		
12-bit A/D converter	4 channels × 2 units	4 channels × 2 units			—		
Clock monitor	1 unit	—			1 unit		
Multiplication and addition calculator	1 unit	1 unit			1 unit		
DMAC	5 channels	5 channels			5 channels		
Wild register	16 channels	16 channels			16 channels		
Debug function	DSU4	—			—		

■ PACKAGE AND CORRESPONDING PRODUCTS

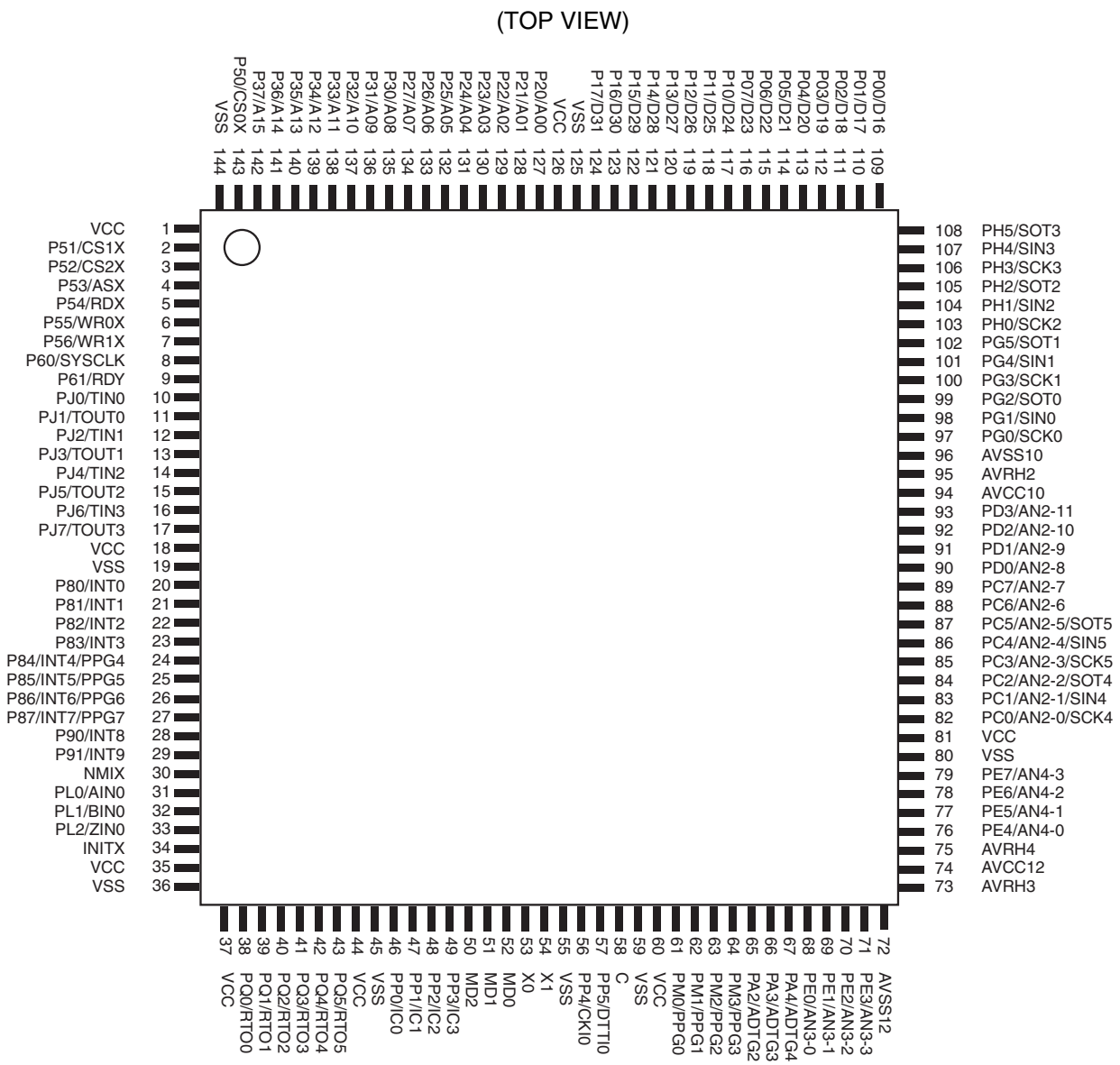
Series name / Package	MB91470 series			MB91480 series	
	MB91F475	MB91F478	MB91F479	MB91F482 MB91F486 MB91F487	MB91482 MB91486 MB91487
FPT-100P-M20 (LQFP-0.50 mm)	—	—	—	○	○
FPT-100P-M06 (QFP-0.65 mm)	—	—	—	○	○
FPT-144P-M12 (LQFP-0.40 mm)	○	—	○	—	—
FPT-144P-M27 (LQFP-0.40 mm)	—	—	○	—	—
BGA-144P-M06 (PFBGA-0.80 mm)	○	○	○	—	—

○ : Supported

Note : For details of each package, refer to “■ PACKAGE DIMENSIONS”.

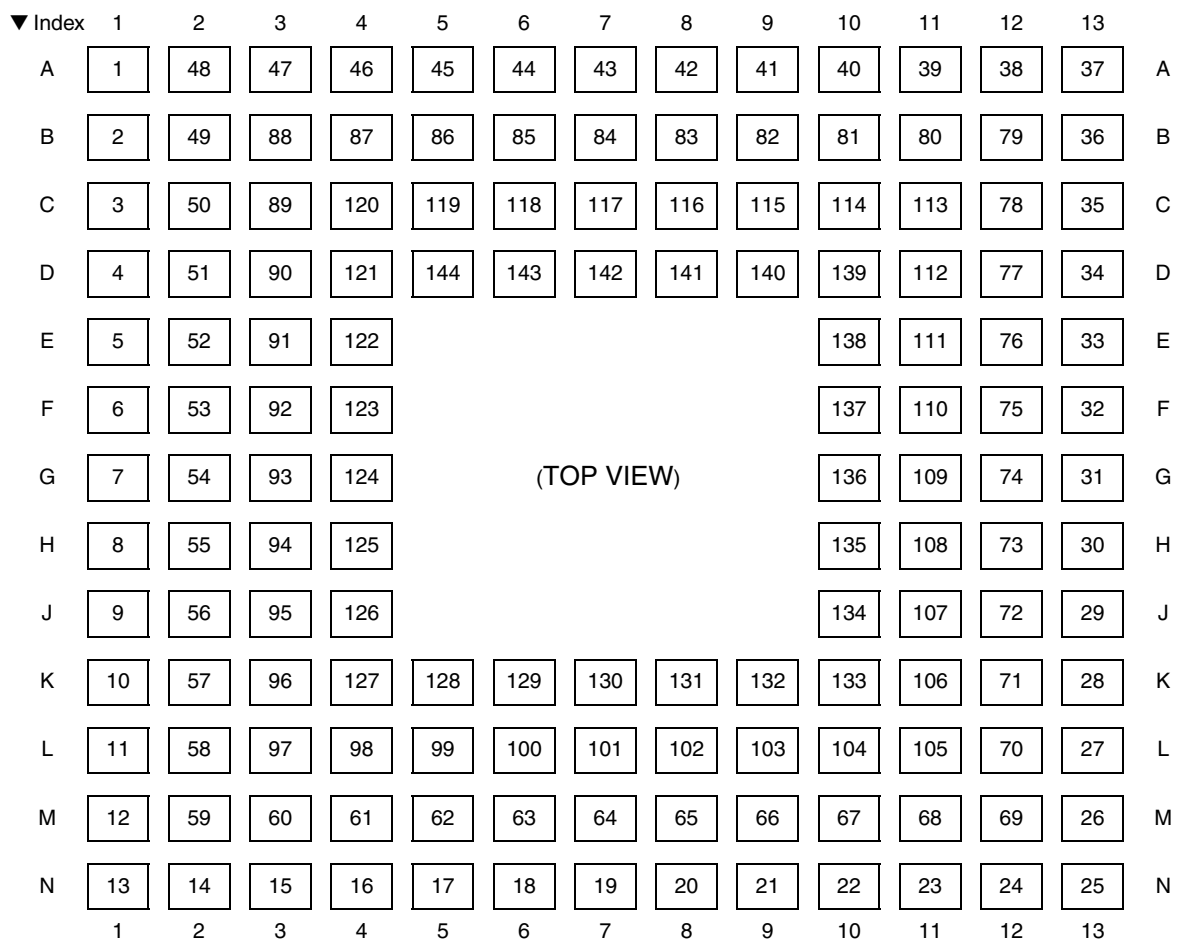
■ PIN ASSIGNMENT

• LQFP-144 (MB91470 series)



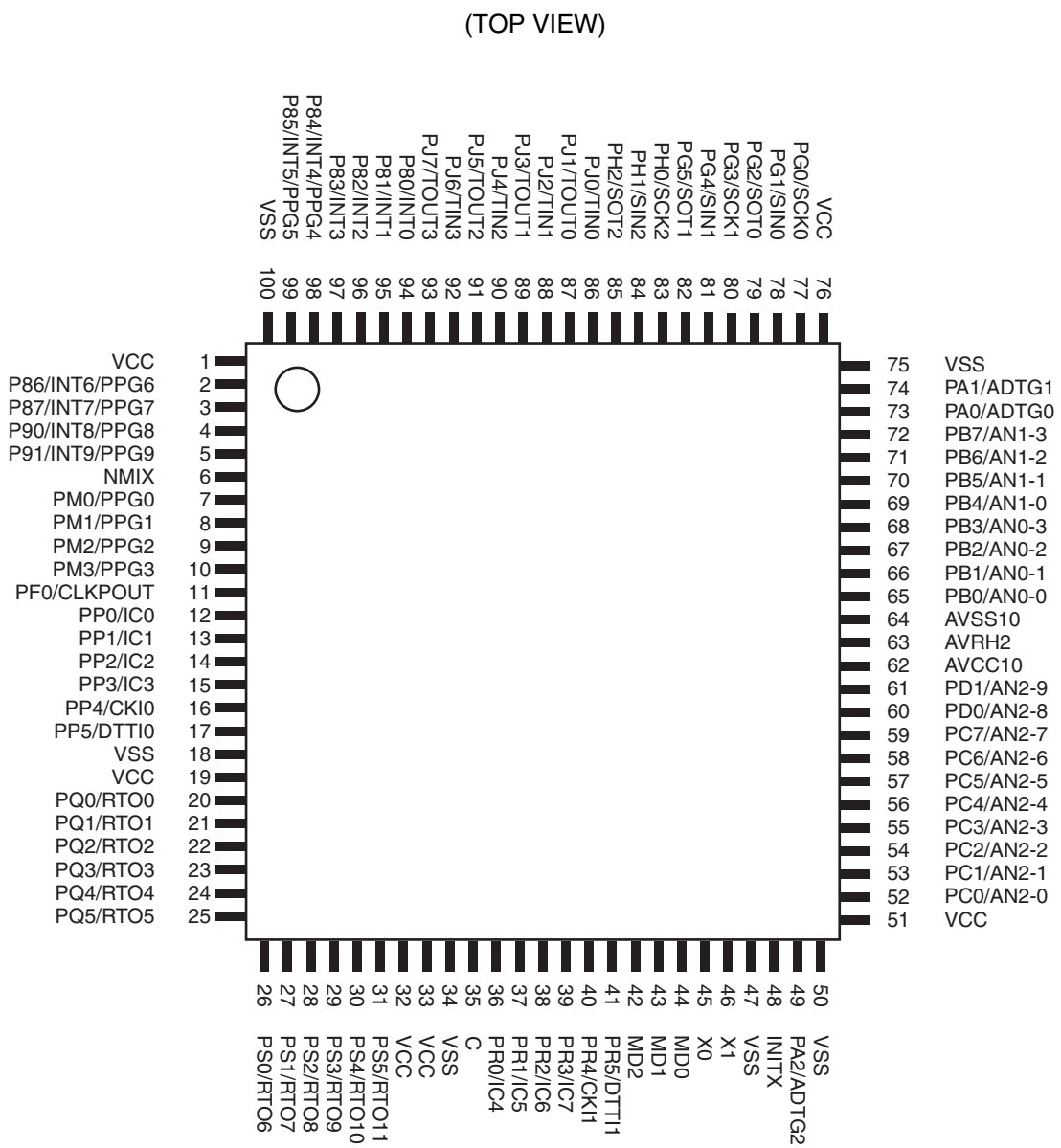
(FPT-144P-M12, FPT-144P-M27)

• **PFBGA-144 (MB91470 series)**



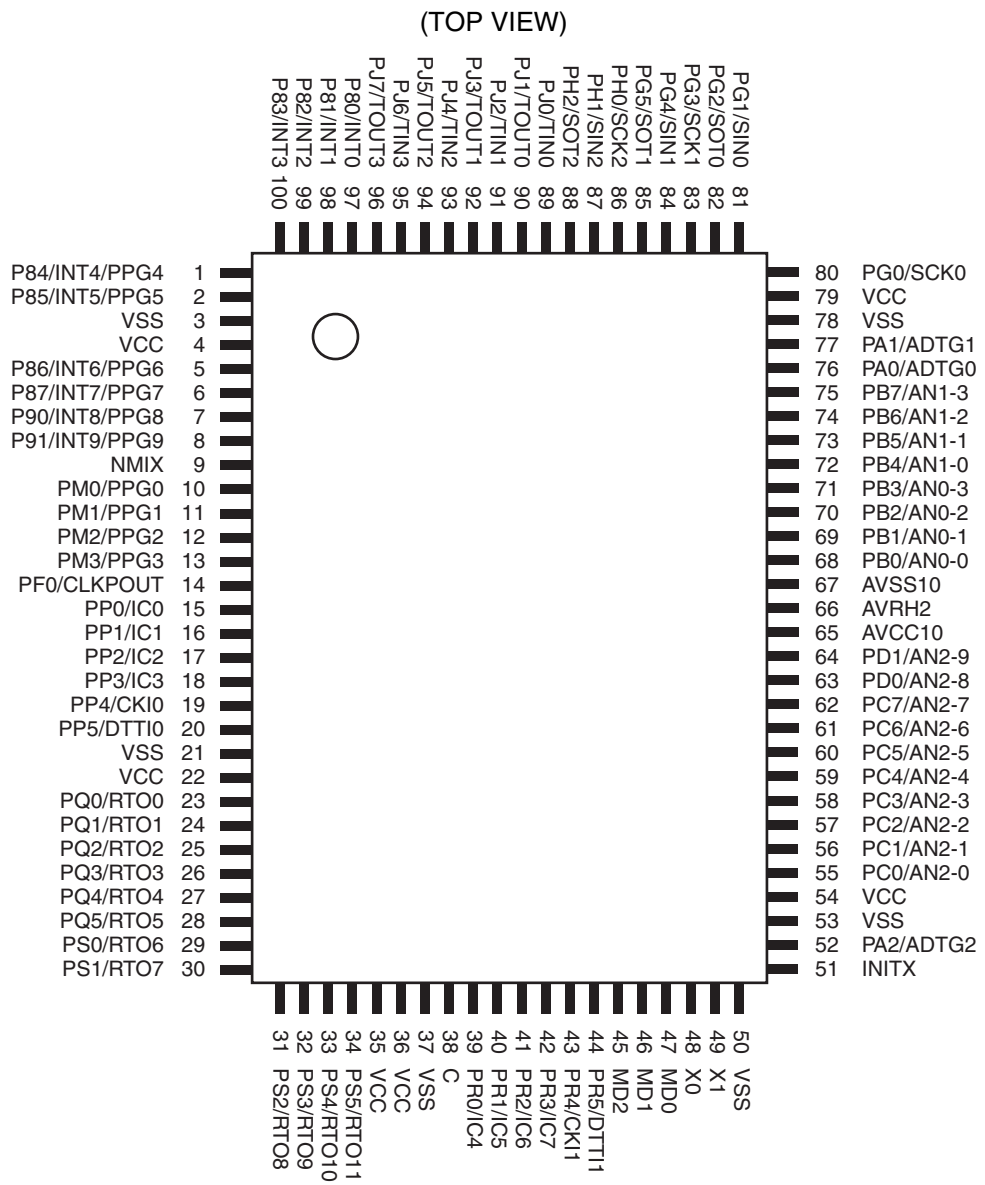
(BGA-144P-M06)

• **LQFP-100 (MB91480 series)**



(FPT-100P-M20)

• **QFP-100 (MB91480 series)**



(FPT-100P-M06)

■ PIN DESCRIPTIONS

Pin no.				Pin name	I/O circuit type*5	Function
MB91470 series		MB91480 series				
LQFP-144*1	PFBGA-144*2	LQFP-100*3	QFP-100*4			
50	M6	42	45	MD2	H, K	Mode pin 2 This pin sets the basic operating mode. Connect this pin to either VCC pin or VSS pin. Use circuit type K on the Flash memory model.
51	N6	43	46	MD1	H, K	Mode pin 1 This pin sets the basic operating mode. Connect this pin to either VCC pin or VSS pin. Use circuit type K on the Flash memory model.
52	K5	44	47	MD0	H, K	Mode pin 0 This pin sets the basic operating mode. Connect this pin to either VCC pin or VSS pin. Use circuit type K on the Flash memory model.
53	L6	45	48	X0	A	Clock (oscillation) input
54	K6	46	49	X1	A	Clock (oscillation) output
34	L1	48	51	INITX	I	External reset input
30	J4	6	9	NMIX	H	NMI (Non Maskable Interrupt) input
109	A12	—	—	D16	C	Bit 16 of external data bus I/O pin
				P00		General-purpose I/O port
110	B12	—	—	D17	C	Bit 17 of external data bus I/O pin
				P01		General-purpose I/O port
111	A11	—	—	D18	C	Bit 18 of external data bus I/O pin
				P02		General-purpose I/O port
112	B11	—	—	D19	C	Bit 19 of external data bus I/O pin
				P03		General-purpose I/O port
113	C12	—	—	D20	C	Bit 20 of external data bus I/O pin
				P04		General-purpose I/O port
114	B10	—	—	D21	C	Bit 21 of external data bus I/O pin
				P05		General-purpose I/O port
115	A10	—	—	D22	C	Bit 22 of external data bus I/O pin
				P06		General-purpose I/O port
116	C11	—	—	D23	C	Bit 23 of external data bus I/O pin
				P07		General-purpose I/O port
117	C10	—	—	D24	C	Bit 24 of external data bus I/O pin
				P10		General-purpose I/O port

(Continued)

Pin no.				Pin name	I/O circuit type*5	Function
MB91470 series		MB91480 series				
LQFP-144*1	PFBGA-144*2	LQFP-100*3	QFP-100*4			
118	B9	—	—	D25	C	Bit 25 of external data bus I/O pin
				P11		General-purpose I/O port
119	A9	—	—	D26	C	Bit 26 of external data bus I/O pin
				P12		General-purpose I/O port
120	D10	—	—	D27	C	Bit 27 of external data bus I/O pin
				P13		General-purpose I/O port
121	C9	—	—	D28	C	Bit 28 of external data bus I/O pin
				P14		General-purpose I/O port
122	B8	—	—	D29	C	Bit 29 of external data bus I/O pin
				P15		General-purpose I/O port
123	A8	—	—	D30	C	Bit 30 of external data bus I/O pin
				P16		General-purpose I/O port
124	D9	—	—	D31	C	Bit 31 of external data bus I/O pin
				P17		General-purpose I/O port
127	A7	—	—	A00	C	Bit 0 of external address bus output pin
				P20		General-purpose I/O port
128	B7	—	—	A01	C	Bit 1 of external address bus output pin
				P21		General-purpose I/O port
129	C7	—	—	A02	C	Bit 2 of external address bus output pin
				P22		General-purpose I/O port
130	D7	—	—	A03	C	Bit 3 of external address bus output pin
				P23		General-purpose I/O port
131	A6	—	—	A04	C	Bit 4 of external address bus output pin
				P24		General-purpose I/O port
132	B6	—	—	A05	C	Bit 5 of external address bus output pin
				P25		General-purpose I/O port
133	C6	—	—	A06	C	Bit 6 of external address bus output pin
				P26		General-purpose I/O port
134	D6	—	—	A07	C	Bit 7 of external address bus output pin
				P27		General-purpose I/O port
135	A5	—	—	A08	C	Bit 8 of external address bus output pin
				P30		General-purpose I/O port

(Continued)

Pin no.				Pin name	I/O circuit type*5	Function
MB91470 series		MB91480 series				
LQFP-144*1	PFBGA-144*2	LQFP-100*3	QFP-100*4			
136	B5	—	—	A09	C	Bit 9 of external address bus output pin
				P31		General-purpose I/O port
137	C5	—	—	A10	C	Bit 10 of external address bus output pin
				P32		General-purpose I/O port
138	D5	—	—	A11	C	Bit 11 of external address bus output pin
				P33		General-purpose I/O port
139	A4	—	—	A12	C	Bit 12 of external address bus output pin
				P34		General-purpose I/O port
140	B4	—	—	A13	C	Bit 13 of external address bus output pin
				P35		General-purpose I/O port
141	C4	—	—	A14	C	Bit 14 of external address bus output pin
				P36		General-purpose I/O port
142	A3	—	—	A15	C	Bit 15 of external address bus output pin
				P37		General-purpose I/O port
143	A2	—	—	CS0X	C	External chip select 0 output
				P50		General-purpose I/O port
2	B2	—	—	CS1X	C	External chip select 1 output
				P51		General-purpose I/O port
3	C1	—	—	CS2X	C	External chip select 2 output
				P52		General-purpose I/O port
4	C2	—	—	ASX	C	External address strobe output
				P53		General-purpose I/O port
5	B3	—	—	RDX	C	External read strobe output
				P54		General-purpose I/O port
6	D2	—	—	WR0X	C	External write strobe output Corresponding to bit 31 to bit 24 of external data bus I/O
				P55		General-purpose I/O port
7	D1	—	—	WR1X	C	External write strobe output Corresponding to bit 23 to bit 16 of external data bus I/O
				P56		General-purpose I/O port
8	C3	—	—	SYSCLK	C	External clock output
				P60		General-purpose I/O port

(Continued)

Pin no.				Pin name	I/O circuit type*5	Function
MB91470 series		MB91480 series				
LQFP-144*1	PFBGA-144*2	LQFP-100*3	QFP-100*4			
9	D3	—	—	RDY	C	External ready input
				P61		General-purpose I/O port
20	G2	94	97	INT0	D	External interrupt 0 input
				P80		General-purpose I/O port
21	G3	95	98	INT1	D	External interrupt 1 input
				P81		General-purpose I/O port
22	G4	96	99	INT2	D	External interrupt 2 input
				P82		General-purpose I/O port
23	H1	97	100	INT3	D	External interrupt 3 input
				P83		General-purpose I/O port
24	H2	98	1	INT4	D	External interrupt 4 input
				PPG4		Output of PPG timer 4
				P84		General-purpose I/O port
25	H3	99	2	INT5	D	External interrupt 5 input
				PPG5		Output of PPG timer 5
				P85		General-purpose I/O port
26	H4	2	5	INT6	D	External interrupt 6 input
				PPG6		Output of PPG timer 6
				P86		General-purpose I/O port
27	J1	3	6	INT7	D	External interrupt 7 input
				PPG7		Output of PPG timer 7
				P87		General-purpose I/O port
28	J2	4	7	INT8	D	External interrupt 8 input
				PPG8		Output of PPG timer 8
				P90		General-purpose I/O port
29	J3	5	8	INT9	D	External interrupt 9 input
				PPG9		Output of PPG timer 9
				P91		General-purpose I/O port
—	—	—	—	INT10	D	External interrupt 10 input
				PPG10		Output of PPG timer 10
				P92		General-purpose I/O port

(Continued)

Pin no.				Pin name	I/O circuit type*5	Function
MB91470 series		MB91480 series				
LQFP-144*1	PFBGA-144*2	LQFP-100*3	QFP-100*4			
—	—	—	—	INT11	D	External interrupt 11 input
				PPG11		Output of PPG timer 11
				P93		General-purpose I/O port
—	—	—	—	INT12	D	External interrupt 12 input
				PPG12		Output of PPG timer 12
				P94		General-purpose I/O port
—	—	—	—	INT13	D	External interrupt 13 input
				PPG13		Output of PPG timer 13
				P95		General-purpose I/O port
—	—	—	—	INT14	D	External interrupt 14 input
				PPG14		Output of PPG timer 14
				P96		General-purpose I/O port
—	—	—	—	INT15	D	External interrupt 15 input
				PPG15		Output of PPG timer 15
				P97		General-purpose I/O port
—	—	73	76	ADTG0	D	External trigger input of 8/10-bit A/D converter 0
				PA0		General-purpose I/O port
—	—	74	77	ADTG1	D	External trigger input of 8/10-bit A/D converter 1
				PA1		General-purpose I/O port
65	L9	49	52	ADTG2	D	External trigger input of 8/10-bit A/D converter 2
				PA2		General-purpose I/O port
66	K9	—	—	ADTG3	D	External trigger input of 12-bit A/D converter 3
				PA3		General-purpose I/O port
67	N10	—	—	ADTG4	D	External trigger input of 12-bit A/D converter 4
				PA4		General-purpose I/O port
—	—	65	68	AN0-0	G	Analog 0 input of 8/10-bit A/D converter 0
				PB0		General-purpose I/O port
—	—	66	69	AN0-1	G	Analog 1 input of 8/10-bit A/D converter 0
				PB1		General-purpose I/O port
—	—	67	70	AN0-2	G	Analog 2 input of 8/10-bit A/D converter 0
				PB2		General-purpose I/O port

(Continued)

Pin no.				Pin name	I/O circuit type*5	Function
MB91470 series		MB91480 series				
LQFP-144*1	PFBGA-144*2	LQFP-100*3	QFP-100*4			
—	—	68	71	AN0-3	G	Analog 3 input of 8/10-bit A/D converter 0
				PB3		General-purpose I/O port
—	—	69	72	AN1-0	G	Analog 0 input of 8/10-bit A/D converter 1
				PB4		General-purpose I/O port
—	—	70	73	AN1-1	G	Analog 1 input of 8/10-bit A/D converter 1
				PB5		General-purpose I/O port
—	—	71	74	AN1-2	G	Analog 2 input of 8/10-bit A/D converter 1
				PB6		General-purpose I/O port
—	—	72	75	AN1-3	G	Analog 3 input of 8/10-bit A/D converter 1
				PB7		General-purpose I/O port
82	J12	52	55	AN2-0	G	Analog 0 input of 8/10-bit A/D converter 2
				SCK4 (SCL4)		Clock I/O of multi-function serial interface 4 (used in I²C mode, SCL4)
				PC0		General-purpose I/O port
83	J13	53	56	AN2-1	G	Analog 1 input of 8/10-bit A/D converter 2
				SIN4		Data input of multi-function serial interface 4 (not used in I²C mode)
				PC1		General-purpose I/O port
84	K10	54	57	AN2-2	G	Analog 2 input of 8/10-bit A/D converter 2
				SOT4 (SDA4)		Data output of multi-function serial interface 4 (used in I²C mode, SDA4)
				PC2		General-purpose I/O port
85	J11	55	58	AN2-3	G	Analog 3 input of 8/10-bit A/D converter 2
				SCK5 (SCL5)		Clock I/O of multi-function serial interface 5 (used in I²C mode, SCL5)
				PC3		General-purpose I/O port
86	H12	56	59	AN2-4	G	Analog 4 input of 8/10-bit A/D converter 2
				SIN5		Data input of multi-function serial interface 5 (not used in I²C mode)
				PC4		General-purpose I/O port
87	H13	57	60	AN2-5	G	Analog 5 input of 8/10-bit A/D converter 2
				SOT5 (SDA5)		Data output of multi-function serial interface 5 (used in I²C mode, SDA5)
				PC5		General-purpose I/O port
88	J10	58	61	AN2-6	G	Analog 6 input of 8/10-bit A/D converter 2
				PC6		General-purpose I/O port

(Continued)

Pin no.				Pin name	I/O circuit type*5	Function
MB91470 series		MB91480 series				
LQFP-144*1	PFBGA-144*2	LQFP-100*3	QFP-100*4			
89	H11	59	62	AN2-7	G	Analog 7 input of 8/10-bit A/D converter 2
				PC7		General-purpose I/O port
90	H10	60	63	AN2-8	G	Analog 8 input of 8/10-bit A/D converter 2
				PD0		General-purpose I/O port
91	G13	61	64	AN2-9	G	Analog 9 input of 8/10-bit A/D converter 2
				PD1		General-purpose I/O port
92	G12	—	—	AN2-10	G	Analog 10 input of 8/10-bit A/D converter 2
				PD2		General-purpose I/O port
93	G11	—	—	AN2-11	G	Analog 11 input of 8/10-bit A/D converter 2
				PD3		General-purpose I/O port
68	M10	—	—	AN3-0/ AN3-0P	G	12-bit A/D converter 3 analog 0 input (in single input mode) 12-bit A/D converter 3 analog 0 (+) side input (in differential input mode)
				PE0		General-purpose I/O port
69	L10	—	—	AN3-1/ AN3-0N	G	12-bit A/D converter 3 analog 1 input (in single input mode) 12-bit A/D converter 3 analog 0 (–) side input (in differential input mode)
				PE1		General-purpose I/O port
70	N11	—	—	AN3-2/ AN3-1P	G	12-bit A/D converter 3 analog 2 input (in single input mode) 12-bit A/D converter 3 analog 1 (+) side input (in differential input mode)
				PE2		General-purpose I/O port
71	N12	—	—	AN3-3/ AN3-1N	G	12-bit A/D converter 3 analog 3 input (in single input mode) 12-bit A/D converter 3 analog 1 (–) side input (in differential input mode)
				PE3		General-purpose I/O port
76	L12	—	—	AN4-0/ AN4-0P	G	12-bit A/D converter 4 analog 0 input (in single input mode) 12-bit A/D converter 4 analog 0 (+) side input (in differential input mode)
				PE4		General-purpose I/O port
77	M11	—	—	AN4-1/ AN4-0N	G	12-bit A/D converter 4 analog 1 input (in single input mode) 12-bit A/D converter 4 analog 0 (–) side input (in differential input mode)
				PE5		General-purpose I/O port

(Continued)

Pin no.				Pin name	I/O circuit type*5	Function
MB91470 series		MB91480 series				
LQFP-144*1	PFBGA-144*2	LQFP-100*3	QFP-100*4			
78	K12	—	—	AN4-2/ AN4-1P	G	12-bit A/D converter 4 analog 2 input (in single input mode) 12-bit A/D converter 4 analog 1 (+) side input (in differential input mode)
				PE6		General-purpose I/O port
79	K13	—	—	AN4-3/ AN4-1N	G	12-bit A/D converter 4 analog 3 input (in single input mode) 12-bit A/D converter 4 analog 1 (−) side input (in differential input mode)
				PE7		General-purpose I/O port
—	—	11	14	CLK-POUT	D	Clock monitor output
				PF0		General-purpose I/O port
—	—	—	—	PF1	D	General-purpose I/O port
—	—	—	—	PF2	D	General-purpose I/O port
—	—	—	—	PF3	D	General-purpose I/O port
—	—	—	—	PF4	D	General-purpose I/O port
—	—	—	—	PF5	D	General-purpose I/O port
—	—	—	—	PF6	D	General-purpose I/O port
—	—	—	—	PF7	D	General-purpose I/O port
97	F11	77	80	SCK0 (SCL0)	D	Clock I/O of multi-function serial interface 0 (used in I²C mode, SCL0)
				PG0		General-purpose I/O port
98	F10	78	81	SIN0	D	Data input of multi-function serial interface 0 (not used in I²C mode)
				PG1		General-purpose I/O port
99	E13	79	82	SOT0 (SDA0)	D	Data output of multi-function serial interface 0 (used in I²C mode, SDA0)
				PG2		General-purpose I/O port
100	E12	80	83	SCK1 (SCL1)	D	Clock I/O of multi-function serial interface 1 (used in I²C mode, SCL1)
				PG3		General-purpose I/O port
101	E11	81	84	SIN1	D	Data input of multi-function serial interface 1 (not used in I²C mode)
				PG4		General-purpose I/O port

(Continued)

Pin no.				Pin name	I/O circuit type*5	Function
MB91470 series		MB91480 series				
LQFP-144*1	PFBGA-144*2	LQFP-100*3	QFP-100*4			
102	E10	82	85	SOT1 (SDA1)	D	Data output of multi-function serial interface 1 (used in I²C mode, SDA1)
				PG5		General-purpose I/O port
103	D13	83	86	SCK2 (SCL2)	D	Clock I/O of multi-function serial interface 2 (used in I²C mode, SCL2)
				PH0		General-purpose I/O port
104	D12	84	87	SIN2	D	Data input of multi-function serial interface 2 (not used in I²C mode)
				PH1		General-purpose I/O port
105	D11	85	88	SOT2 (SDA2)	D	Data output of multi-function serial interface 2 (used in I²C mode, SDA2)
				PH2		General-purpose I/O port
106	C13	—	—	SCK3 (SCL3)	D	Clock I/O of multi-function serial interface 3 (used in I²C mode, SCL3)
				PH3		General-purpose I/O port
107	B13	—	—	SIN3	D	Data input of multi-function serial interface 3 (not used in I²C mode)
				PH4		General-purpose I/O port
108	A13	—	—	SOT3 (SDA3)	D	Data output of multi-function serial interface 3 (used in I²C mode, SDA3)
				PH5		General-purpose I/O port
10	E2	86	89	TIN0	D	Base timer 0 input
				PJ0		General-purpose I/O port
11	E1	87	90	TOUT0	D	Base timer 0 output
				PJ1		General-purpose I/O port
12	D4	88	91	TIN1	D	Base timer 1 input
				PJ2		General-purpose I/O port
13	E3	89	92	TOUT1	D	Base timer 1 output
				PJ3		General-purpose I/O port
14	F2	90	93	TIN2	D	Base timer 2 input
				PJ4		General-purpose I/O port
15	F1	91	94	TOUT2	D	Base timer 2 output
				PJ5		General-purpose I/O port

(Continued)

Pin no.				Pin name	I/O circuit type*5	Function
MB91470 series		MB91480 series				
LQFP-144*1	PFBGA-144*2	LQFP-100*3	QFP-100*4			
16	E4	92	95	TIN3	D	Base timer 3 input
				PJ6		General-purpose I/O port
17	F3	93	96	TOUT3	D	Base timer 3 output
				PJ7		General-purpose I/O port
31	K1	—	—	AIN0	D	8/16-bit up count input pin for up/down counter 0
				PL0		General-purpose I/O port
32	K2	—	—	BIN0	D	8/16-bit down count input pin for up/down counter 0
				PL1		General-purpose I/O port
33	K3	—	—	ZIN0	D	8/16-bit reset input pin for up/down counter 0
				PL2		General-purpose I/O port
61	L8	7	10	PPG0	D	Output of PPG timer 0
				PM0		General-purpose I/O port
62	K8	8	11	PPG1	D	Output of PPG timer 1
				PM1		General-purpose I/O port
63	N9	9	12	PPG2	D	Output of PPG timer 2
				PM2		General-purpose I/O port
64	M9	10	13	PPG3	D	Output of PPG timer 3
				PM3		General-purpose I/O port
46	M5	12	15	IC0	D	Trigger input of input capture 0
				PP0		General-purpose I/O port
47	N5	13	16	IC1	D	Trigger input of input capture 1
				PP1		General-purpose I/O port
48	K4	14	17	IC2	D	Trigger input of input capture 2
				PP2		General-purpose I/O port
49	L5	15	18	IC3	D	Trigger input of input capture 3
				PP3		General-purpose I/O port
56	M7	16	19	CKI0	D	External clock input pin of free-run timer ch.0 to ch.2
				PP4		General-purpose I/O port
57	L7	17	20	DTTI0	D	Input signal controlling wave form generator outputs RTO0 to RTO5 of multi-function timer 0
				PP5		General-purpose I/O port

(Continued)

Pin no.				Pin name	I/O circuit type*5	Function
MB91470 series		MB91480 series				
LQFP-144*1	PFBGA-144*2	LQFP-100*3	QFP-100*4			
38	M2	20	23	RTO0	J	Wave form generator output of multi-function timer 0
				PQ0		General-purpose I/O port
39	N3	21	24	RTO1	J	Wave form generator output of multi-function timer 0
				PQ1		General-purpose I/O port
40	M3	22	25	RTO2	J	Wave form generator output of multi-function timer 0
				PQ2		General-purpose I/O port
41	L2	23	26	RTO3	J	Wave form generator output of multi-function timer 0
				PQ3		General-purpose I/O port
42	M4	24	27	RTO4	J	Wave form generator output of multi-function timer 0
				PQ4		General-purpose I/O port
43	N4	25	28	RTO5	J	Wave form generator output of multi-function timer 0
				PQ5		General-purpose I/O port
—	—	36	39	IC4	D	Trigger input of input capture 4
				PR0		General-purpose I/O port
—	—	37	40	IC5	D	Trigger input of input capture 5
				PR1		General-purpose I/O port
—	—	38	41	IC6	D	Trigger input of input capture 6
				PR2		General-purpose I/O port
—	—	39	42	IC7	D	Trigger input of input capture 7
				PR3		General-purpose I/O port
—	—	40	43	CKI1	D	External clock input pin of free-run timer ch.3 to ch.5
				PR4		General-purpose I/O port
—	—	41	44	DTTI1	D	Input signal controlling wave form generator outputs RTO6 to RTO11 of multi-function timer 1
				PR5		General-purpose I/O port
—	—	26	29	RTO6	J	Wave form generator output of multi-function timer 1
				PS0		General-purpose I/O port
—	—	27	30	RTO7	J	Wave form generator output of multi-function timer 1
				PS1		General-purpose I/O port
—	—	28	31	RTO8	J	Wave form generator output of multi-function timer 1
				PS2		General-purpose I/O port

(Continued)

(Continued)

Pin no.				Pin name	I/O circuit type*5	Function
MB91470 series		MB91480 series				
LQFP-144*1	PFBGA-144*2	LQFP-100*3	QFP-100*4			
—	—	29	32	RTO9	J	Wave form generator output of multi-function timer 1
				PS3		General-purpose I/O port
—	—	30	33	RTO10	J	Wave form generator output of multi-function timer 1
				PS4		General-purpose I/O port
—	—	31	34	RTO11	J	Wave form generator output of multi-function timer 1
				PS5		General-purpose I/O port

*1 : FPT-144P-M12, FPT-144P-M27

*2 : BGA-144P-M06

*3 : FPT-100P-M20

*4 : FPT-100P-M06

*5 : Refer to “■ I/O CIRCUIT TYPE” for details on the I/O circuit types.

Power supply pins and GND pins

Pin number				Pin name	Function
MB91470 series		MB91480 series			
LQFP-144*1	PFBGA-144*2	LQFP-100*3	QFP-100*4		
1 18 35 37 44 60 81 126	B1 F4 M1 N2 L3 M8 K11 D8	— 1 19 32 33 51 76 —	— 4 22 35 36 54 79 —	VCC	Power supply pins Connect all pins to the same potential.
19 36 45 55 59 80 125 144	A1 G1 N1 L4 N7 N8 L11 C8	— 18 34 47 50 75 100 —	— 21 37 50 53 78 3 —	VSS	GND pins Connect all pins to the same potential.
58	K7	35	38	C	Capacitor coupling pin for internal regulator
94	G10	62	65	AVCC10	Analog power supply pin for 8/10-bit A/D converter 0/1/2
96	F12	64	67	AVSS10	Analog GND pin for 8/10-bit A/D converter
74	M12	—	—	AVCC12	Analog power supply pin for 12-bit A/D converter 3/4
72	N13	—	—	AVSS12	Analog GND pin for 12-bit A/D converter 3/4
—	—	—	—	AVRH0	Analog reference power supply pin for 8/10-bit A/D converter 0
—	—	—	—	AVRH1	Analog reference power supply pin for 8/10-bit A/D converter 1
95	F13	63	66	AVRH2	Analog reference power supply pin for 8/10-bit A/D converter 2
73	M13	—	—	AVRH3	Analog reference power supply pin for 12-bit A/D converter 3
75	L13	—	—	AVRH4	Analog reference power supply pin for 12-bit A/D converter 4

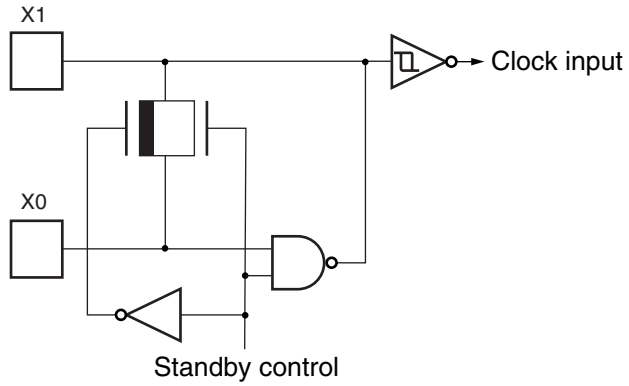
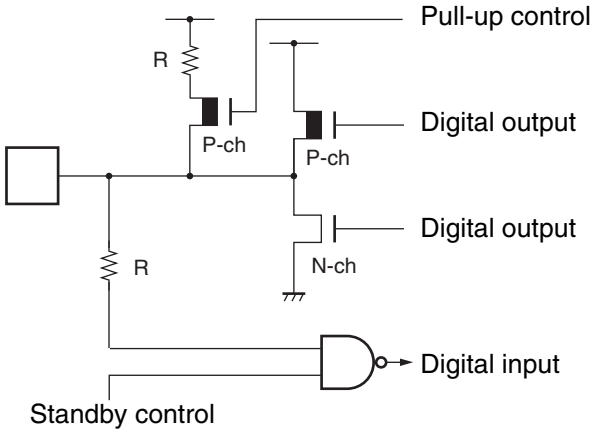
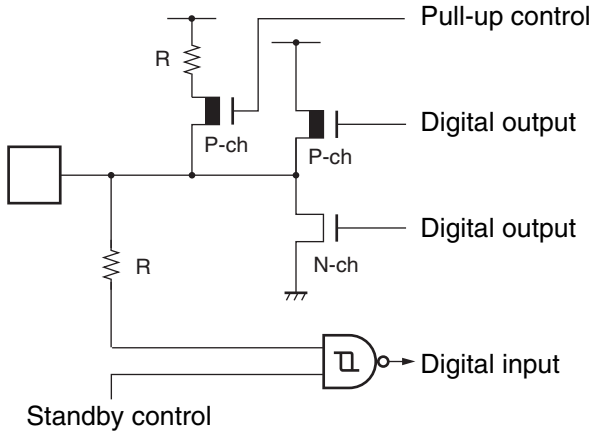
*1 : FPT-144P-M12, FPT-144P-M27

*2 : BGA-144P-M06

*3 : FPT-100P-M20

*4 : FPT-100P-M06

■ I/O CIRCUIT TYPE

Type	Circuit	Remarks
A		Oscillation feedback resistance for high speed (main clock oscillation) approx. 1 MΩ
C		• CMOS level output • CMOS level input • With standby control • With pull-up control
D		• CMOS level output • CMOS level hysteresis input • With standby control • With pull-up control

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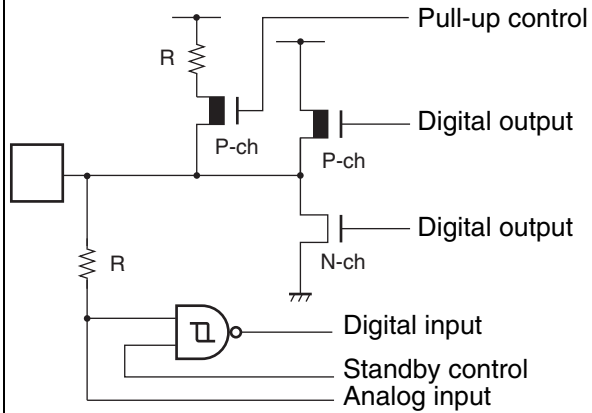
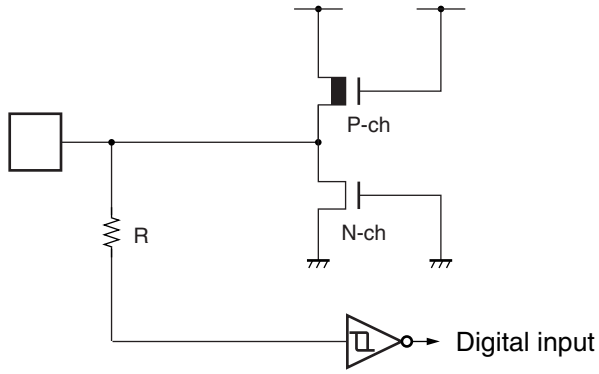
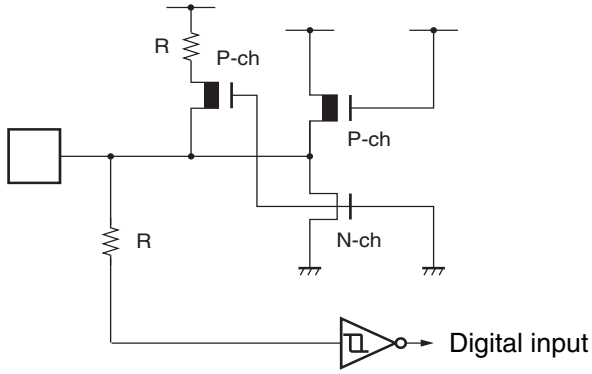
Type	Circuit	Remarks
G		• Analog/CMOS level hysteresis I/O pin • CMOS level output • CMOS level hysteresis input (with standby control) • Analog input (Operates as an analog input when the corresponding AICR register bit is “1”.) • With pull-up control
H		• CMOS level hysteresis input • Without standby control
I		• CMOS level hysteresis input • Without standby control • With pull-up resistance

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