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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	Obsolete
Core Processor	F ² MC-16FX
Core Size	16-Bit
Speed	56MHz
Connectivity	CANbus, EBI/EMI, I ² C, LINbus, SCI, UART/USART
Peripherals	DMA, LVD, LVR, POR, PWM, WDT
Number of I/O	51
Program Memory Size	96KB (96K x 8)
Program Memory Type	FLASH
EEPROM Size	-
RAM Size	8K x 8
Voltage - Supply (Vcc/Vdd)	3V ~ 5.5V
Data Converters	A/D 15x10b
Oscillator Type	Internal
Operating Temperature	-40°C ~ 105°C (TA)
Mounting Type	Surface Mount
Package / Case	64-LQFP
Supplier Device Package	64-LQFP (10x10)
Purchase URL	https://www.e-xfl.com/product-detail/infineon-technologies/mb96f353asbpmc1-gse2

MB96350 Series

■ PIN CIRCUIT TYPE

Pin circuit types

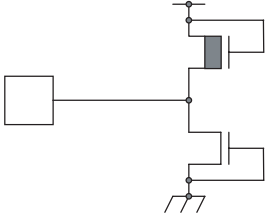
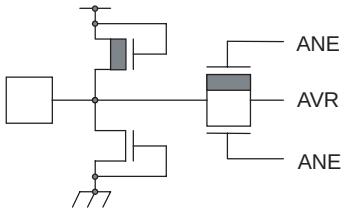
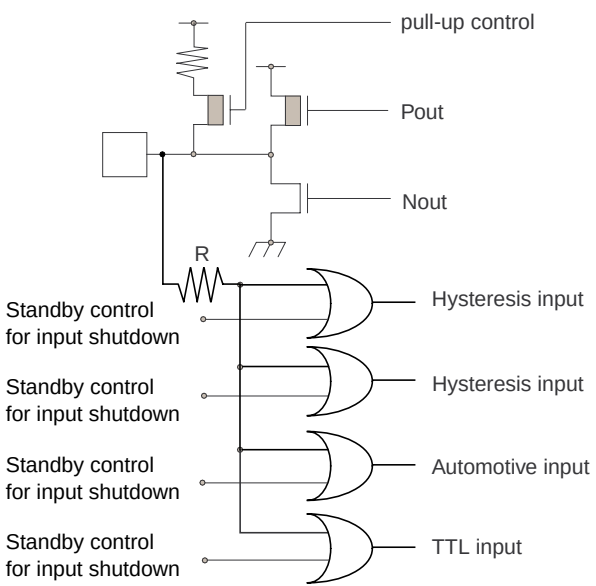
FPT-64P-M23/24	
Pin no.	Circuit type ^{*1}
1	Supply
2	G
3 to 15	I
16,17	H
18	Supply
19,20	B ^{*2}
19,20	H ^{*3}
21 to 23	C
24 to 44	H
45	E
46,47	A
48,49	Supply
50	F
51	H
52,53	N
54 to 61	H
62,63	I
64	Supply

*1: Please refer to “■ I/O CIRCUIT TYPE” for details on the I/O circuit types

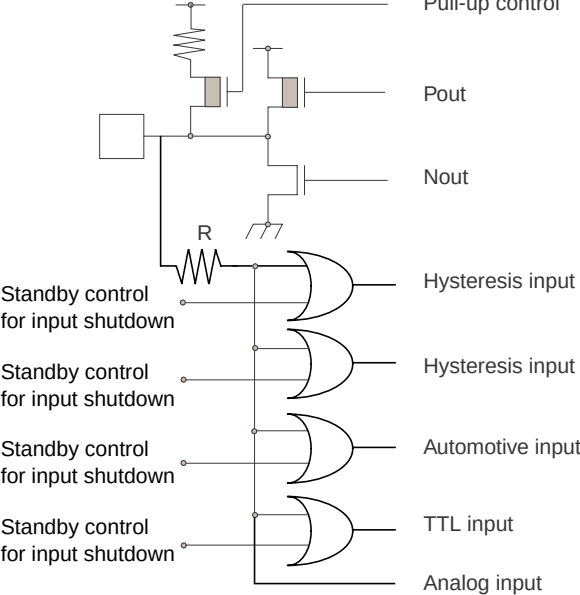
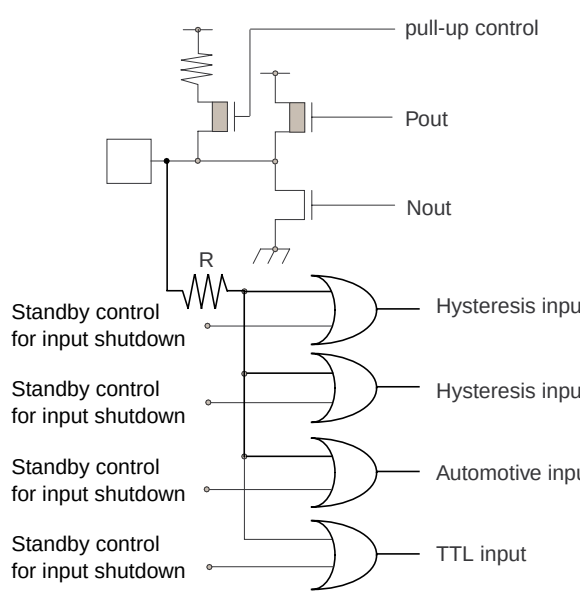
*2: Devices with suffix “W”

*3: Devices without suffix “W”

MB96350 Series

Type	Circuit	Remarks
F		Power supply input protection circuit
G		- A/D converter ref+ (AVRH) power supply input pin with protection circuit - Flash devices do not have a protection circuit against VCC for pin AVRH
H	 Standby control for input shutdown Standby control for input shutdown Standby control for input shutdown Standby control for input shutdown R pull-up control Pout Nout Hysteresis input Hysteresis input Automotive input TTL input	- CMOS level output (programmable $I_{OL} = 5\text{mA}$, $I_{OH} = -5\text{mA}$ and $I_{OL} = 2\text{mA}$, $I_{OH} = -2\text{mA}$) 2 different CMOS hysteresis inputs with input shutdown function - Automotive input with input shutdown function - TTL input with input shutdown function - Programmable pull-up resistor: 50kΩ approx. Note: MB96F353/F355: Only Automotive input and CMOS hysteresis input (0.7/0.3) are supported

MB96350 Series

Type	Circuit	Remarks
I	 Pull-up control Pout Nout R Standby control for input shutdown Hysteresis input Hysteresis input Automotive input TTL input Analog input	• CMOS level output (programmable $I_{OL} = 5\text{mA}$, $I_{OH} = -5\text{mA}$ and $I_{OL} = 2\text{mA}$, $I_{OH} = -2\text{mA}$) • 2 different CMOS hysteresis inputs with input shutdown function • Automotive input with input shutdown function • TTL input with input shutdown function. • Programmable pull-up resistor: 50kΩ approx. • Analog input Note: MB96F353/F355: Only Automotive input and CMOS hysteresis input (0.7/0.3) are supported
N	 pull-up control Pout Nout R Standby control for input shutdown Hysteresis input Hysteresis input Automotive input TTL input	• CMOS level output ($I_{OL} = 3\text{mA}$, $I_{OH} = -3\text{mA}$) • 2 different CMOS hysteresis inputs with input shutdown function • Automotive input with input shutdown function • TTL input with input shutdown function • Programmable pull-up resistor: 50kΩ approx. *1: N-channel transistor has slew rate control according to I²C spec, irrespective of usage Note: MB96F353/F355: Only Automotive input and CMOS hysteresis input (0.7/0.3) are supported

MB96350 Series

■ RAMSTART/END AND EXTERNAL BUS END ADDRESSES

Devices	Bank 0 RAM size	Bank 1 RAM size	External Bus end address	RAMSTART0	RAMSTART1	RAMEND1
MB96F353/F355	8KByte	-	00:51FF _H	00:6240 _H	-	-
MB96F356	12KByte	-	00:51FF _H	00:5240 _H	-	-

MB96350 Series

■ I/O MAP

I/O map MB96(F)35x (1 of 28)

Address	Register	Abbreviation 8-bit access	Abbreviation 16-bit access	Access
000000 _H	I/O Port P00 - Port Data Register	PDR00		R/W
000001 _H	I/O Port P01 - Port Data Register	PDR01		R/W
000002 _H	I/O Port P02 - Port Data Register	PDR02		R/W
000003 _H	I/O Port P03 - Port Data Register	PDR03		R/W
000004 _H	I/O Port P04 - Port Data Register	PDR04		R/W
000005 _H	I/O Port P05 - Port Data Register	PDR05		R/W
000006 _H	I/O Port P06 - Port Data Register	PDR06		R/W
000007 _H - 000017 _H	Reserved			-
000018 _H	ADC0 - Control Status register Low	ADCSL	ADCS	R/W
000019 _H	ADC0 - Control Status register High	ADCSH		R/W
00001A _H	ADC0 - Data Register Low	ADCRL	ADCR	R
00001B _H	ADC0 - Data Register High	ADCRH		R
00001C _H	ADC0 - Setting Register		ADSR	R/W
00001D _H	ADC0 - Setting Register			R/W
00001E _H	ADC0 - Extended Configuration Register	ADECR		R/W
00001F _H	Reserved			-
000020 _H	FRT0 - Data register of free-running timer		TCDT0	R/W
000021 _H	FRT0 - Data register of free-running timer			R/W
000022 _H	FRT0 - Control status register of free-running timer Low	TCCSL0	TCCS0	R/W
000023 _H	FRT0 - Control status register of free-running timer High	TCCSH0		R/W
000024 _H	FRT1 - Data register of free-running timer		TCDT1	R/W
000025 _H	FRT1 - Data register of free-running timer			R/W
000026 _H	FRT1 - Control status register of free-running timer Low	TCCSL1	TCCS1	R/W
000027 _H	FRT1 - Control status register of free-running timer High	TCCSH1		R/W
000028 _H - 000033 _H	Reserved			-

MB96350 Series

I/O map MB96(F)35x (3 of 28)

Address	Register	Abbreviation 8-bit access	Abbreviation 16-bit access	Access
000056 _H	ICU7 - Capture Register Low	IPCPL7	IPCP7	R
000057 _H	ICU7 - Capture Register High	IPCPH7		R
000058 _H	EXTINT0 - External Interrupt Enable Register	ENIR0		R/W
000059 _H	EXTINT0 - External Interrupt Interrupt request Register	EIRR0		R/W
00005A _H	EXTINT0 - External Interrupt Level Select Low	ELVRL0	ELVR0	R/W
00005B _H	EXTINT0 - External Interrupt Level Select High	ELVRH0		R/W
00005C _H	EXTINT1 - External Interrupt Enable Register	ENIR1		R/W
00005D _H	EXTINT1 - External Interrupt Interrupt request Register	EIRR1		R/W
00005E _H	EXTINT1 - External Interrupt Level Select Low	ELVRL1	ELVR1	R/W
00005F _H	EXTINT1 - External Interrupt Level Select High	ELVRH1		R/W
000060 _H	RLT0 - Timer Control Status Register Low	TMCSRL0	TMCSR0	R/W
000061 _H	RLT0 - Timer Control Status Register High	TMCSRH0		R/W
000062 _H	RLT0 - Reload Register - for writing		TMRLR0	W
000062 _H	RLT0 - Reload Register - for reading		TMR0	R
000063 _H	RLT0 - Reload Register - for writing			W
000063 _H	RLT0 - Reload Register - for reading			R
000064 _H	RLT1 - Timer Control Status Register Low	TMCSRL1	TMCSR1	R/W
000065 _H	RLT1 - Timer Control Status Register High	TMCSRH1		R/W
000066 _H	RLT1 - Reload Register - for writing		TMRLR1	W
000066 _H	RLT1 - Reload Register - for reading		TMR1	R
000067 _H	RLT1 - Reload Register - for writing			W
000067 _H	RLT1 - Reload Register - for reading			R
000068 _H	RLT2 - Timer Control Status Register Low	TMCSRL2	TMCSR2	R/W
000069 _H	RLT2 - Timer Control Status Register High	TMCSRH2		R/W
00006A _H	RLT2 - Reload Register - for writing		TMRLR2	W
00006A _H	RLT2 - Reload Register - for reading		TMR2	R
00006B _H	RLT2 - Reload Register - for writing			W
00006B _H	RLT2 - Reload Register - for reading			R
00006C _H	RLT3 - Timer Control Status Register Low	TMCSRL3	TMCSR3	R/W

MB96350 Series

I/O map MB96(F)35x (11 of 28)

Address	Register	Abbreviation 8-bit access	Abbreviation 16-bit access	Access
0003DB _H	Memory Patch function - Patch data 5 High	PFDH5		R/W
0003DC _H	Memory Patch function - Patch data 6 Low	PFDL6	PFD6	R/W
0003DD _H	Memory Patch function - Patch data 6 High	PFDH6		R/W
0003DE _H	Memory Patch function - Patch data 7 Low	PFDL7	PFD7	R/W
0003DF _H	Memory Patch function - Patch data 7 High	PFDH7		R/W
0003E0 _H - 0003F0 _H	Reserved			-
0003F1 _H	Memory Control Status Register A	MCSRA		R/W
0003F2 _H	Memory Timing Configuration Register A Low	MTCRAL	MTCRA	R/W
0003F3 _H	Memory Timing Configuration Register A High	MTCRAH		R/W
0003F4 _H - 0003F8 _H	Reserved			-
0003F9 _H	Flash Memory Write Control register 1	FMWC1		R/W
0003FA _H	Flash Memory Write Control register 2	FMWC2		R/W
0003FB _H	Flash Memory Write Control register 3	FMWC3		R/W
0003FC _H	Flash Memory Write Control register 4	FMWC4		R/W
0003FD _H	Flash Memory Write Control register 5	FMWC5		R/W
0003FE _H - 0003FF _H	Reserved			-
000400 _H	Standby Mode control register	SMCR		R/W
000401 _H	Clock select register	CKSR		R/W
000402 _H	Clock Stabilization select register	CKSSR		R/W
000403 _H	Clock monitor register	CKMR		R
000404 _H	Clock Frequency control register Low	CKFCRL	CKFCR	R/W
000405 _H	Clock Frequency control register High	CKFCRH		R/W
000406 _H	PLL Control register Low	PLLCRL	PLLCR	R/W
000407 _H	PLL Control register High	PLLCRH		R/W
000408 _H	RC clock timer control register	RCTCR		R/W
000409 _H	Main clock timer control register	MCTCR		R/W
00040A _H	Sub clock timer control register	SCTCR		R/W

MB96350 Series

I/O map MB96(F)35x (12 of 28)

Address	Register	Abbreviation 8-bit access	Abbreviation 16-bit access	Access
00040B _H	Reset cause and clock status register with clear function	RCCSRC		R
00040C _H	Reset configuration register	RCR		R/W
00040D _H	Reset cause and clock status register	RCCSR		R
00040E _H	Watch dog timer configuration register	WDTC		R/W
00040F _H	Watch dog timer clear pattern register	WDTCP		W
000410 _H - 000414 _H	Reserved			-
000415 _H	Clock output activation register	COAR		R/W
000416 _H	Clock output configuration register 0	COCR0		R/W
000417 _H	Clock output configuration register 1	COCR1		R/W
000418 _H	Clock Modulator control register	CMCR		R/W
000419 _H	Reserved			-
00041A _H	Clock Modulator Parameter register Low	CMPL	CMPL	R/W
00041B _H	Clock Modulator Parameter register High	CMPLH		R/W
00041C _H - 00042B _H	Reserved			-
00042C _H	Voltage Regulator Control register	VRCL		R/W
00042D _H	Clock Input and LVD Control Register	CILCR		R/W
00042E _H - 00042F _H	Reserved			-
000430 _H	I/O Port P00 - Data Direction Register	DDR00		R/W
000431 _H	I/O Port P01 - Data Direction Register	DDR01		R/W
000432 _H	I/O Port P02 - Data Direction Register	DDR02		R/W
000433 _H	I/O Port P03 - Data Direction Register	DDR03		R/W
000434 _H	I/O Port P04 - Data Direction Register	DDR04		R/W
000435 _H	I/O Port P05 - Data Direction Register	DDR05		R/W
000436 _H	I/O Port P06 - Data Direction Register	DDR06		R/W
000437 _H - 000443 _H	Reserved			-
000444 _H	I/O Port P00 - Port Input Enable Register	PIER00		R/W
000445 _H	I/O Port P01 - Port Input Enable Register	PIER01		R/W

MB96350 Series

I/O map MB96(F)35x (15 of 28)

Address	Register	Abbreviation 8-bit access	Abbreviation 16-bit access	Access
0004DA _H	Peripheral Resource Relocation Register 4	PRRR4		R/W
0004DB _H	Peripheral Resource Relocation Register 5	PRRR5		R/W
0004DC _H	Peripheral Resource Relocation Register 6	PRRR6		R/W
0004DD _H	Peripheral Resource Relocation Register 7	PRRR7		R/W
0004DE _H	Peripheral Resource Relocation Register 8	PRRR8		R/W
0004DF _H	Peripheral Resource Relocation Register 9	PRRR9		R/W
0004E0 _H	RTC - Sub Second Register L	WTBRL0	WTBR0	R/W
0004E1 _H	RTC - Sub Second Register M	WTBRH0		R/W
0004E2 _H	RTC - Sub-Second Register H	WTBR1		R/W
0004E3 _H	RTC - Second Register	WTSR		R/W
0004E4 _H	RTC - Minutes	WTMR		R/W
0004E5 _H	RTC - Hour	WTHR		R/W
0004E6 _H	RTC - Timer Control Extended Register	WTCER		R/W
0004E7 _H	RTC - Clock select register	WTCKSR		R/W
0004E8 _H	RTC - Timer Control Register Low	WTCRL	WTCR	R/W
0004E9 _H	RTC - Timer Control Register High	WTCRH		R/W
0004EA _H	CAL - Calibration unit Control register	CUCR		R/W
0004EB _H	Reserved			-
0004EC _H	CAL - Duration Timer Data Register Low	CUTDL	CUTD	R/W
0004ED _H	CAL - Duration Timer Data Register High	CUTDH		R/W
0004EE _H	CAL - Calibration Timer Register 2 Low	CUTR2L	CUTR2	R
0004EF _H	CAL - Calibration Timer Register 2 High	CUTR2H		R
0004F0 _H	CAL - Calibration Timer Register 1 Low	CUTR1L	CUTR1	R
0004F1 _H	CAL - Calibration Timer Register 1 High	CUTR1H		R
0004F2 _H - 0004F9 _H	Reserved			-
0004FA _H	RLT - Timer input select (for Cascading)	TMISR		R/W
0004FB _H - 0004FF _H	Reserved			-
000500 _H	FRT2 - Data register of free-running timer		TCDT2	R/W
000501 _H	FRT2 - Data register of free-running timer			R/W

MB96350 Series

Interrupt vector table MB96(F)35x (2 of 3)

Vector number	Offset in vector table	Vector name	Cleared by DMA	Index in ICR to program	Description
33	378 _H	CAN2	No	33	CAN Controller 2 (only MB96F356Y/R and MB96F353R/F355R)
34	374 _H	PPG0	Yes	34	Programmable Pulse Generator 0
35	370 _H	PPG1	Yes	35	Programmable Pulse Generator 1
36	36C _H	PPG2	Yes	36	Programmable Pulse Generator 2
37	368 _H	PPG3	Yes	37	Programmable Pulse Generator 3
38	364 _H	PPG4	Yes	38	Programmable Pulse Generator 4
39	360	PPG5	Yes	39	Programmable Pulse Generator 5
40	35C _H	PPG6	Yes	40	Programmable Pulse Generator 6
41	358 _H	PPG7	Yes	41	Programmable Pulse Generator 7
42	354 _H	PPG8	Yes	42	Programmable Pulse Generator 8
43	350 _H	PPG9	Yes	43	Programmable Pulse Generator 9
44	34C _H	PPG10	Yes	44	Programmable Pulse Generator 10
45	348 _H	PPG11	Yes	45	Programmable Pulse Generator 11
46	344 _H	PPG12	Yes	46	Programmable Pulse Generator 12
47	340 _H	PPG13	Yes	47	Programmable Pulse Generator 13
48	33C _H	PPG14	Yes	48	Programmable Pulse Generator 14
49	338 _H	PPG15	Yes	49	Programmable Pulse Generator 15
50	334 _H	PPG16	Yes	50	Programmable Pulse Generator 16
51	330 _H	PPG17	Yes	51	Programmable Pulse Generator 17
52	32C _H	PPG18	Yes	52	Programmable Pulse Generator 18
53	328 _H	PPG19	Yes	53	Programmable Pulse Generator 19
54	324 _H	RLT0	Yes	54	Reload Timer 0
55	320 _H	RLT1	Yes	55	Reload Timer 1
56	31C _H	RLT2	Yes	56	Reload Timer 2
57	318 _H	RLT3	Yes	57	Reload Timer 3
58	314 _H	PPGRLT	Yes	58	Reload Timer 6 - dedicated for PPG
59	310 _H	ICU0	Yes	59	Input Capture Unit 0
60	30C _H	ICU1	Yes	60	Input Capture Unit 1
61	308 _H				Reserved
62	304 _H				Reserved
63	300 _H	ICU4	Yes	63	Input Capture Unit 4
64	2FC _H	ICU5	Yes	64	Input Capture Unit 5
65	2F8 _H	ICU6	Yes	65	Input Capture Unit 6
66	2F4 _H	ICU7	Yes	66	Input Capture Unit 7

MB96350 Series

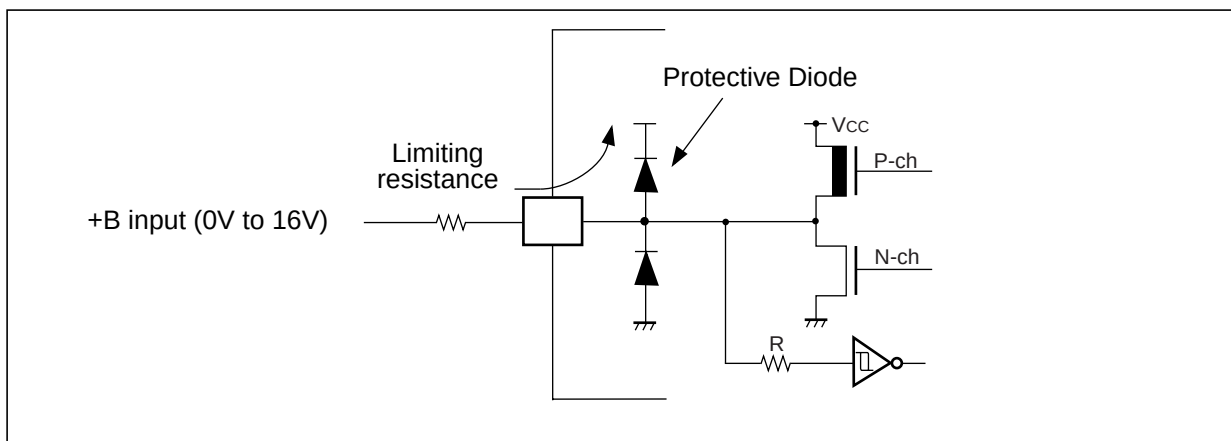
Interrupt vector table MB96(F)35x (3 of 3)

Vector number	Offset in vector table	Vector name	Cleared by DMA	Index in ICR to program	Description
67	2F0 _H				Reserved
68	2EC _H	ICU9	Yes	68	Input Capture Unit 9
69	2E8 _H	ICU10	Yes	69	Input Capture Unit 10
70	2E4 _H				Reserved
71	2E0 _H	OCU4	Yes	71	Output Compare Unit 4
72	2DC _H	OCU5	Yes	72	Output Compare Unit 5
73	2D8 _H	OCU6	Yes	73	Output Compare Unit 6
74	2D4 _H	OCU7	Yes	74	Output Compare Unit 7
75	2D0 _H				Reserved
76	2CC _H				Reserved
77	2C8 _H	FRT0	Yes	77	Free Running Timer 0
78	2C4 _H	FRT1	Yes	78	Free Running Timer 1
79	2C0 _H	FRT2	Yes	79	Free Running Timer 2
80	2BC _H	FRT3	Yes	80	Free Running Timer 3
81	2B8 _H	RTC0	No	81	Real Timer Clock
82	2B4 _H	CAL0	No	82	Clock Calibration Unit
83	2B0 _H	IIC0	Yes	83	I2C interface
84	2AC _H	ADC0	Yes	84	A/D Converter
85	2A8 _H	LINR2	Yes	85	LIN USART 2 RX
86	2A4 _H	LINT2	Yes	86	LIN USART 2 TX
87	2A0 _H	LINR3	Yes	87	LIN USART 3 RX
88	29C _H	LINT3	Yes	88	LIN USART 3 TX
89	298 _H	LINR7	Yes	89	LIN USART 7 RX
90	294 _H	LINT7	Yes	90	LIN USART 7 TX
91	290 _H	LINR8	Yes	91	LIN USART 8 RX
92	28C _H	LINT8	Yes	92	LIN USART 8 TX
93	288 _H	FLASH_A	No	93	Flash memory A (only Flash devices)

MB96350 Series

- *2: V_I and V_O should not exceed $V_{CC} + 0.3$ V. V_I should also not exceed the specified ratings. However if the maximum current to/from a input is limited by some means with external components, the I_{CLAMP} rating supersedes the V_I rating. Input/output voltages of standard ports depend on V_{CC} .
- *3: • Applicable to all general purpose I/O pins (Pnn_m)
 • Use within recommended operating conditions.
 • Use at DC voltage (current)
 • The +B signal should always be applied a limiting resistance placed between the +B signal and the microcontroller.
 • The value of the limiting resistance should be set so that when the +B signal is applied the input current to the microcontroller pin does not exceed rated values, either instantaneously or for prolonged periods.
 • Note that when the microcontroller drive current is low, such as in the power saving modes, the +B input potential may pass through the protective diode and increase the potential at the VCC pin, and this may affect other devices.
 • Note that if a +B signal is input when the microcontroller power supply is off (not fixed at 0 V), the power supply is provided from the pins, so that incomplete operation may result.
 • Note that if the +B input is applied during power-on, the power supply is provided from the pins and the resulting supply voltage may not be sufficient to operate the Power reset (except devices with persistent low voltage reset in internal vector mode).

- Sample recommended circuits:



- *4: The maximum permitted power dissipation depends on the ambient temperature, the air flow velocity and the thermal conductance of the package on the PCB.
 The actual power dissipation depends on the customer application and can be calculated as follows:
 $P_D = P_{IO} + P_{INT}$
 $P_{IO} = \sum (V_{OL} * I_{OL} + V_{OH} * I_{OH})$ (IO load power dissipation, sum is performed on all IO ports)
 $P_{INT} = V_{CC} * (I_{CC} + I_A)$ (internal power dissipation)
 I_{CC} is the total core current consumption into V_{CC} as described in the "DC characteristics" and depends on the selected operation mode and clock frequency and the usage of functions like Flash programming or the clock modulator.
 I_A is the analog current consumption into AV_{CC} .
- *5: Worst case value for a package mounted on single layer PCB at specified T_A without air flow.
- *6: Please contact Fujitsu for reliability limitations when using under these conditions.

WARNING: Semiconductor devices can be permanently damaged by application of stress (voltage, current, temperature, etc.) in excess of absolute maximum ratings. Do not exceed these ratings.

MB96350 Series

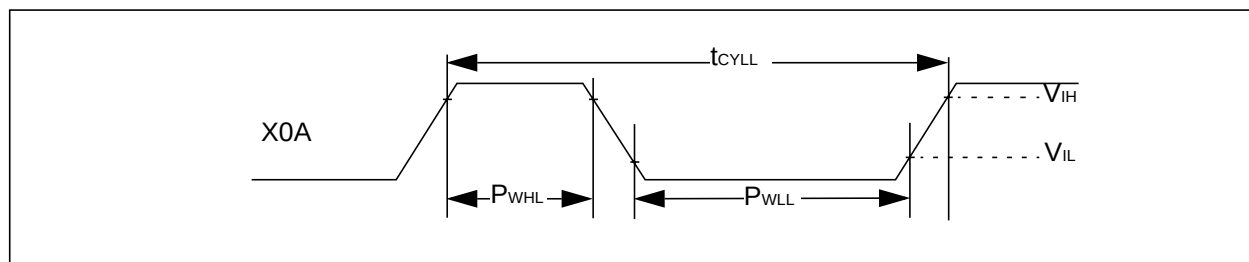
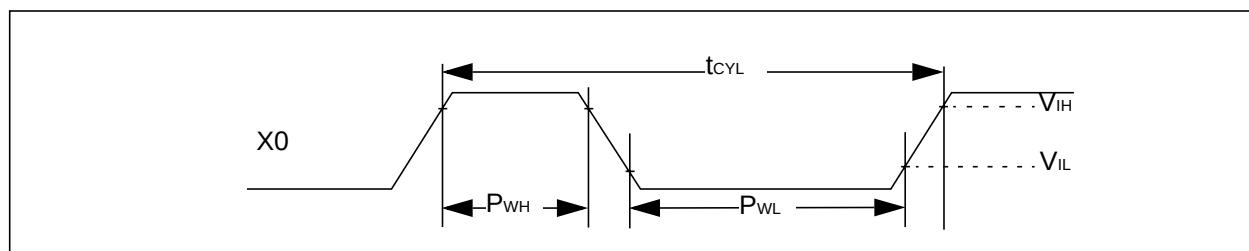
(T_A = -40°C to 125°C, V_{CC} = AV_{CC} = 3.0V to 5.5V, V_{SS} = AV_{SS} = 0V)

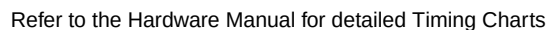
Parameter	Symbol	Condition (at T _A)		Value			Remarks
				Typ	Max	Unit	
Power supply current in Sleep modes*	I _{CCSRCL}	RC Sleep mode with CLKS1/2 = CLKP1/2 = 100kHz, SMCR:LPMSS = 0	+25°C	0.08	0.2	mA	MB96F353/F355
			+125°C	0.59	2.95		
		(CLKMC, CLKPLL and CLKSC stopped. Voltage regulator in high power mode)	+25°C	0.3	0.5	mA	MB96F356
			+125°C	0.8	3.3		
		RC Sleep mode with CLKS1/2 = CLKP1/2 = 100kHz, SMCR:LPMSS = 1	+25°C	0.05	0.15	mA	MB96F353/F355/ F356
			+125°C	0.56	2.9		
	(CLKMC, CLKPLL and CLKSC stopped. Voltage regulator in low power mode)						
		I _{CCSSUB}	Sub Sleep mode with CLKS1/2 = CLKP1/2 = 32kHz	+25°C	0.04	0.12	mA
(CLKMC, CLKPLL and CLKRC stopped)	+125°C		0.54	2.9			
Power supply current in Timer modes*	I _{CCTPLL}	PLL Timer mode with CLKMC = 4MHz, CLKPLL = 48MHz	+25°C	1.3	1.8	mA	MB96F353/F355
			+125°C	1.9	4.8		
		(CLKRC and CLKSC stopped)	+25°C	1.5	2	mA	MB96F356
			+125°C	2.1	5		
	I _{CCTMAIN}	Main Timer mode with CLKMC = 4MHz, SMCR:LPMSS = 0	+25°C	0.11	0.2	mA	MB96F353/F355
			+125°C	0.63	3		
		(CLKPLL, CLKRC and CLKSC stopped. Voltage regulator in high power mode)	+25°C	0.35	0.5	mA	MB96F356
			+125°C	0.85	3.3		
		Main Timer mode with CLKMC = 4MHz, SMCR:LPMSS = 1	+25°C	0.08	0.15	mA	MB96F353/F355/ F356
			+125°C	0.6	2.9		
(CLKPLL, CLKRC and CLKSC stopped. Voltage regulator in low power mode)							

MB96350 Series

(T_A = -40°C to 125°C, V_{CC} = AV_{CC} = 3.0V to 5.5V, V_{SS} = AV_{SS} = 0V)

Parameter	Symbol	Condition (at T _A)		Value			Remarks
				Typ	Max	Unit	
Power supply current in Timer modes*	I _{CCTRCH}	RC Timer mode with CLKRC = 2MHz, SMCR:LPMSS = 0	+25°C	0.1	0.2	mA	MB96F353/F355
			+125°C	0.63	3		
		(CLKMC, CLKPLL and CLKSC stopped. Voltage regulator in high power mode)	+25°C	0.35	0.5	mA	MB96F356
			+125°C	0.85	3.3		
		RC Timer mode with CLKRC = 2MHz, SMCR:LPMSS = 1	+25°C	0.07	0.15	mA	MB96F353/F355/F356
			+125°C	0.6	2.9		
	I _{CCTRCL}	RC Timer mode with CLKRC = 100kHz, SMCR:LPMSS = 0	+25°C	0.06	0.15	mA	MB96F353/F355
			+125°C	0.56	2.95		
		(CLKMC, CLKPLL and CLKSC stopped. Voltage regulator in high power mode)	+25°C	0.3	0.45	mA	MB96F356
			+125°C	0.8	3.2		
		RC Timer mode with CLKRC = 100kHz, SMCR:LPMSS = 1	+25°C	0.03	0.1	mA	MB96F353/F355/F356
			+125°C	0.53	2.85		
	I _{CCTSUB}	Sub Timer mode with CLKSC = 32kHz (CLKMC, CLKPLL and CLKRC stopped)	+25°C	0.035	0.1	mA	MB96F353/F355/F356
			+125°C	0.53	2.85		
Power supply current in Stop Mode	I _{CCH}	VR _{CR} :LPMB[2:0] = 110 _B (Core voltage at 1.8V)	+25°C	0.02	0.08	mA	MB96F353/F355/F356
			+125°C	0.52	2.8		
		VR _{CR} :LPMB[2:0] = 000 _B (Core voltage at 1.2V)	+25°C	0.015	0.06	mA	MB96F353/F355/F356
			+125°C	0.4	2.3		
Power supply current for active Low Voltage detector	I _{CCLVD}	Low voltage detector enabled (RCR:LVDE = 1)	+25°C	5	10	μA	MB96F353/F355
			+125°C	7	20	μA	Must be added to all current above
			+25°C	90	140	μA	MB96F356
			+125°C	100	150		Must be added to all current above





Bus Timing (Write)

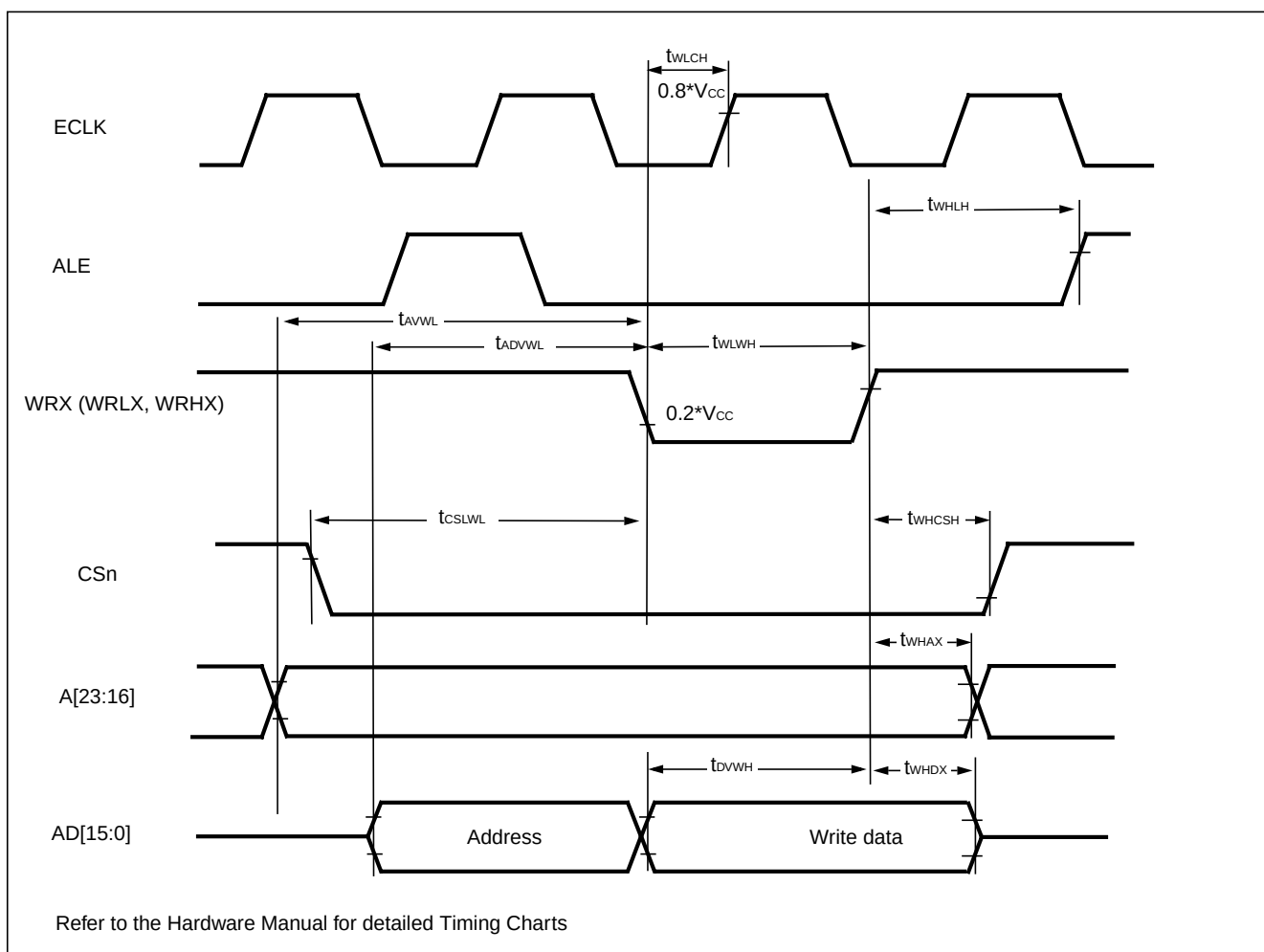
($T_A = -40\text{ }^{\circ}\text{C}$ to $+125\text{ }^{\circ}\text{C}$, $V_{CC} = 5.0\text{ V} \pm 10\%$, $V_{SS} = 0.0\text{ V}$, $I_{Odrive} = 5\text{mA}$, $C_L = 50\text{pF}$)

Parameter	Symbol	Pin	Condition	Value		Unit	Remarks
				Min	Max		
Valid address ⇒ WRX ↓ time	t _{AVWL}	WRX, WRLX, WRHX, A[23:16]	EACL:ACE=0	3t _{cyc} /2 – 15	—	ns	
			EACL:ACE=1	5t _{cyc} /2 – 15	—		
	t _{ADVWL}	WRX, WRLX, WRHX, AD[15:0]	EACL:ACE=0	t _{cyc} – 15	—	ns	
			EACL:ACE=1	2t _{cyc} – 15	—		
WRX pulse width	t _{WLWH}	WRX, WRLX, WRHX	—	t _{cyc} – 5	—	ns	w/o cycle extension
Valid data output ⇒ WRX ↑ time	t _{DVWH}	WRX, WRLX, WRHX, AD[15:0]	—	t _{cyc} – 20	—	ns	w/o cycle extension

MB96350 Series

($T_A = -40\text{ }^{\circ}\text{C}$ to $+125\text{ }^{\circ}\text{C}$, $V_{CC} = 3.0$ to 4.5V , $V_{SS} = 0.0\text{V}$, $I_{Odrive} = 5\text{mA}$, $C_L = 50\text{pF}$)

Parameter	Symbol	Pin	Condition	Value		Unit	Remarks
				Min	Max		
WRX $\uparrow \Rightarrow$ ALE $\uparrow$ time	t_{WHLH}	WRX, WRLX, WRHX, ALE	EBM:ACE=1 and EACL:STS=1	$2t_{CYC} - 15$	—	ns	
			other EBM:ACE and EACL:STS setting	$t_{CYC} - 15$	—		
WRX $\downarrow \Rightarrow$ ECLK $\uparrow$ time	t_{WLCH}	WRX, WRLX, WRHX, ECLK	—	$t_{CYC}/2 - 15$	—	ns	
CSn $\Rightarrow$ WRX time	t_{CSLWL}	WRX, WRLX, WRHX, CSn	EACL:ACE=0	—	$3t_{CYC}/2 - 20$	ns	
			EACL:ACE=1	—	$5t_{CYC}/2 - 20$		
WRX $\Rightarrow$ CSn time	t_{WHCSH}	WRX, WRLX, WRHX, CSn	—	$t_{CYC}/2 - 20$	—	ns	



Definition of A/D Converter Terms

Resolution: Analog variation that is recognized by an A/D converter.

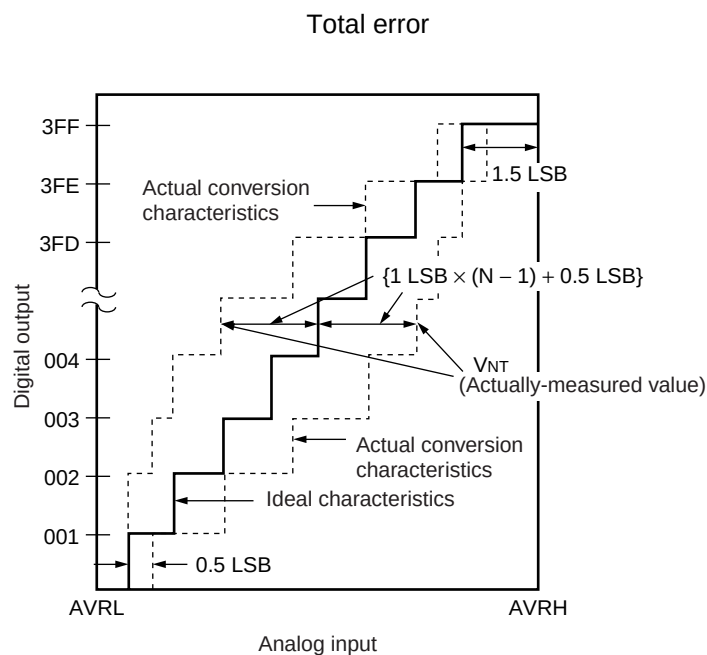
Total error: Difference between the actual value and the ideal value. The total error includes zero transition error, full-scale transition error and nonlinearity error.

Nonlinearity error: Deviation between a line across zero-transition line ("00 0000 0000" <--> "00 0000 0001") and full-scale transition line ("11 1111 1110" <--> "11 1111 1111") and actual conversion characteristics.

Differential nonlinearity error: Deviation of input voltage, which is required for changing output code by 1 LSB, from an ideal value.

Zero reading voltage: Input voltage which results in the minimum conversion value.

Full scale reading voltage: Input voltage which results in the maximum conversion value.



$$\text{Total error of digital output "N"} = \frac{V_{NT} - \{1 \text{ LSB} \times (N - 1) + 0.5 \text{ LSB}\}}{1 \text{ LSB}} \quad [\text{LSB}]$$

$$1 \text{ LSB} = (\text{Ideal value}) \frac{AVRH - AVRL}{1024} \quad [\text{V}]$$

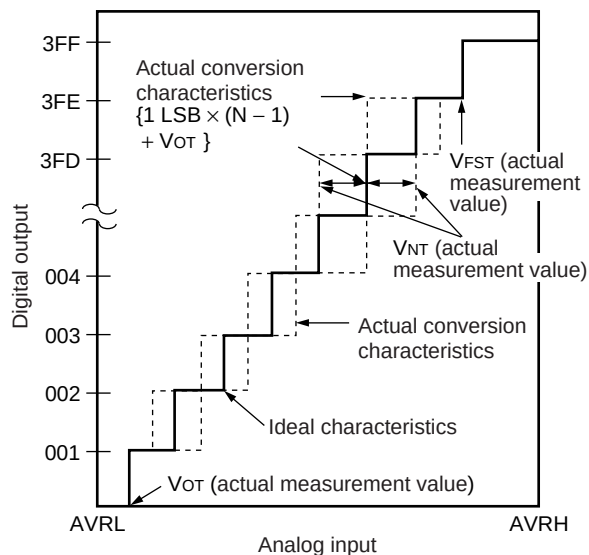
N: A/D converter digital output value

$$V_{OT} (\text{Ideal value}) = AVRL + 0.5 \text{ LSB} \quad [\text{V}]$$

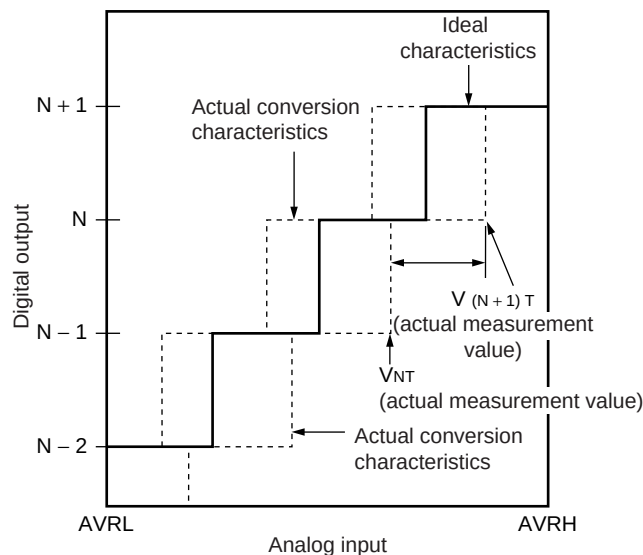
$$V_{FST} (\text{Ideal value}) = AVRH - 1.5 \text{ LSB} \quad [\text{V}]$$

V_{NT} : A voltage at which digital output transitions from (N - 1) to N.

Nonlinearity error



Differential nonlinearity error



$$\text{Nonlinearity error of digital output } N = \frac{V_{NT} - \{1 \text{ LSB} \times (N - 1) + V_{OT}\}}{1 \text{ LSB}} \text{ [LSB]}$$

$$\text{Differential nonlinearity error of digital output } N = \frac{V_{(N+1)T} - V_{NT}}{1 \text{ LSB}} - 1 \text{ LSB [LSB]}$$

$$1 \text{ LSB} = \frac{V_{FST} - V_{OT}}{1022} \text{ [V]}$$

N : A/D converter digital output value

V_{OT} : Voltage at which digital output transits from "000_H" to "001_H."

V_{FST} : Voltage at which digital output transits from "3FE_H" to "3FF_H."

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