Renesas Electronics America Inc - UPD78F0452GB-GAH-AX Datasheet

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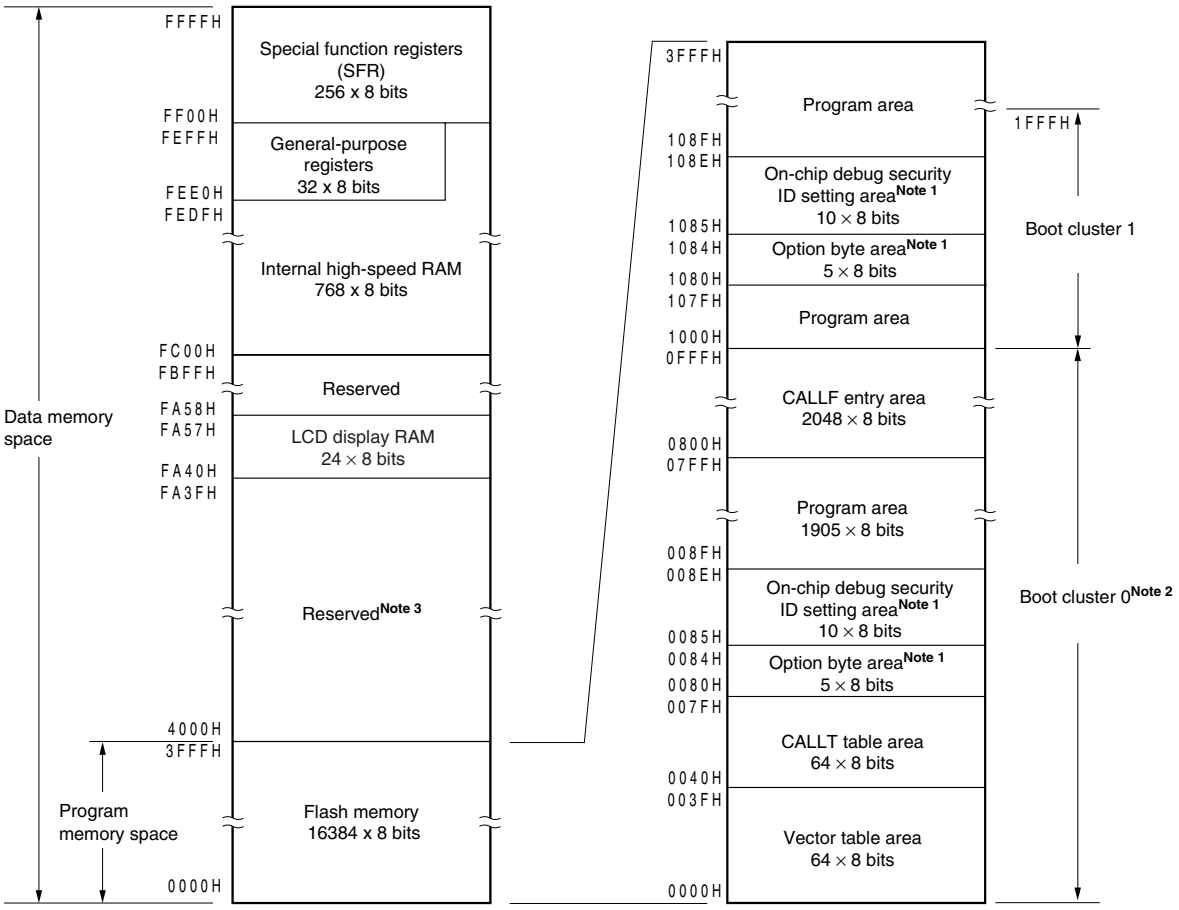
What is "Embedded - Microcontrollers"?

"Embedded - Microcontrollers" refer to small, integrated circuits designed to perform specific tasks within larger systems. These microcontrollers are essentially compact computers on a single chip, containing a processor core, memory, and programmable input/output peripherals. They are called "embedded" because they are embedded within electronic devices to control various functions, rather than serving as standalone computers. Microcontrollers are crucial in modern electronics, providing the intelligence and control needed for a wide range of applications.

Applications of "Embedded - Microcontrollers"

Details	
Product Status	Active
Core Processor	78K/0
Core Size	8-Bit
Speed	10MHz
Connectivity	3-Wire SIO, LINbus, UART/USART
Peripherals	LCD, LVD, POR, PWM, WDT
Number of I/O	46
Program Memory Size	24KB (24K x 8)
Program Memory Type	FLASH
EEPROM Size	-
RAM Size	1K x 8
Voltage - Supply (Vcc/Vdd)	1.8V ~ 5.5V
Data Converters	A/D 8x10b
Oscillator Type	Internal
Operating Temperature	-40°C ~ 85°C (TA)
Mounting Type	Surface Mount
Package / Case	64-TQFP
Supplier Device Package	-
Purchase URL	https://www.e-xfl.com/product-detail/renesas-electronics-america/upd78f0452gb-gah-ax

Figure 3-2. Memory Map (μPD78F0461)



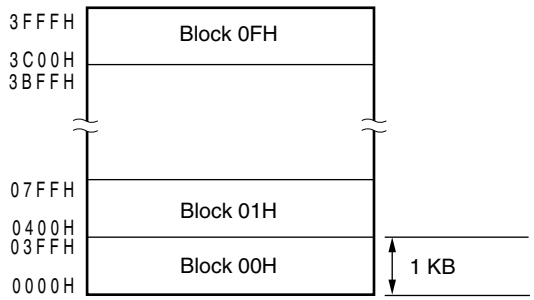
Notes 1. When boot swap is not used: Set the option bytes to 0080H to 0084H, and the on-chip debug security IDs to 0085H to 008EH.

When boot swap is used: Set the option bytes to 0080H to 0084H and 1080H to 1084H, and the on-chip debug security IDs to 0085H to 008EH and 1085H to 108EH.

2. Writing boot cluster 0 can be prohibited depending on the setting of security (see **27.8 Security Setting**).

<R> **3.** However, FA26H and FA27H can be used (See **13.3 Registers Used in 16-Bit ΔΣ Type A/D Converter**).

Remark The flash memory is divided into blocks (one block = 1 KB). For the address values and block numbers, see **Table 3-2 Correspondence Between Address Values and Block Numbers in Flash Memory**.

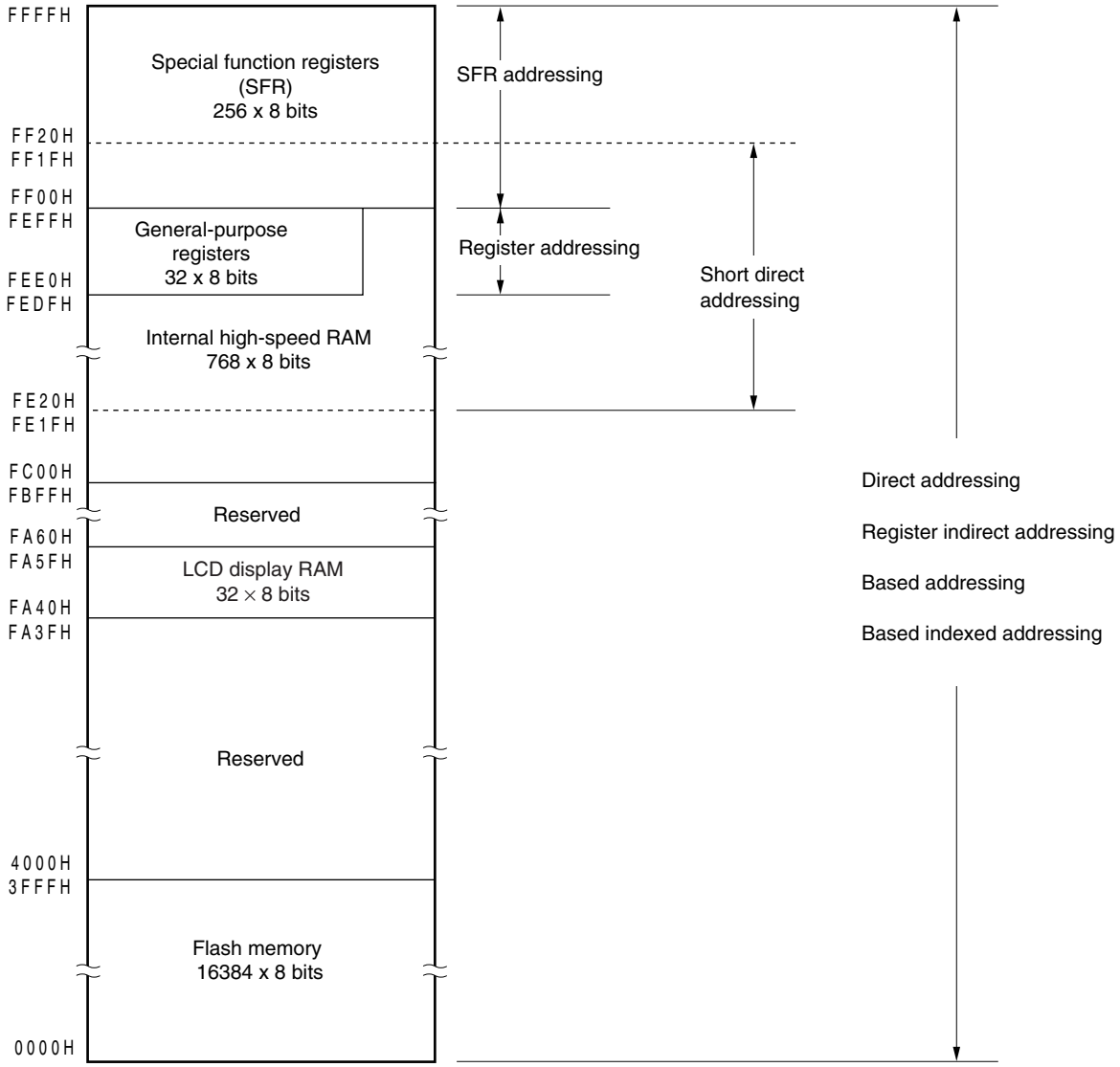


3.1.4 Data memory addressing

Addressing refers to the method of specifying the address of the instruction to be executed next or the address of the register or memory relevant to the execution of instructions.

Several addressing modes are provided for addressing the memory relevant to the execution of instructions for the 78K0/LE3, based on operability and other considerations. For areas containing data memory in particular, special addressing methods designed for the functions of special function registers (SFR) and general-purpose registers are available for use. Figures 3-11 to 3-20 show correspondence between data memory and addressing. For details of each addressing mode, see **3.4 Operand Address Addressing**.

Figure 3-11. Correspondence Between Data Memory and Addressing (μPD78F0441, 78F0451)



(6) Main clock mode register (MCM)

This register selects the main system clock supplied to CPU clock and clock supplied to peripheral hardware clock.

MCM can be set by a 1-bit or 8-bit memory manipulation instruction.

Reset signal generation clears this register to 00H.

Figure 5-6. Format of Main Clock Mode Register (MCM)

Address: FFA1H After reset: 00H R/W[Note]

Symbol	7	6	5	4	3	<2>	<1>	<0>
MCM	0	0	0	0	0	XSEL	MCS	MCM0

XSEL	MCM0	Selection of clock supplied to main system clock and peripheral hardware	
		Main system clock (f_{XP})	Peripheral hardware clock (f_{PRS})
0	0	Internal high-speed oscillation clock (f_{RH})	Internal high-speed oscillation clock (f_{RH})
0	1		
1	0		High-speed system clock (f_{XH})
1	1	High-speed system clock (f_{XH})	

MCS	Main system clock status
0	Operates with internal high-speed oscillation clock
1	Operates with high-speed system clock

Note Bit 1 is read-only.

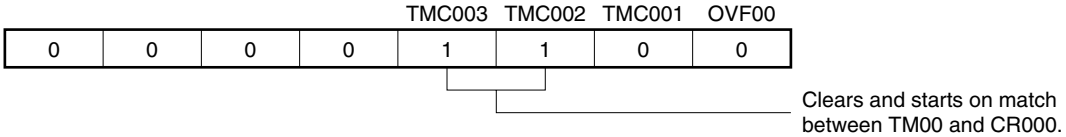
Cautions 1. XSEL can be changed only once after a reset release.

2. A clock other than f_{PRS} is supplied to the following peripheral functions regardless of the setting of XSEL and MCM0.

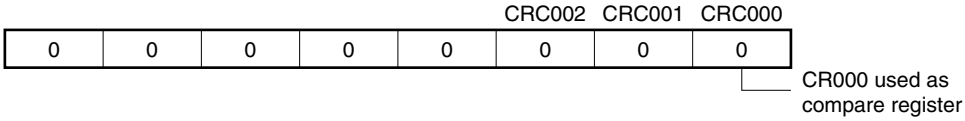
- **Watchdog timer (operates with internal low-speed oscillation clock)**
- **When "f_{RL}", "$f_{RL}/2^7$", or "$f_{RL}/2^9$" is selected as the count clock for 8-bit timer H1 (operates with internal low-speed oscillation clock)**
- **When "$f_{RL}/2^3$" is selected as the LCD source clock for LCD controller/driver (operates with internal low-speed oscillation clock)**
- **Peripheral hardware selects the external clock as the clock source (Except when the external count clock of TM00 is selected (TI000 pin valid edge))**

Figure 6-14. Example of Register Settings for Interval Timer Operation

(a) 16-bit timer mode control register 00 (TMC00)



(b) Capture/compare control register 00 (CRC00)



(c) 16-bit timer output control register 00 (TOC00)

	OSPT00	OSPE00	TOC004	LVS00	LVR00	TOC001	TOE00
0	0	0	0	0	0	0	0

(d) Prescaler mode register 00 (PRM00)

ES101	ES100	ES001	ES000	3	PRM002	PRM001	PRM000
0	0	0	0	0	0/1	0/1	0/1

Selects count clock

(e) 16-bit timer counter 00 (TM00)

By reading TM00, the count value can be read.

(f) 16-bit capture/compare register 000 (CR000)

If M is set to CR000, the interval time is as follows.

- Interval time = (M + 1) × Count clock cycle

Setting CR000 to 0000H is prohibited.

(g) 16-bit capture/compare register 010 (CR010)

Usually, CR010 is not used for the interval timer function. However, a compare match interrupt (INTTM010) is generated when the set value of CR010 matches the value of TM00.

Therefore, mask the interrupt request by using the interrupt mask flag (TMMK010).

6.4.2 Square wave output operation

When 16-bit timer/event counter 00 operates as an interval timer (see **6.4.1**), a square wave can be output from the TO00 pin by setting the 16-bit timer output control register 00 (TOC00) to 03H.

When TMC003 and TMC002 are set to 11 (count clear & start mode entered upon a match between TM00 and CR000), the counting operation is started in synchronization with the count clock.

When the value of TM00 later matches the value of CR000, TM00 is cleared to 0000H, an interrupt signal (INTTM000) is generated, and TO00 output is inverted. This TO00 output that is inverted at fixed intervals enables TO00 to output a square wave.

Remarks 1. For the setting of I/O pins, see **6.3 (6) Port mode register 3 (PM3)**.

2. For how to enable the INTTM000 signal interrupt, see **CHAPTER 20 INTERRUPT FUNCTIONS**.

Figure 6-16. Block Diagram of Square Wave Output Operation

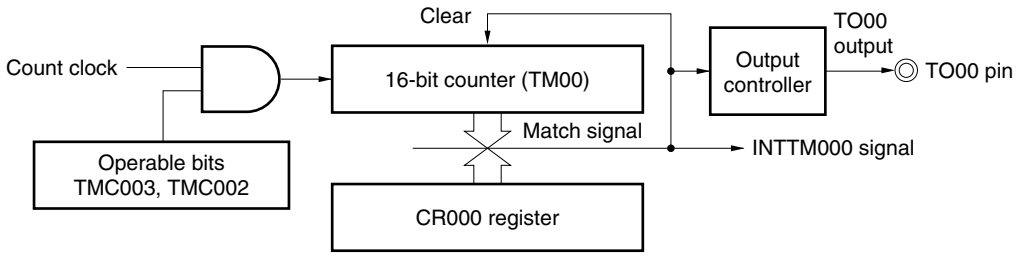


Figure 6-17. Basic Timing Example of Square Wave Output Operation

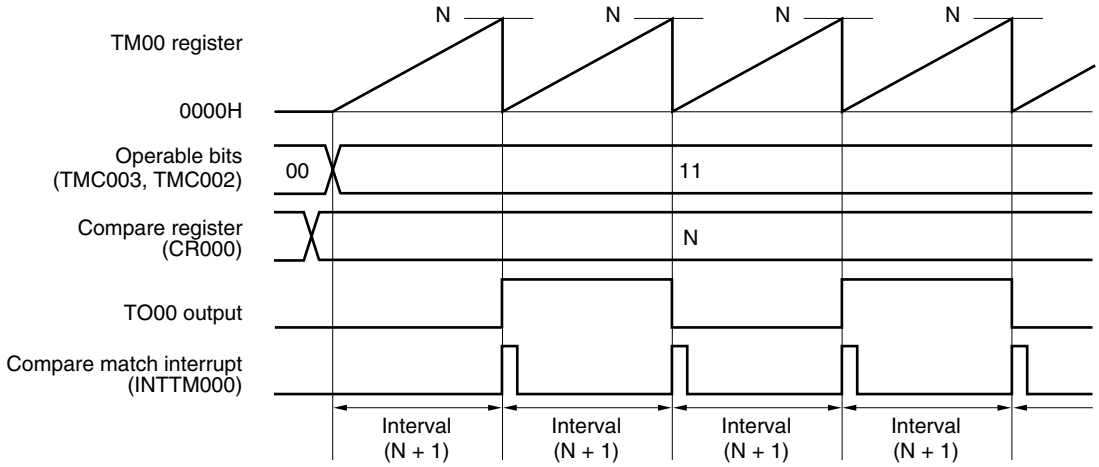
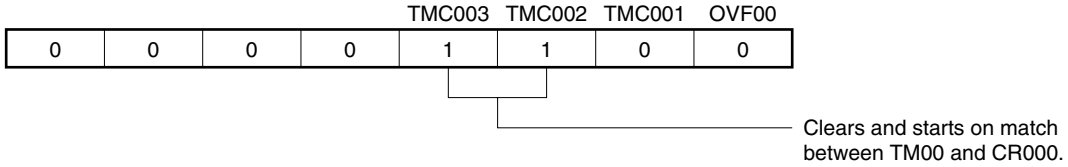
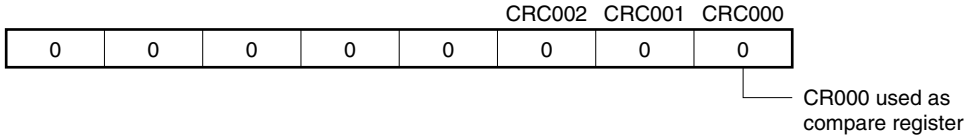


Figure 6-18. Example of Register Settings for Square Wave Output Operation

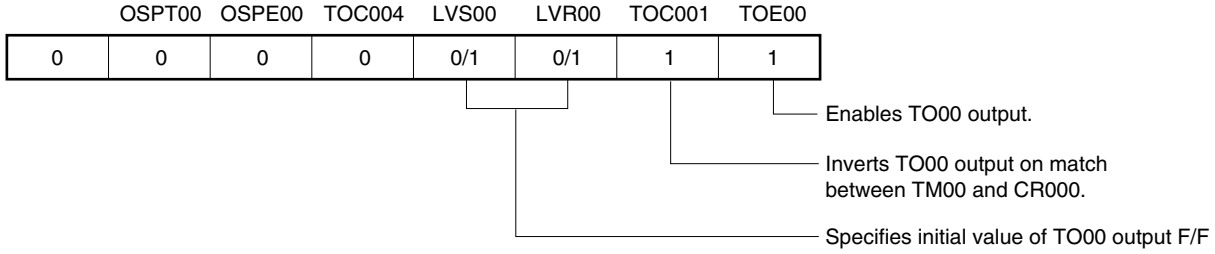
(a) 16-bit timer mode control register 00 (TMC00)



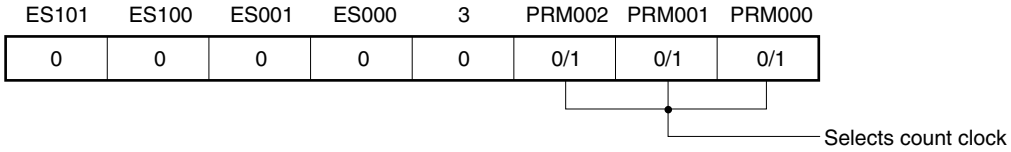
(b) Capture/compare control register 00 (CRC00)



(c) 16-bit timer output control register 00 (TOC00)



(d) Prescaler mode register 00 (PRM00)



(e) 16-bit timer counter 00 (TM00)

By reading TM00, the count value can be read.

(f) 16-bit capture/compare register 000 (CR000)

If M is set to CR000, the interval time is as follows.

- Square wave frequency = 1 / [2 × (M + 1) × Count clock cycle]

Setting CR000 to 0000H is prohibited.

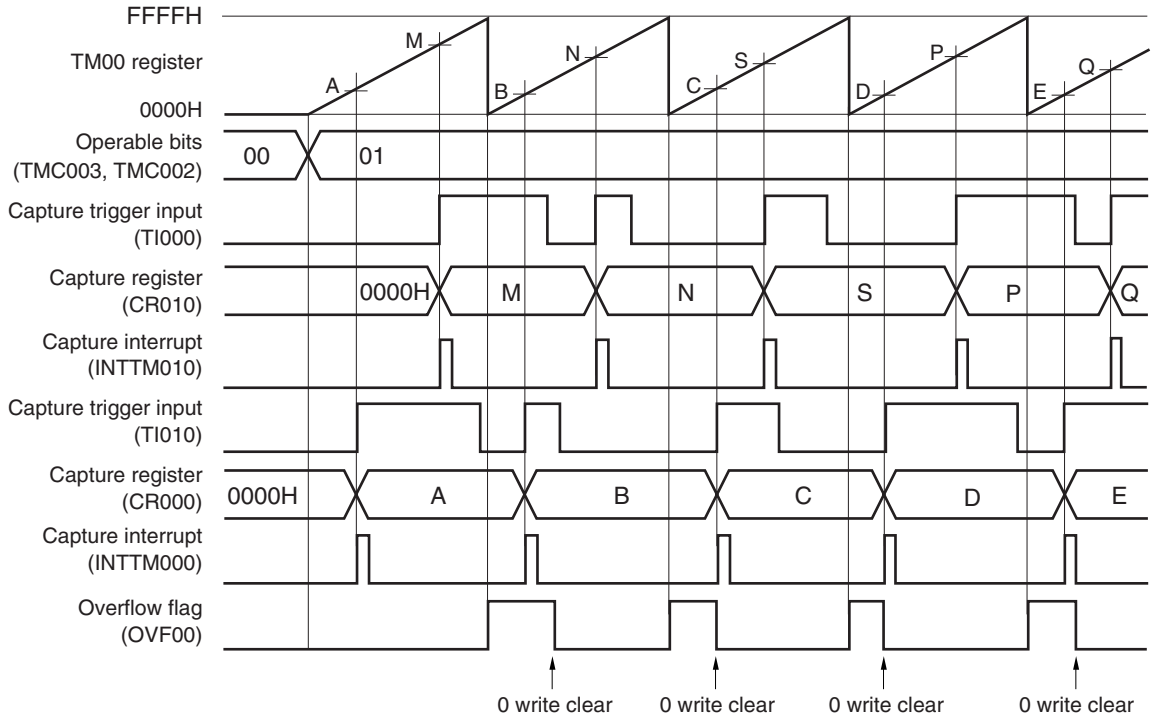
(g) 16-bit capture/compare register 010 (CR010)

Usually, CR010 is not used for the square wave output function. However, a compare match interrupt (INTTM010) is generated when the set value of CR010 matches the value of TM00.

Therefore, mask the interrupt request by using the interrupt mask flag (TMMK010).

Figure 6-38. Timing Example of Free-Running Timer Mode (CR000: Capture Register, CR010: Capture Register) (1/2)

(a) TOC00 = 13H, PRM00 = 50H, CRC00 = 05H, TMC00 = 04H



This is an application example where the count values that have been captured at the valid edges of separate capture trigger signals are stored in separate capture registers in the free-running timer mode.

The count value is captured to CR010 when the valid edge of the TI000 pin input is detected and to CR000 when the valid edge of the TI010 pin input is detected.

(7) Minute count register (MIN)

The MIN register is an 8-bit register that takes a value of 0 to 59 (decimal) and indicates the count value of minutes.

It counts up when the second counter overflows.

When data is written to this register, it is written to a buffer and then to the counter up to 2 clocks (32.768 kHz) later. Set a decimal value of 00 to 59 to this register in BCD code. If a value outside this range is set, the register value returns to the normal value after 1 period.

MIN can be set by an 8-bit memory manipulation instruction.

Reset signal generation clears this register to 00H.

Figure 9-8. Format of Minute Count Register (MIN)

Address: FF63H After reset: 00H R/W

Symbol	7	6	5	4	3	2	1	0
MIN	0	MIN40	MIN20	MIN10	MIN8	MIN4	MIN2	MIN1

(8) Hour count register (HOUR)

The HOUR register is an 8-bit register that takes a value of 00 to 23 or 01 to 12, 21 to 32 (decimal) and indicates the count value of hours.

It counts up when the minute counter overflows.

When data is written to this register, it is written to a buffer and then to the counter up to 2 clocks (32.768 kHz) later. Set a decimal value of 00 to 23 or 01 to 12, 21 to 32 to this register in BCD code. If a value outside this range is set, the register value returns to the normal value after 1 period.

HOUR can be set by an 8-bit memory manipulation instruction.

Reset signal generation clears this register to 12H.

However, the value of this register is 00H if the AMPM bit is set to 1 after reset.

Figure 9-9. Format of Hour Count Register (HOUR)

Address: FF64H After reset: 12H R/W

Symbol	7	6	5	4	3	2	1	0
HOUR	0	0	HOUR20	HOUR10	HOUR8	HOUR4	HOUR2	HOUR1

Caution Bit 5 (HOUR20) of HOUR indicates AM(0)/PM(1) if AMPM = 0 (if the 12-hour system is selected).

(16) Alarm week register (ALARMWW)

This register is used to set date of alarm.

ALARMWW can be set by an 8-bit memory manipulation instruction.

Reset signal generation clears this register to 00H.

Figure 9-17. Format of Alarm Week Register (ALARMWW)

Address: FF88H After reset: 00H R/W

Symbol	7	6	5	4	3	2	1	0
ALARMWW	0	WW6	WW5	WW4	WW3	WW2	WW1	WW0

Here is an example of setting the alarm.

Time of Alarm	Day							12-Hour Display				24-Hour Display			
	Sunday WW0	Monday WW1	Tuesday WW2	Wednesday WW3	Thursday WW4	Friday WW5	Saturday WW6	Hour 10	Hour 1	Minute 10	Minute 1	Hour 10	Hour 1	Minute 10	Minute 1
Every day, 0:00 a.m.	1	1	1	1	1	1	1	1	2	0	0	0	0	0	0
Every day, 1:30 a.m.	1	1	1	1	1	1	1	0	1	3	0	0	1	3	0
Every day, 11:59 a.m.	1	1	1	1	1	1	1	1	1	5	9	1	1	5	9
Monday through Friday, 0:00 p.m.	0	1	1	1	1	1	0	3	2	0	0	1	2	0	0
Sunday, 1:30 p.m.	1	0	0	0	0	0	0	2	1	3	0	1	3	3	0
Monday, Wednesday, Friday, 11:59 p.m.	0	1	0	1	0	1	0	3	1	5	9	2	3	5	9

Cautions 4. The operation of the watchdog timer in the HALT and STOP modes differs as follows depending on the set value of bit 0 (LSROSC) of the option byte.

	LSROSC = 0 (Internal Low-Speed Oscillator Can Be Stopped by Software)	LSROSC = 1 (Internal Low-Speed Oscillator Cannot Be Stopped)
In HALT mode	Watchdog timer operation stops.	Watchdog timer operation continues.
In STOP mode		

If LSROSC = 0, the watchdog timer resumes counting after the HALT or STOP mode is released. At this time, the counter is not cleared to 0 but starts counting from the value at which it was stopped.

If oscillation of the internal low-speed oscillator is stopped by setting LSRSTOP (bit 1 of the internal oscillation mode register (RCM) = 1) when LSROSC = 0, the watchdog timer stops operating. At this time, the counter is not cleared to 0.

5. The watchdog timer continues its operation during self-programming and EEPROM emulation of the flash memory. During processing, the interrupt acknowledge time is delayed. Set the overflow time and window size taking this delay into consideration.

10.4.2 Setting overflow time of watchdog timer

Set the overflow time of the watchdog timer by using bits 3 to 1 (WDCS2 to WDCS0) of the option byte (0080H).

If an overflow occurs, an internal reset signal is generated. The present count is cleared and the watchdog timer starts counting again by writing “ACH” to WDTE during the window open period before the overflow time.

The following overflow time is set.

Table 10-3. Setting of Overflow Time of Watchdog Timer

WDCS2	WDCS1	WDCS0	Overflow Time of Watchdog Timer
0	0	0	$2^{10}/f_{RL}$ (3.88 ms)
0	0	1	$2^{11}/f_{RL}$ (7.76 ms)
0	1	0	$2^{12}/f_{RL}$ (15.52 ms)
0	1	1	$2^{13}/f_{RL}$ (31.03 ms)
1	0	0	$2^{14}/f_{RL}$ (62.06 ms)
1	0	1	$2^{15}/f_{RL}$ (124.12 ms)
1	1	0	$2^{16}/f_{RL}$ (248.24 ms)
1	1	1	$2^{17}/f_{RL}$ (496.48 ms)

Cautions 1. The combination of WDCS2 = WDCS1 = WDCS0 = 0 and WINDOW1 = WINDOW0 = 0 is prohibited.

2. The watchdog timer continues its operation during self-programming and EEPROM emulation of the flash memory. During processing, the interrupt acknowledge time is delayed. Set the overflow time and window size taking this delay into consideration.

Remarks 1. f_{RL}: Internal low-speed oscillation clock frequency

2. ( ): f_{RL} = 264 kHz (MAX.)

12.3 Registers Used in 10-Bit Successive Approximation Type A/D Converter

The A/D converter uses the following seven registers.

- A/D converter mode register (ADM)
- A/D port configuration register 0 (ADPC0)
- Analog input channel specification register (ADS)
- Port function register 2 (PF2) (μPD78F045x only)
- Port mode register 2 (PM2)
- 10-bit A/D conversion result register (ADCR)
- 8-bit A/D conversion result register (ADCRH)

(1) A/D converter mode register (ADM)

This register sets the conversion time for analog input to be A/D converted, and starts/stops conversion.

ADM can be set by a 1-bit or 8-bit memory manipulation instruction.

Reset signal generation clears this register to 00H.

Figure 12-3. Format of A/D Converter Mode Register (ADM)

Address: FF8DH After reset: 00H R/W

Symbol	<7>	6	5	4	3	2	1	<0>
ADM	ADCS	FR3 Note 1	FR2 Note 1	FR1 Note 1	FR0 Note 1	LV1 Note 1	LV0 Note 1	ADCE

ADCS	A/D conversion operation control
0	Stops conversion operation
1	Enables conversion operation

ADCE	Comparator operation control Note 2
0	Stops comparator operation
1	Enables comparator operation

Notes 1. For details of FR3 to FR0, LV1, LV0, and A/D conversion, see **Table 12-2 A/D Conversion Time Selection**.

2. The operation of the comparator is controlled by ADCS and ADCE, and it takes 1 μs from operation start to operation stabilization. Therefore, when ADCS is set to 1 after 1 μs or more has elapsed from the time ADCE is set to 1, the conversion result at that time has priority over the first conversion result. Otherwise, ignore data of the first conversion.

Table 12-1. Settings of ADCS and ADCE

ADCS	ADCE	A/D Conversion Operation
0	0	Stop status (DC power consumption path does not exist)
0	1	Conversion waiting mode (comparator operation, only comparator consumes power)
1	0	Conversion mode (comparator operation stopped Note)
1	1	Conversion mode (comparator operation)

Note Ignore data of the first conversion.

(6) A/D port configuration register 0 (ADPC0)

This register switches the ANI0/P20/DS0- to ANI7/P27/REF+ pins to analog input (analog input of 16-bit ΔΣ type A/D converter or analog input of 10-bit successive approximation type A/D converter) or digital I/O of port.

ADPC0 can be set by a 1-bit or 8-bit memory manipulation instruction.

Reset signal generation sets this register to 08H.

Figure 13-7. Format of A/D Port Configuration Register 0 (ADPC0)

Address: FF8FH After reset: 08H R/W

Symbol	7	6	5	4	3	2	1	0
ADPC0	0	0	0	0	ADPC03	ADPC02	ADPC01	ADPC00

ADPC03	ADPC02	ADPC01	ADPC00	Digital I/O (D)/analog input (A: successive approximation type, Δ: ΔΣ type) switching							
				P27/ ANI7/ REF+	P26/ ANI6/ REF-	P25/ ANI5/ DS2+	P24/ ANI4/ DS2-	P23/ ANI3/ DS1+	P22/ ANI2/ DS1-	P21/ ANI1/ DS0+	P20/ ANI0/ DS0-
0	0	0	0	A/Δ	A/Δ	A/Δ	A/Δ	A/Δ	A/Δ	A/Δ	A/Δ
0	0	0	1	A/Δ	A/Δ	A/Δ	A/Δ	A/Δ	A/Δ	A	D
0	0	1	0	A/Δ	A/Δ	A/Δ	A/Δ	A/Δ	A/Δ	D	D
0	0	1	1	A/Δ	A/Δ	A/Δ	A/Δ	A	D	D	D
0	1	0	0	A/Δ	A/Δ	A/Δ	A/Δ	D	D	D	D
0	1	0	1	A	A	A	D	D	D	D	D
0	1	1	0	A	A	D	D	D	D	D	D
0	1	1	1	A	D	D	D	D	D	D	D
1	0	0	0	D	D	D	D	D	D	D	D
Other than above				Setting prohibited							

Cautions 1. Set the channel used for A/D conversion to the input mode by using port mode register 2 (PM2).

2. Do not set the pin set by ADPC0 as digital I/O by ADS, ADDS1, or ADDS0.

3. If data is written to ADPC0, a wait cycle is generated. Do not write data to ADPC0 when the CPU is operating on the subsystem clock and the peripheral hardware clock is stopped. For details, see CHAPTER 33 CAUTIONS FOR WAIT.

Table 13-4. Input Voltage Range

		Input Voltage Range to DSn+	Input Voltage Range to DSn-
Differential input	High-accuracy mode ON	0.5 × (REF+) + X1	0.5 × (REF+) − X1
	High-accuracy mode OFF	0.5 × (REF+) + X2	0.5 × (REF+) − X2
Single input	High-accuracy mode ON	0.1 × (REF+) to 0.9 × (REF+)	Fixed to AV_{SS}
	High-accuracy mode OFF	0 to REF+	

Remark X1 = −0.4 × (REF+) to 0.4 × (REF+)
X2 = −0.5 × (REF+) to 0.5 × (REF+)
n = 0 to 2

Figure 13-12. Example of Application circuit

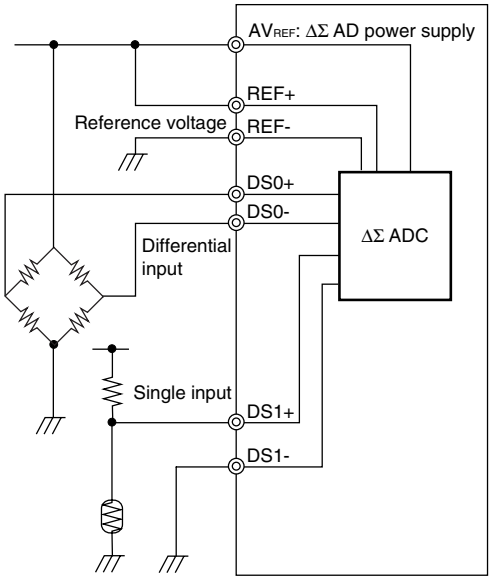
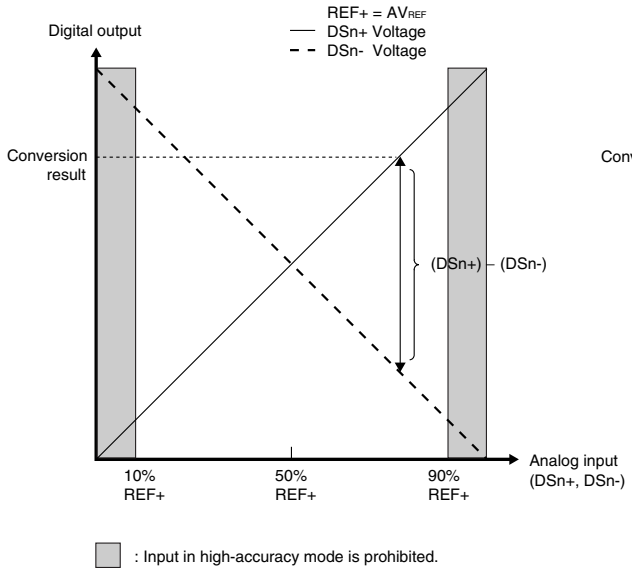
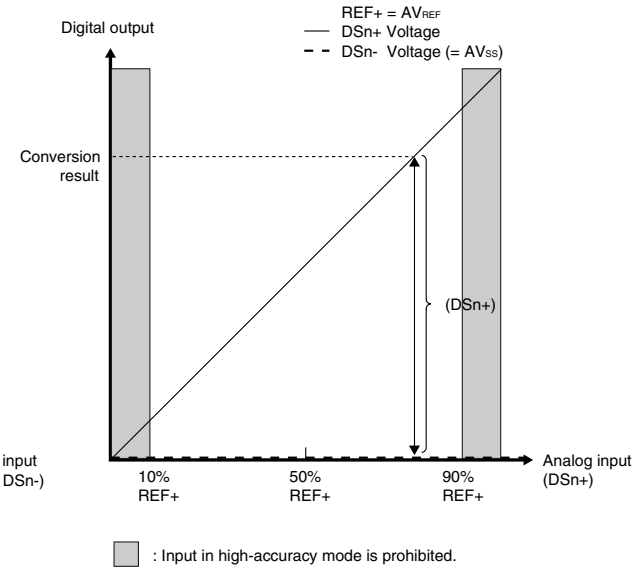


Figure 13-13. Enabled input range by A/D converter mode

< Differential input >

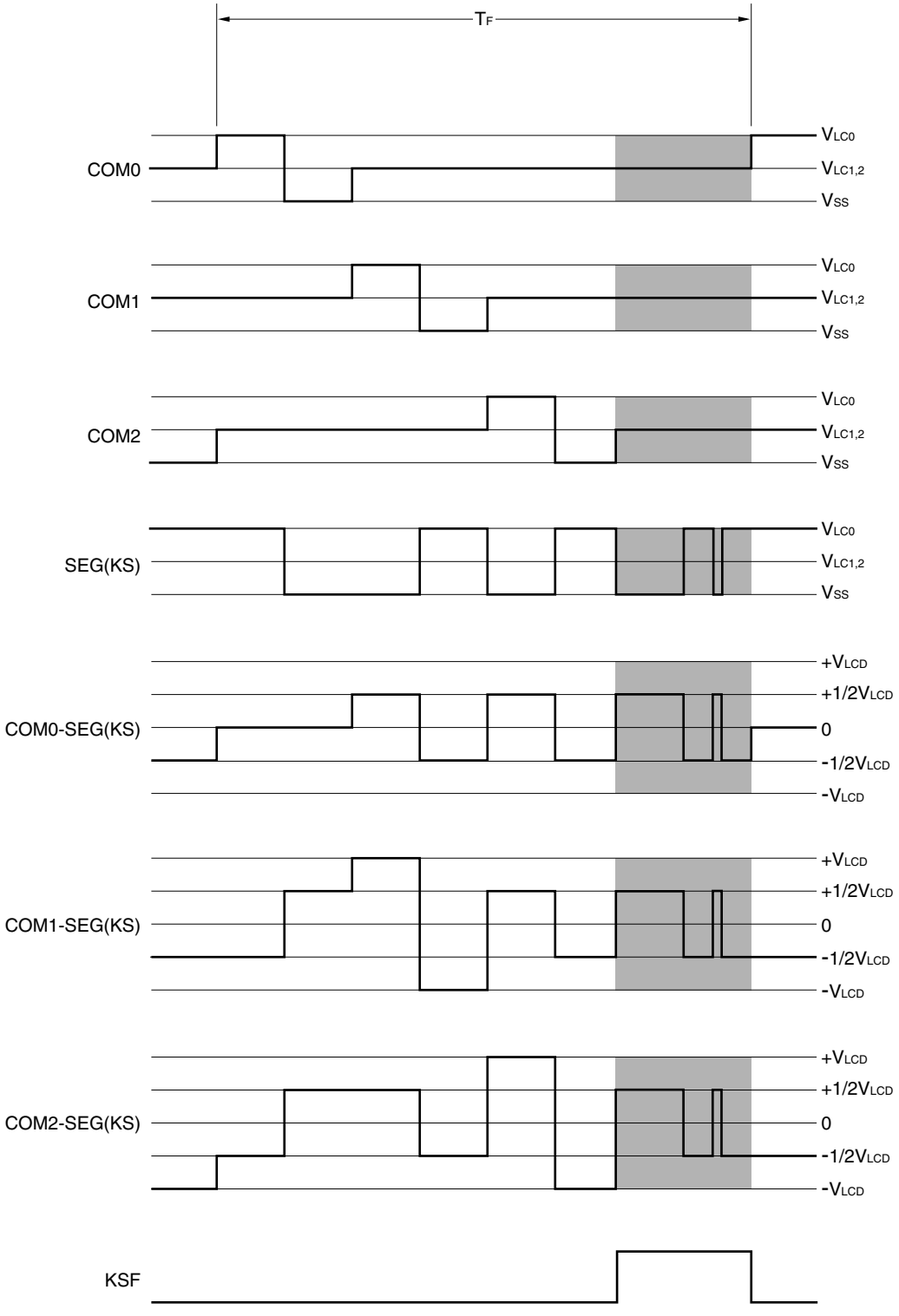


< Single input >



Remark n = 0 to 2

<Key identification>

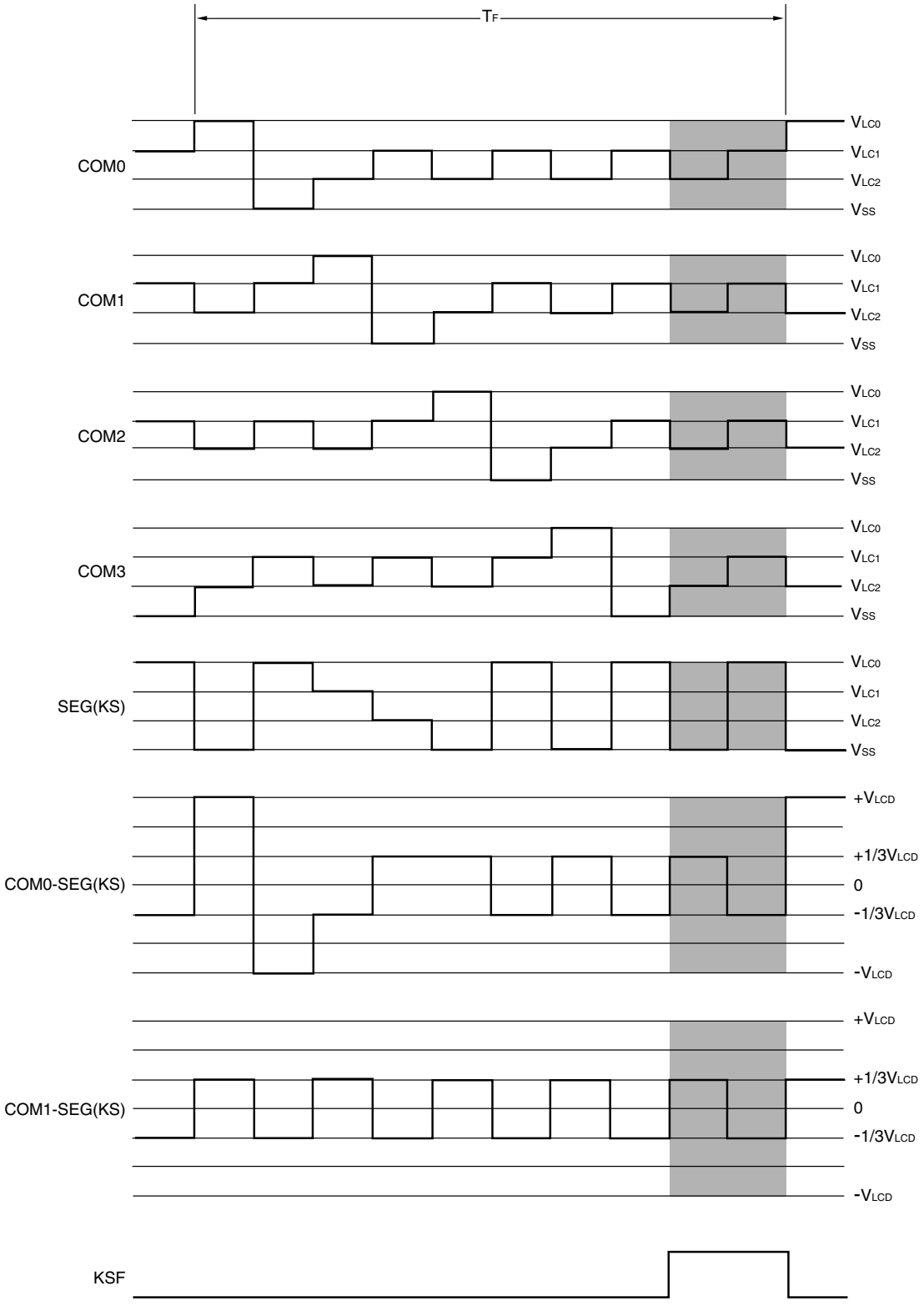


Shaded sections: Segment key scan output period

Remark During key identification, the residual charge of the LCD panel can be eliminated by outputting a signal with an inverted relationship between its first half and latter half.

(b) When segment key scan function is used (KSON = 1)

<Key input wait>



Shaded sections: Segment key scan output period

18.4.2 Manchester code generator mode

This mode is used to transmit data in Manchester code format using the MCGO pin.

(1) Register description

MCG control register 0 (MC0CTL0), MCG control register 1 (MC0CTL1), and MCG control register 2 (MC0CTL2) are used to set the Manchester code generator mode.

(a) MCG control register 0 (MC0CTL0)

This register can be set by a 1-bit or 8-bit memory manipulation instruction.

Reset signal generation sets this register to 10H.

Address: FF4CH After reset: 10H R/W

Symbol	<7>	6	5	<4>	3	2	<1>	<0>
MC0CTL0	MC0PWR	0	0	MC0DIR	0	0	MC0OSL	MC0OLV

MC0PWR	Operation control
0	Operation stopped
1	Operation enabled

MC0DIR	First bit specification
0	MSB
1	LSB

MC0OSL	Data format
0	Manchester code
1	Bit sequential data

MC0OLV	Output level when transmission suspended
0	Low level
1	High level

Caution Clear (0) the MC0PWR bit before rewriting the MC0DIR, MC0OSL, and MC0OLV bits (it is possible to rewrite these bits by an 8-bit memory manipulation instruction at the same time when the MC0PWR bit is set (1)).

(b) MCG control register 1 (MC0CTL1)

This register is used to set the base clock of the Manchester code generator.

This register can be set by an 8-bit memory manipulation instruction.

Reset signal generation clears this register to 00H.

Address: FF4DH After reset: 00H R/W

Symbol	7	6	5	4	3	2	1	0
MC0CTL1	0	0	0	0	0	MC0CKS2	MC0CKS1	MC0CKS0

MC0CKS2	MC0CKS1	MC0CKS0	Base clock (f_{XCLK}) selection[Note 1]
0	0	0	f_{PRS}[Note 2] (10 MHz)
0	0	1	$f_{PRS}/2$ (5 MHz)
0	1	0	$f_{PRS}/2^2$ (2.5 MHz)
0	1	1	$f_{PRS}/2^3$ (1.25 MHz)
1	0	0	$f_{PRS}/2^4$ (625 kHz)
1	0	1	$f_{PRS}/2^5$ (312.5 kHz)
1	1	0	
1	1	1	

Notes 1. If the peripheral hardware clock (f_{PRS}) operates on the high-speed system clock (f_{XH}) (XSEL = 1), the f_{PRS} operating frequency varies depending on the supply voltage.

- V_{DD} = 2.7 to 5.5 V: $f_{PRS} \leq$ 10 MHz
- V_{DD} = 1.8 to 2.7 V: $f_{PRS} \leq$ 5 MHz

2. If the peripheral hardware clock (f_{PRS}) operates on the internal high-speed oscillation clock (f_{RH}) (XSEL = 0), when 1.8 V $\leq V_{DD} <$ 2.7 V, the setting of MC0CKS2 = MC0CKS1 = MC0CKS0 = 0 (base clock: f_{PRS}) is prohibited.

Caution Clear bit 7 (MC0PWR) of the MC0CTL0 register to 0 before rewriting the MC0CKS2 to MC0CKS0 bits.

Remarks 1. f_{PRS}: Peripheral hardware clock frequency

2. Figures in parentheses are for operation with f_{PRS} = 10 MHz.

Table 20-1. Interrupt Source List (2/2)

Interrupt Type	Default Priority[Note 1]	Interrupt Source		Internal/ External	Vector Table Address	Basic Configuration Type[Note 2]
		Name	Trigger			
Maskable	21	INTDSAD[Note 4]	End of 16-bit ΔΣ type A/D conversion	Internal	0030H	(A)
	22	INTTM52	Match between TM52 and CR52 (when compare register is specified)		0032H	
	23	INTTMH2	Match between TMH2 and CRH2 (when compare register is specified)		0034H	
	24	INTMCG	End of Manchester code reception		0036H	
	25	INTRIN	Remote controller reception edge detection		0038H	
	26	INTRERR/ INTGP/ INTREND/ INTDFULL	Remote controller reception error occurrence Remote controller guide pulse detection Remote controller data reception completion Read request for remote controller 8-bit shift data		003AH	
Software	–	BRK	BRK instruction execution	–	003EH	(D)
Reset	–	RESET	Reset input	–	0000H	–
		POC	Power-on clear			
		LVI	Low-voltage detection[Note 3]			
		WDT	WDT overflow			

Notes 1. The default priority determines the sequence of processing vectored interrupts if two or more maskable interrupts occur simultaneously. Zero indicates the highest priority and 26 indicates the lowest priority.

2. Basic configuration types (A) to (D) correspond to (A) to (D) in Figure 20-1.

3. When bit 1 (LVIMD) of the low-voltage detection register (LVIM) is set to 1.

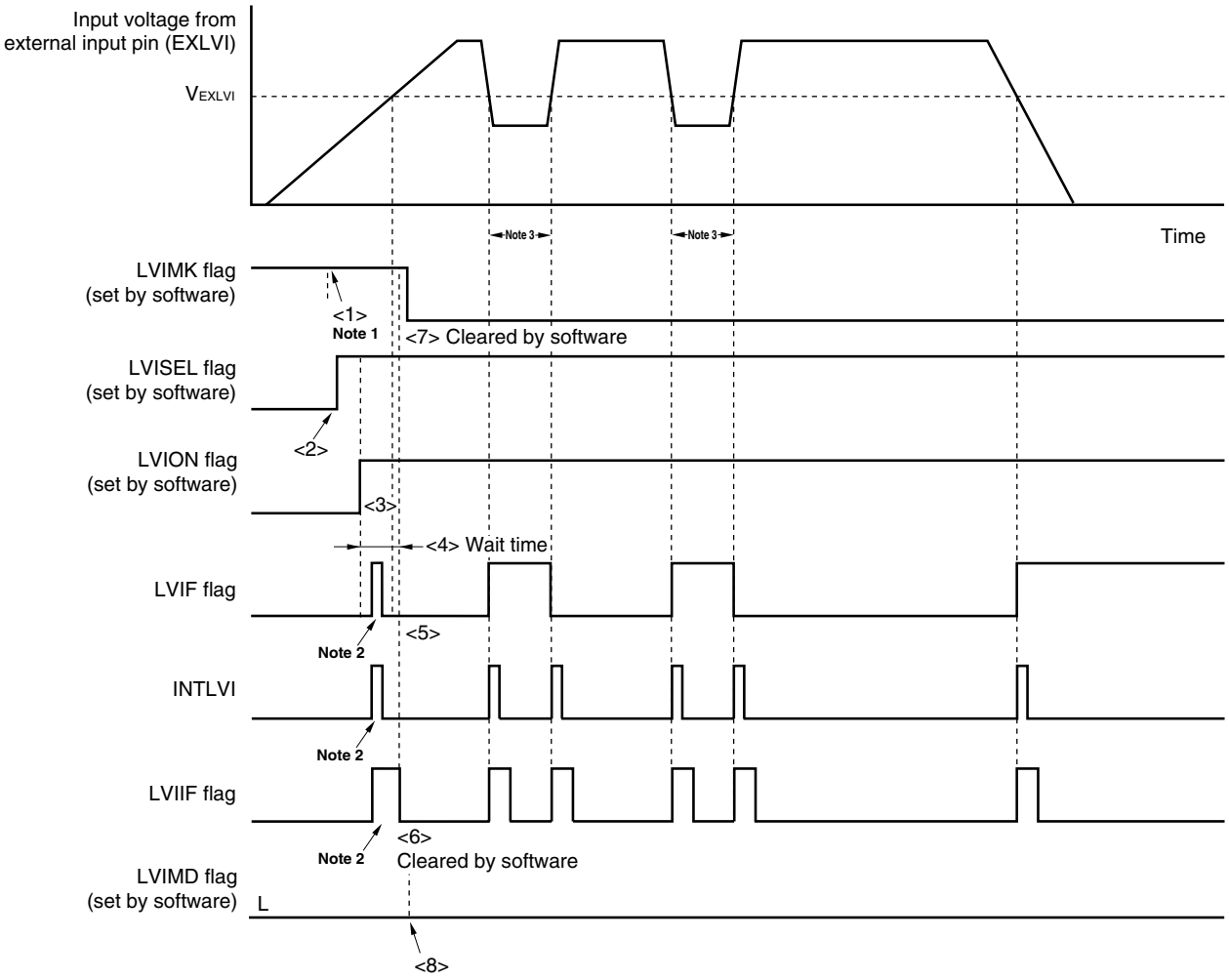
4. μPD78F046x only.

Table 23-1. Operation Statuses During Reset Period

Item		During Reset Period
System clock		Clock supply to the CPU is stopped.
Main system clock	f_{RH}	Operation stopped
	f_X	Operation stopped (pin is I/O port mode)
	f_{EXCLK}	Clock input invalid (pin is I/O port mode)
Subsystem clock	f_{XT}	Operation stopped (pin is I/O port mode)
f_{RL}		Operation stopped
CPU		
Flash memory		
RAM		
Port (latch)		
16-bit timer/event counter 00		
8-bit timer/event counter	50	
	51	
	52	
8-bit timer	H0	
	H1	
	H2	
Real-time counter		
Watchdog timer		
Buzzer output		
10-bit successive approximation type A/D converter		
16-bit ΔΣ type A/D converter		
Serial interface	UART0	
	UART6	
	CSI10	
LCD controller/driver		
Manchester code generator		
Remote controller receiver		
Power-on-clear function		Operable
Low-voltage detection function		Operation stopped
External interrupt		

Remark f_{RH}: Internal high-speed oscillation clock
f_X: X1 oscillation clock
f_{EXCLK}: External main system clock
f_{XT}: XT1 oscillation clock
f_{RL}: Internal low-speed oscillation clock

Figure 25-8. Timing of Low-Voltage Detector Interrupt Signal Generation (Detects Level of Input Voltage from External Input Pin (EXLVI))



Notes 1. The LVIMK flag is set to "1" by reset signal generation.

2. The interrupt request signal (INTLVI) is generated and the LVIF and LVIIF flags may be set (1).

3. If LVION is cleared (0) in a state below the LVI detection voltage, an INTLVI signal is generated and LVIIF becomes 1.

Remark <1> to <8> in Figure 25-8 above correspond to <1> to <8> in the description of "When starting operation" in **25.4.2 (2) When detecting level of input voltage from external input pin (EXLVI)**.