Infineon Technologies - MB96F348TSBPMC-GE2 Datasheet

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Applications of "Embedded - Microcontrollers"

Details	
Product Status	Active
Core Processor	F²MC-16FX
Core Size	16-Bit
Speed	56MHz
Connectivity	CANbus, EBI/EMI, I²C, LINbus, SCI, UART/USART
Peripherals	DMA, LVD, LVR, POR, PWM, WDT
Number of I/O	82
Program Memory Size	576KB (576K x 8)
Program Memory Type	FLASH
EEPROM Size	-
RAM Size	24K x 8
Voltage - Supply (Vcc/Vdd)	3V ~ 5.5V
Data Converters	A/D 24x10b
Oscillator Type	Internal
Operating Temperature	-40°C ~ 105°C (TA)
Mounting Type	Surface Mount
Package / Case	100-LQFP
Supplier Device Package	100-LQFP (14x14)
Purchase URL	https://www.e-xfl.com/product-detail/infineon-technologies/mb96f348tsbpmc-ge2

Features

Feature	Description
Technology	■ 0.18μm CMOS
CPU	■ F^{2}MC-16FX CPU ■ Up to 56 MHz internal, 17.8 ns instruction cycle time ■ Optimized instruction set for controller applications (bit, byte, word and long-word data types; 23 different addressing modes; barrel shift; variety of pointers) ■ 8-byte instruction execution queue ■ Signed multiply (16-bit × 16-bit) and divide (32-bit/16-bit) instructions available
System clock	■ On-chip PLL clock multiplier (x1 - x25, x1 when PLL stop) ■ 3 MHz - 16 MHz external crystal oscillator clock (maximum frequency when using ceramic resonator depends on Q-factor). ■ Up to 56 MHz external clock for devices with fast clock input feature ■ 32-100 kHz subsystem quartz clock ■ 100kHz/2MHz internal RC clock for quick and safe startup, oscillator stop detection, watchdog ■ Clock source selectable from main- and subclock oscillator (part number suffix “W”) and on-chip RC oscillator, independently for CPU and 2 clock domains of peripherals. ■ Low Power Consumption - 13 operating modes : (different Run, Sleep, Timer modes, Stop mode) ■ Clock modulator
On-chip voltage regulator	■ Internal voltage regulator supports reduced internal MCU voltage, offering low EMI and low power consumption figures
Low voltage reset	■ Reset is generated when supply voltage is below minimum.
Code Security	■ Protects ROM content from unintended read-out
Memory Patch Function	■ Replaces ROM content ■ Can also be used to implement embedded debug support
DMA	■ Automatic transfer function independent of CPU, can be assigned freely to resources
Interrupts	■ Fast Interrupt processing ■ 8 programmable priority levels ■ Non-Maskable Interrupt (NMI)
Timers	■ Three independent clock timers (23-bit RC clock timer, 23-bit Main clock timer, 17-bit Sub clock timer) ■ Watchdog Timer
CAN	■ Supports CAN protocol version 2.0 part A and B ■ ISO16845 certified ■ Bit rates up to 1 Mbit/s ■ 32 message objects ■ Each message object has its own identifier mask ■ Programmable FIFO mode (concatenation of message objects) ■ Maskable interrupt ■ Disabled Automatic Retransmission mode for Time Triggered CAN applications ■ Programmable loop-back mode for self-test operation
USART	■ Full duplex USARTs (SCI/LIN) ■ Wide range of baud rate settings using a dedicated reload timer ■ Special synchronous options for adapting to different synchronous serial protocols ■ LIN functionality working either as master or slave LIN device

Contents

Table 1: Pin Function description

Pin name	Feature	Description
RDY	External bus	External bus interface external wait state request input
RSTX	Core	Reset input
RXn	CAN	CAN interface n RX input
SCKn	USART	USART n serial clock input/output
SCKn_R	USART	Relocated USART n serial clock input/output
SCLn	I2C	I^2C interface n clock I/O input/output
SDAn	I2C	I^2C interface n serial data I/O input/output
SINn	USART	USART n serial data input
SINn_R	USART	Relocated USART n serial data input
SOTn	USART	USART n serial data output
SOTn_R	USART	Relocated USART n serial data output
TINn	Reload Timer	Reload Timer n event input
TOTn	Reload Timer	Reload Timer n output
TTGn	PPG	Programmable Pulse Generator n trigger input
TXn	CAN	CAN interface n TX output
UBX	External bus	External Bus Interface Upper Byte select strobe output
V_{CC}	Supply	Power supply
V_{SS}	Supply	Power supply
WOT	RTC	Real Timer clock output
WRHX	External bus	External bus High byte write strobe output
WRLX/WRX	External bus	External bus Low byte / Word write strobe output
X0	Clock	Oscillator input
X0A	Clock	Subclock Oscillator input (only for devices with suffix "W")
X1	Clock	Oscillator output
X1A	Clock	Subclock Oscillator output (only for devices with suffix "W")

10. Serial Programming Communication Interface

Table 3: USART pins for Flash serial programming (MD[2:0] = 010, Serial Communication mode)

MB96F34x			
Pin number	Pin number	USART Number	Normal function
LQFP-100	QFP-100		
57	59	USART0	SIN0
58	60		SOT0
59	61		SCK0
60	62	USART1	SIN1
61	63		SOT1
62	64		SCK1
22	24	USART2	SIN2
23	25		SOT2
24	26		SCK2
85	87	USART3	SIN3
86	88		SOT3
87	89		SCK3

Note: If a Flash programmer and its software needs to use a handshaking pin, Cypress suggests to the tool vendor to support at least port P00_1 on pin 76/78.If handshaking is used by the tool but P00_1 is not available in customer's application, Cypress suggests to the customer to check the tool manual or to contact the tool vendor for alternative handshaking pins.

Table 4: I/O map MB96(F)34x

Address	Register	Abbreviation 8-bit access	Abbreviation 16-bit access	Access
$0000A1_H$	PPG4 - Duty cycle register			W
$0000A2_H$	PPG4 - Control status register Low	PCNL4	PCN4	R/W
$0000A3_H$	PPG4 - Control status register High	PCNH4		R/W
$0000A4_H$	PPG5 - Timer register		PTMR5	R
$0000A5_H$	PPG5 - Timer register			R
$0000A6_H$	PPG5 - Period setting register		PCSR5	W
$0000A7_H$	PPG5 - Period setting register			W
$0000A8_H$	PPG5 - Duty cycle register		PDUT5	W
$0000A9_H$	PPG5 - Duty cycle register			W
$0000AA_H$	PPG5 - Control status register Low	PCNL5	PCN5	R/W
$0000AB_H$	PPG5 - Control status register High	PCNH5		R/W
$0000AC_H$	I2C0 - Bus Status Register	IBSR0		R
$0000AD_H$	I2C0 - Bus Control Register	IBCR0		R/W
$0000AE_H$	I2C0 - Ten bit Slave address Register Low	ITBAL0	ITBA0	R/W
$0000AF_H$	I2C0 - Ten bit Slave address Register High	ITBAH0		R/W
$0000B0_H$	I2C0 - Ten bit Address mask Register Low	ITMKL0	ITMK0	R/W
$0000B1_H$	I2C0 - Ten bit Address mask Register High	ITMKH0		R/W
$0000B2_H$	I2C0 - Seven bit Slave address Register	ISBA0		R/W
$0000B3_H$	I2C0 - Seven bit Address mask Register	ISMK0		R/W
$0000B4_H$	I2C0 - Data Register	IDAR0		R/W
$0000B5_H$	I2C0 - Clock Control Register	ICCR0		R/W
$0000B6_H$	I2C1 - Bus Status Register	IBSR1		R
$0000B7_H$	I2C1 - Bus Control Register	IBCR1		R/W
$0000B8_H$	I2C1 - Ten bit Slave address Register Low	ITBAL1	ITBA1	R/W
$0000B9_H$	I2C1 - Ten bit Slave address Register High	ITBAH1		R/W
$0000BA_H$	I2C1 - Ten bit Address mask Register Low	ITMKL1	ITMK1	R/W
$0000BB_H$	I2C1 - Ten bit Address mask Register High	ITMKH1		R/W
$0000BC_H$	I2C1 - Seven bit Slave address Register	ISBA1		R/W
$0000BD_H$	I2C1 - Seven bit Address mask Register	ISMK1		R/W
$0000BE_H$	I2C1 - Data Register	IDAR1		R/W
$0000BF_H$	I2C1 - Clock Control Register	ICCR1		R/W
$0000C0_H$	USART0 - Serial Mode Register	SMR0		R/W

Table 4: I/O map MB96(F)34x

Address	Register	Abbreviation 8-bit access	Abbreviation 16-bit access	Access
000114_H	DMA2 - I/O register address pointer low byte	IOAL2	IOA2	R/W
000115_H	DMA2 - I/O register address pointer high byte	IOAH2		R/W
000116_H	DMA2 - Data counter low byte	DCTL2	DCT2	R/W
000117_H	DMA2 - Data counter high byte	DCTH2		R/W
000118_H	DMA3 - Buffer address pointer low byte	BAPL3		R/W
000119_H	DMA3 - Buffer address pointer middle byte	BAPM3		R/W
$00011A_H$	DMA3 - Buffer address pointer high byte	BAPH3		R/W
$00011B_H$	DMA3 - DMA control register	DMACS3		R/W
$00011C_H$	DMA3 - I/O register address pointer low byte	IOAL3	IOA3	R/W
$00011D_H$	DMA3 - I/O register address pointer high byte	IOAH3		R/W
$00011E_H$	DMA3 - Data counter low byte	DCTL3	DCT3	R/W
$00011F_H$	DMA3 - Data counter high byte	DCTH3		R/W
000120_H	DMA4 - Buffer address pointer low byte	BAPL4		R/W
000121_H	DMA4 - Buffer address pointer middle byte	BAPM4		R/W
000122_H	DMA4 - Buffer address pointer high byte	BAPH4		R/W
000123_H	DMA4 - DMA control register	DMACS4		R/W
000124_H	DMA4 - I/O register address pointer low byte	IOAL4	IOA4	R/W
000125_H	DMA4 - I/O register address pointer high byte	IOAH4		R/W
000126_H	DMA4 - Data counter low byte	DCTL4	DCT4	R/W
000127_H	DMA4 - Data counter high byte	DCTH4		R/W
000128_H	DMA5 - Buffer address pointer low byte	BAPL5		R/W
000129_H	DMA5 - Buffer address pointer middle byte	BAPM5		R/W
$00012A_H$	DMA5 - Buffer address pointer high byte	BAPH5		R/W
$00012B_H$	DMA5 - DMA control register	DMACS5		R/W
$00012C_H$	DMA5 - I/O register address pointer low byte	IOAL5	IOA5	R/W
$00012D_H$	DMA5 - I/O register address pointer high byte	IOAH5		R/W
$00012E_H$	DMA5 - Data counter low byte	DCTL5	DCT5	R/W
$00012F_H$	DMA5 - Data counter high byte	DCTH5		R/W
000130_H-$00017F_H$	Reserved			-
000180_H-$00037F_H$	CPU - General Purpose registers (RAM access)	GPR_RAM		R/W
000380_H	DMA0 - Interrupt select	DISEL0		R/W
000381_H	DMA1 - Interrupt select	DISEL1		R/W

Table 4: I/O map MB96(F)34x

Address	Register	Abbreviation 8-bit access	Abbreviation 16-bit access	Access
$0004E3_H$	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
$0004FB_H$-$00053D_H$	Reserved			-
$00053E_H$	USART7 - Serial Mode Register	SMR7		R/W
$00053F_H$	USART7 - Serial Control Register	SCR7		R/W
000540_H	USART7 - Serial TX Register	TDR7		W
000540_H	USART7 - Serial RX Register	RDR7		R
000541_H	USART7 - Serial Status Register	SSR7		R/W
000542_H	USART7 - Ext. Control/Com. Register	ECCR7		R/W
000543_H	USART7 - Ext. Status Com. Register	ESCR7		R/W
000544_H	USART7 - Baud Rate Generator Register Low	BGRL7	BGR7	R/W
000545_H	USART7 - Baud Rate Generator Register High	BGRH7		R/W
000546_H	USART7 - Extended Serial Interrupt Register	ESIR7		R/W
000547_H	Reserved			-
000548_H	USART8 - Serial Mode Register	SMR8		R/W
000549_H	USART8 - Serial Control Register	SCR8		R/W
$00054A_H$	USART8 - Serial TX Register	TDR8		W

Table 4: I/O map MB96(F)34x

Address	Register	Abbreviation 8-bit access	Abbreviation 16-bit access	Access
$0006EB_H$	External Bus - Area configuration register 5 High	EACH5		R/W
$0006EC_H$	External Bus - Area select register 2	EAS2		R/W
$0006ED_H$	External Bus - Area select register 3	EAS3		R/W
$0006EE_H$	External Bus - Area select register 4	EAS4		R/W
$0006EF_H$	External Bus - Area select register 5	EAS5		R/W
$0006F0_H$	External Bus - Mode register	EBM		R/W
$0006F1_H$	External Bus - Clock and Function register	EBCF		R/W
$0006F2_H$	External Bus - Address output enable register 0	EBAE0		R/W
$0006F3_H$	External Bus - Address output enable register 1	EBAE1		R/W
$0006F4_H$	External Bus - Address output enable register 2	EBAE2		R/W
$0006F5_H$	External Bus - Control signal register	EBCS		R/W
$0006F6_H$-$0006FF_H$	Reserved			-
000700_H	CAN0 - Control register Low	CTRLRL0	CTRLR0	R/W
000701_H	CAN0 - Control register High (reserved)	CTRLRH0		R
000702_H	CAN0 - Status register Low	STATRL0	STATR0	R/W
000703_H	CAN0 - Status register High (reserved)	STATRH0		R
000704_H	CAN0 - Error Counter Low (Transmit)	ERRCNTL0	ERRCNT0	R
000705_H	CAN0 - Error Counter High (Receive)	ERRCNTH0		R
000706_H	CAN0 - Bit Timing Register Low	BTRL0	BTR0	R/W
000707_H	CAN0 - Bit Timing Register High	BTRH0		R/W
000708_H	CAN0 - Interrupt Register Low	INTRL0	INTR0	R
000709_H	CAN0 - Interrupt Register High	INTRH0		R
$00070A_H$	CAN0 - Test Register Low	TESTRL0	TESTR0	R/W
$00070B_H$	CAN0 - Test Register High (reserved)	TESTRH0		R
$00070C_H$	CAN0 - BRP Extension register Low	BRPERL0	BRPER0	R/W
$00070D_H$	CAN0 - BRP Extension register High (reserved)	BRPERH0		R
$00070E_H$-$00070F_H$	Reserved			-
000710_H	CAN0 - IF1 Command request register Low	IF1CREQL0	IF1CREQ0	R/W
000711_H	CAN0 - IF1 Command request register High	IF1CREQH0		R/W
000712_H	CAN0 - IF1 Command Mask register Low	IF1CMSKL0	IF1CMSK0	R/W
000713_H	CAN0 - IF1 Command Mask register High (reserved)	IF1CMSKH0		R
000714_H	CAN0 - IF1 Mask 1 Register Low	IF1MSK1L0	IF1MSK10	R/W

Table 4: I/O map MB96(F)34x

Address	Register	Abbreviation 8-bit access	Abbreviation 16-bit access	Access
000822_H	CAN1 - IF1 Data B1 Low	IF1DTB1L1	IF1DTB11	R/W
000823_H	CAN1 - IF1 Data B1 High	IF1DTB1H1		R/W
000824_H	CAN1 - IF1 Data B2 Low	IF1DTB2L1	IF1DTB21	R/W
000825_H	CAN1 - IF1 Data B2 High	IF1DTB2H1		R/W
000826_H-$00083F_H$	Reserved			-
000840_H	CAN1 - IF2 Command request register Low	IF2CREQL1	IF2CREQ1	R/W
000841_H	CAN1 - IF2 Command request register High	IF2CREQH1		R/W
000842_H	CAN1 - IF2 Command Mask register Low	IF2CMSKL1	IF2CMSK1	R/W
000843_H	CAN1 - IF2 Command Mask register High (reserved)	IF2CMSKH1		R
000844_H	CAN1 - IF2 Mask 1 Register Low	IF2MSK1L1	IF2MSK11	R/W
000845_H	CAN1 - IF2 Mask 1 Register High	IF2MSK1H1		R/W
000846_H	CAN1 - IF2 Mask 2 Register Low	IF2MSK2L1	IF2MSK21	R/W
000847_H	CAN1 - IF2 Mask 2 Register High	IF2MSK2H1		R/W
000848_H	CAN1 - IF2 Arbitration 1 Register Low	IF2ARB1L1	IF2ARB11	R/W
000849_H	CAN1 - IF2 Arbitration 1 Register High	IF2ARB1H1		R/W
$00084A_H$	CAN1 - IF2 Arbitration 2 Register Low	IF2ARB2L1	IF2ARB21	R/W
$00084B_H$	CAN1 - IF2 Arbitration 2 Register High	IF2ARB2H1		R/W
$00084C_H$	CAN1 - IF2 Message Control Register Low	IF2MCTRL1	IF2MCTR1	R/W
$00084D_H$	CAN1 - IF2 Message Control Register High	IF2MCTRH1		R/W
$00084E_H$	CAN1 - IF2 Data A1 Low	IF2DTA1L1	IF2DTA11	R/W
$00084F_H$	CAN1 - IF2 Data A1 High	IF2DTA1H1		R/W
000850_H	CAN1 - IF2 Data A2 Low	IF2DTA2L1	IF2DTA21	R/W
000851_H	CAN1 - IF2 Data A2 High	IF2DTA2H1		R/W
000852_H	CAN1 - IF2 Data B1 Low	IF2DTB1L1	IF2DTB11	R/W
000853_H	CAN1 - IF2 Data B1 High	IF2DTB1H1		R/W
000854_H	CAN1 - IF2 Data B2 Low	IF2DTB2L1	IF2DTB21	R/W
000855_H	CAN1 - IF2 Data B2 High	IF2DTB2H1		R/W
000856_H-$00087F_H$	Reserved			-
000880_H	CAN1 - Transmission Request 1 Register Low	TREQR1L1	TREQR11	R
000881_H	CAN1 - Transmission Request 1 Register High	TREQR1H1		R
000882_H	CAN1 - Transmission Request 2 Register Low	TREQR2L1	TREQR21	R
000883_H	CAN1 - Transmission Request 2 Register High	TREQR2H1		R

13.7 Crystal oscillator and ceramic resonator circuit

Noise at X0, X1 pins or X0A, X1A pins might cause abnormal operation. It is required to provide bypass capacitors with shortest possible distance to X0, X1 pins and X0A, X1A pins, crystal oscillator (or ceramic resonator) and ground lines, and, to the utmost effort, that the lines of oscillation circuit do not cross the lines of other circuits.

It is highly recommended to provide a printed circuit board art work surrounding X0, X1 pins and X0A, X1A pins with a ground area for stabilizing the operation.

It is highly recommended to evaluate the quartz/MCU or resonator/MCU system at the quartz or resonator manufacturer, especially when using low-Q resonators at higher frequencies.

13.8 Turn on sequence of power supply to A/D converter and analog inputs

It is required to turn the A/D converter power supply (AV_{CC}, AVRH, AVRL) and analog inputs (ANn) on after turning the digital power supply (V_{CC}) on.

It is also required to turn the digital power off after turning the A/D converter supply and analog inputs off. In this case, the voltage must not exceed AVRH or AV_{CC} (turning the analog and digital power supplies simultaneously on or off is acceptable).

13.9 Pin handling when not using the A/D converter

It is required to connect the unused pins of the A/D converter as $AV_{CC} = V_{CC}$, AV_{SS} = AVRH = AVRL = V_{SS}.

13.10 Notes on Power-on

To prevent malfunction of the internal voltage regulator, supply voltage profile while turning the power supply on should be slower than 50µs from 0.2 V to 2.7 V.

13.11 Stabilization of power supply voltage

If the power supply voltage varies acutely even within the operation safety range of the Vcc power supply voltage, a malfunction may occur. The Vcc power supply voltage must therefore be stabilized. As stabilization guidelines, the power supply voltage must be stabilized in such a way that Vcc ripple fluctuations (peak to peak value) in the commercial frequencies (50 to 60 Hz) fall within 10% of the standard Vcc power supply voltage and the transient fluctuation rate becomes 0.1V/µs or less in instantaneous fluctuation for power supply switching.

13.12 Serial communication

There is a possibility to receive wrong data due to noise or other causes on the serial communication.Therefore, design a printed circuit board so as to avoid noise.Consider receiving of wrong data when designing the system. For example apply a checksum and retransmit the data if an error occurs.

13.13 Handling of Data Flash

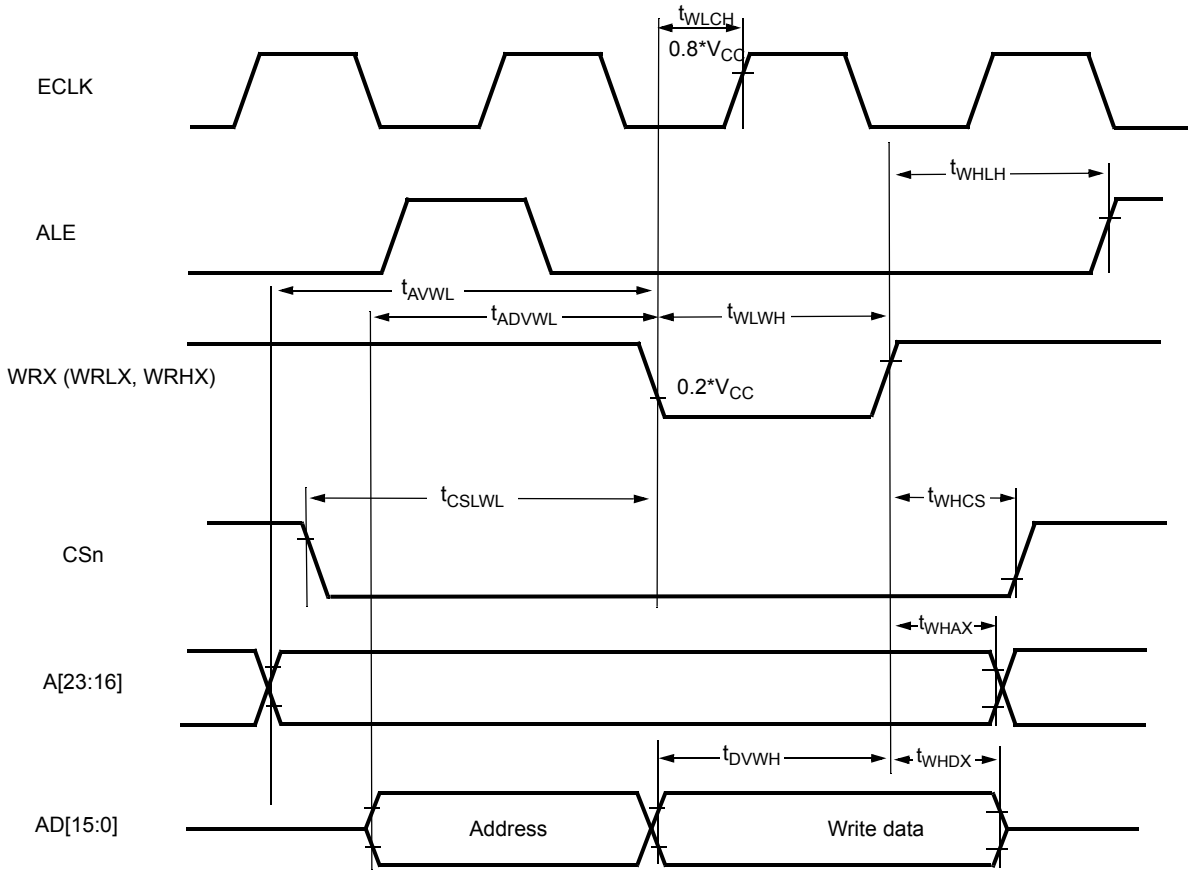
The Data Flash requires different and additional control signals for parallel programming. Please check with your programming equipment maker for support of this interface.

(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[1]	I_{CCSRCH}	RC Sleep mode with CLKS1/2 = CLKP1/2 = 2MHz (CLKMC, CLKPLL and CLKSC stopped)	+25°C	0.9	1.4	mA	Flash devices
			+125°C	1.5	4.1		
			+25°C	0.9	1.4	mA	MB96345/346
			+125°C	1.5	3.1		
	I_{CCSRCL}	RC Sleep mode with CLKS1/2 = CLKP1/2 = 100kHz, SMCR:LPMSS = 0 (CLKMC, CLKPLL and CLKSC stopped. Voltage regulator in high power mode)	+25°C	0.3	0.5	mA	MB96F346/F347/F348
			+125°C	0.8	3.4		
			+25°C	0.09	0.2	mA	MB96F345
			+125°C	0.59	3.1		
			+25°C	0.3	0.5	mA	MB96345/346
			+125°C	0.8	2.3		
		RC Sleep mode with CLKS1/2 = CLKP1/2 = 100kHz, SMCR:LPMSS = 1 (CLKMC, CLKPLL and CLKSC stopped. Voltage regulator in low power mode)	+25°C	0.06	0.15	mA	Flash devices
			+125°C	0.56	3		
			+25°C	0.06	0.15	mA	MB96345/346
			+125°C	0.56	1.9		
	I_{CCSSUB}	Sub Sleep mode with CLKS1/2 = CLKP1/2 = 32kHz (CLKMC, CLKPLL and CLKRC stopped)	+25°C	0.04	0.12	mA	Flash devices
			+125°C	0.54	2.9		
			+25°C	0.04	0.12	mA	MB96345/346
			+125°C	0.54	1.85		

(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[1]	I_{CCTRCL}	RC Timer mode with CLKRC = 100kHz, SMCR:LPMSS = 0 (CLKMC, CLKPLL and CLKSC stopped. Voltage regulator in high power mode)	+25°C	0.3	0.45	mA	MB96F346/F347/F348
			+125°C	0.8	3.2		
			+25°C	0.08	0.15	mA	MB96F345
			+125°C	0.58	2.95		
			+25°C	0.3	0.45	mA	MB96345/346
			+125°C	0.8	2.2		
		RC Timer mode with CLKRC = 100kHz, SMCR:LPMSS = 1 (CLKMC, CLKPLL and CLKSC stopped. Voltage regulator in low power mode)	+25°C	0.05	0.1	mA	Flash devices
			+125°C	0.55	2.85		
			+25°C	0.05	0.1	mA	MB96345/346
			+125°C	0.55	1.85		
	I_{CCTSUB}	Sub Timer mode with CLKSC = 32kHz (CLKMC, CLKPLL and CLKRC stopped)	+25°C	0.03	0.1	mA	Flash devices
			+125°C	0.53	2.85		
			+25°C	0.03	0.1	mA	MB96345/346
			+125°C	0.53	1.85		
Power supply current in Stop Mode	I_{CCH}	VRCR:LPMB[2:0] = 110_B (Core voltage at 1.8V)	+25°C	0.02	0.08	mA	Flash devices
			+125°C	0.52	2.8		
			+25°C	0.02	0.08	mA	MB96345/346
			+125°C	0.52	1.8		
		VRCR:LPMB[2:0] = 000_B (Core voltage at 1.2V)	+25°C	0.015	0.06	mA	Flash devices
			+125°C	0.4	2.3		
			+25°C	0.015	0.06	mA	MB96345/346
			+125°C	0.4	1.4		
Power supply current for active Low Voltage detector	I_{CCLVD}	Low voltage detector enabled (RCR:LVDE = 1)	-	5	10	µA	MB96F345 Must be added to all current above
			+25°C	90	140	µA	Other devices Must be added to all current above
			+125°C	100	150		



Refer to the Hardware Manual for detailed Timing Charts

14.4.10 Ready Input Timing

(T_A = –40°C to +125°C, V_{CC} = 5.0 V ± 10%, V_{SS} = 0.0 V, IO_{drive} = 5mA, C_L = 50pF)

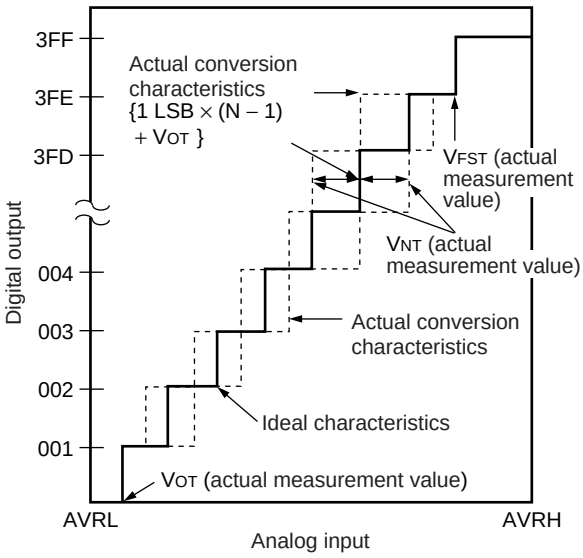
Parameter	Symbol	Pin	Test Condition	Rated Value		Units	Remarks
				Min	Max		
RDY setup time	t_{RYHS}	RDY	-	35	-	ns	
RDY hold time	t_{RYHH}	RDY		0	-	ns	

(T_A = –40°C to +125°C, V_{CC} = 3.0 to 4.5V, V_{SS} = 0.0 V, IO_{drive} = 5mA, C_L = 50pF)

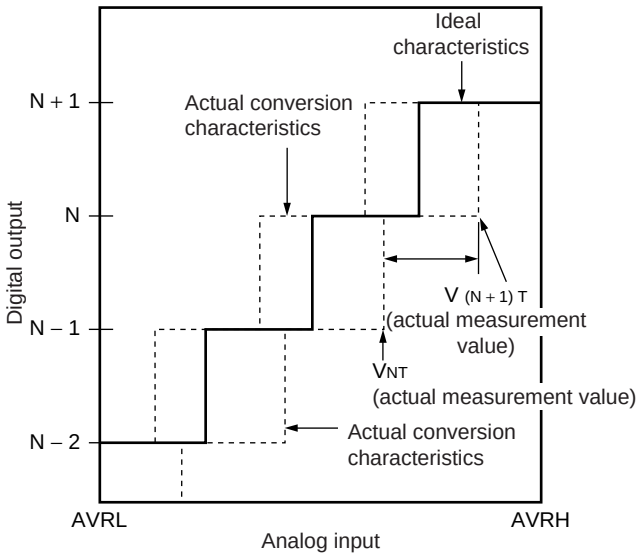
Parameter	Symbol	Pin	Test Condition	Rated Value		Units	Remarks
				Min	Max		
RDY setup time	t_{RYHS}	RDY	-	45	-	ns	
RDY hold time	t_{RYHH}	RDY		0	-	ns	

Note: If the RDY setup time is insufficient, use the auto-ready function.

Nonlinearity error



Differential nonlinearity error



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

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

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

N: A/D converter digital output value

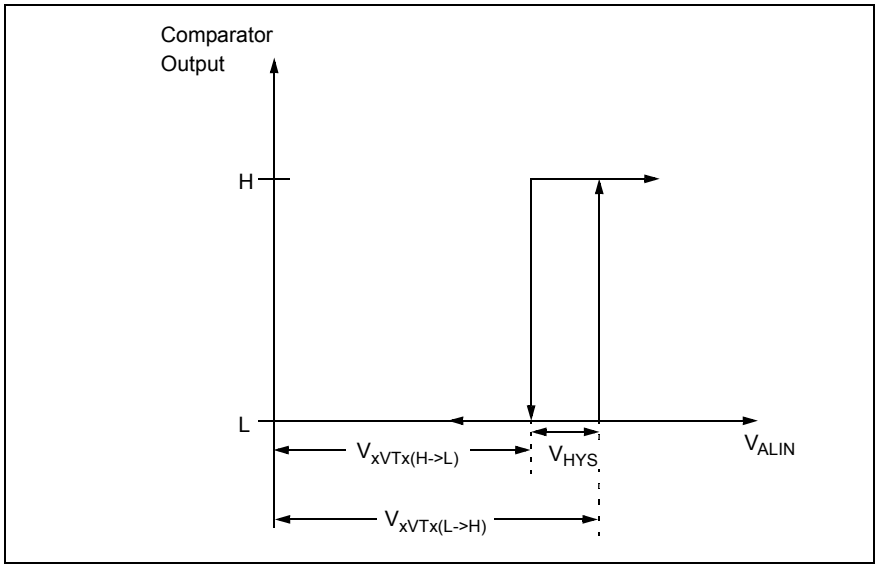
V_{OT}: Voltage at which digital output transits from "000_H" to "001_H."

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

14.6 Alarm Comparator

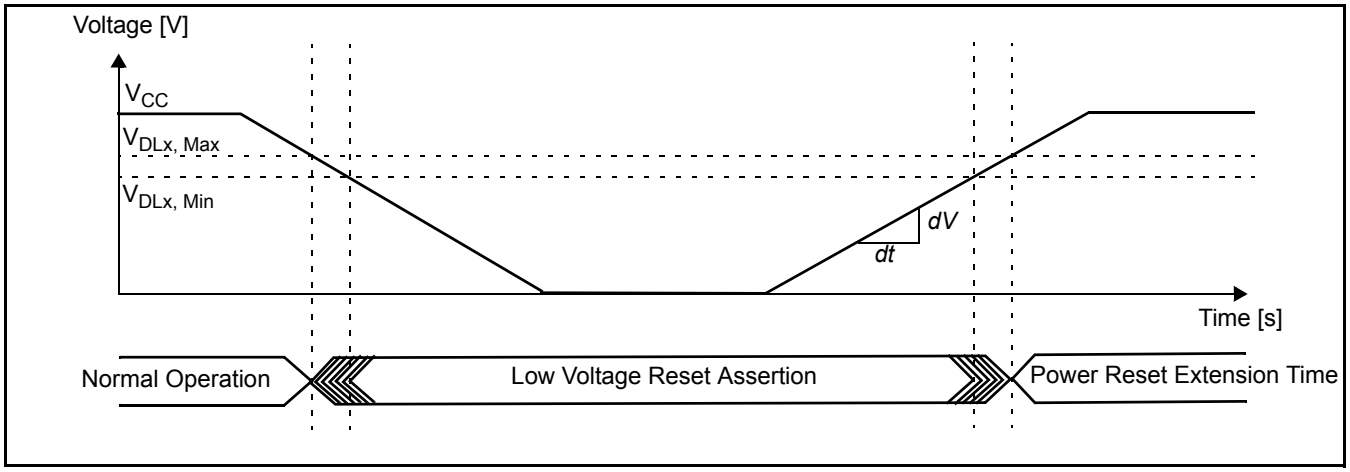
(T_A = -40 °C to +125 °C, V_{CC} = AV_{CC} = 3.0V - 5.5V, V_{SS} = AV_{SS} = 0V)

Parameter	Symbol	Pin	Value			Unit	Remarks
			Min	Typ	Max		
Power supply current	I_{A5ALMF}	AV_{CC}	-	25	45	µA	Alarm comparator enabled in fast mode (one channel)
	I_{A5ALMS}		-	7	13	µA	Alarm comparator enabled in slow mode (one channel)
	I_{A5ALMH}		-	-	5	µA	Alarm comparator disabled
ALARM pin input current	I_{ALIN}	ALARM0, ALARM1	-1	-	+1	µA	T_A = 25 °C
			-3	-	+3	µA	T_A = 125 °C
ALARM pin input voltage range	V_{ALIN}		0	-	AV_{CC}	V	
External low threshold high->low transition	$V_{EVTL(H->L)}$		0.36 * AV_{CC} -0.25	0.36 * AV_{CC} -0.1	-	V	INTREF = 0
External low threshold low->high transition	$V_{EVTL(L->H)}$		-	0.36 * AV_{CC} +0.1	0.36 * AV_{CC} +0.25	V	
External high threshold high->low transition	$V_{EVTH(H->L)}$		0.78 * AV_{CC} -0.25	0.78 * AV_{CC} -0.1	-	V	
External high threshold low->high transition	$V_{EVTH(L->H)}$			0.78 * AV_{CC} +0.1	0.78 * AV_{CC} +0.25	V	
Internal low threshold high->low transition	$V_{IVTL(H->L)}$		0.9	1.1	-	V	INTREF = 1
Internal low threshold low->high transition	$V_{IVTL(L->H)}$		-	1.3	1.55	V	
Internal high threshold high->low transition	$V_{IVTH(H->L)}$		2.2	2.4	-	V	
Internal high threshold low->high transition	$V_{IVTH(L->H)}$		-	2.6	2.85	V	
Switching hysteresis	V_{HYS}		50	-	300	mV	
Comparison time	t_{COMPF}		-	0.1	1	µs	CMD = 1 (fast)
	t_{COMPS}		-	1	10	µs	CMD = 0 (slow)
Power-up stabilization time after enabling alarm comparator	t_{PD}		-	1	5	ms	Threshold levels specified above are not guaranteed within this time
Slow/Fast mode transition time	t_{CMD}		-	100	500	µs	


Comparator
Output
H
L
$V_{xVTx(H->L)}$
V_{HYS}
V_{ALIN}
$V_{xVTx(L->H)}$

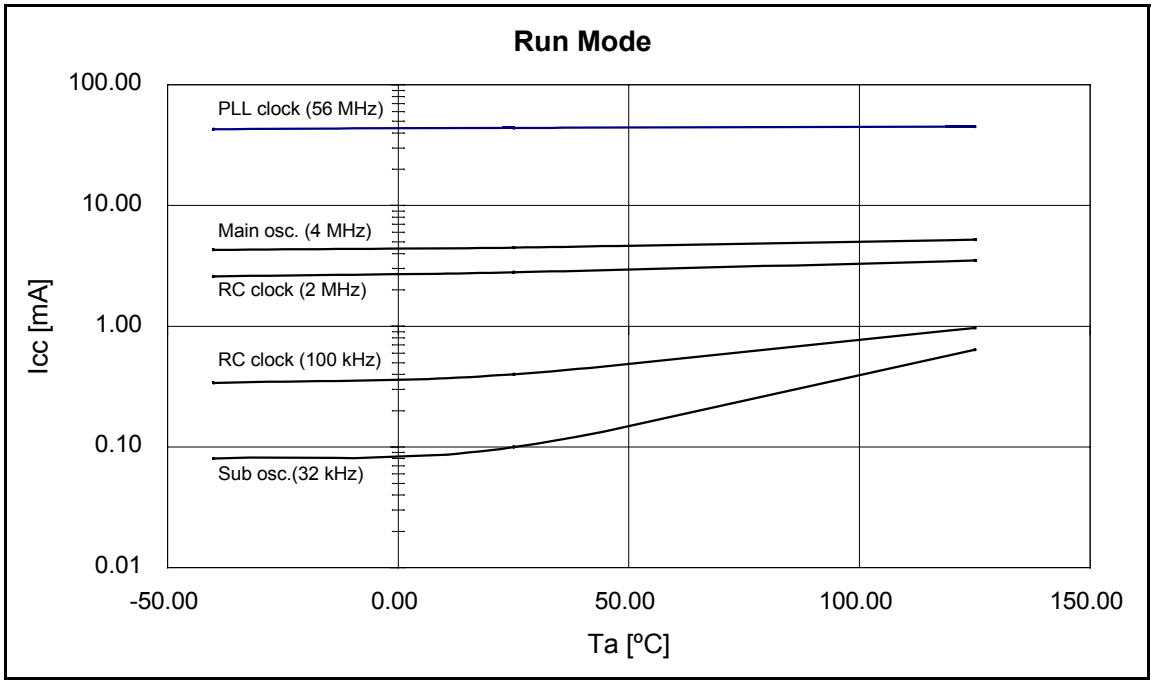
14.7.1 Low Voltage Detector Operation

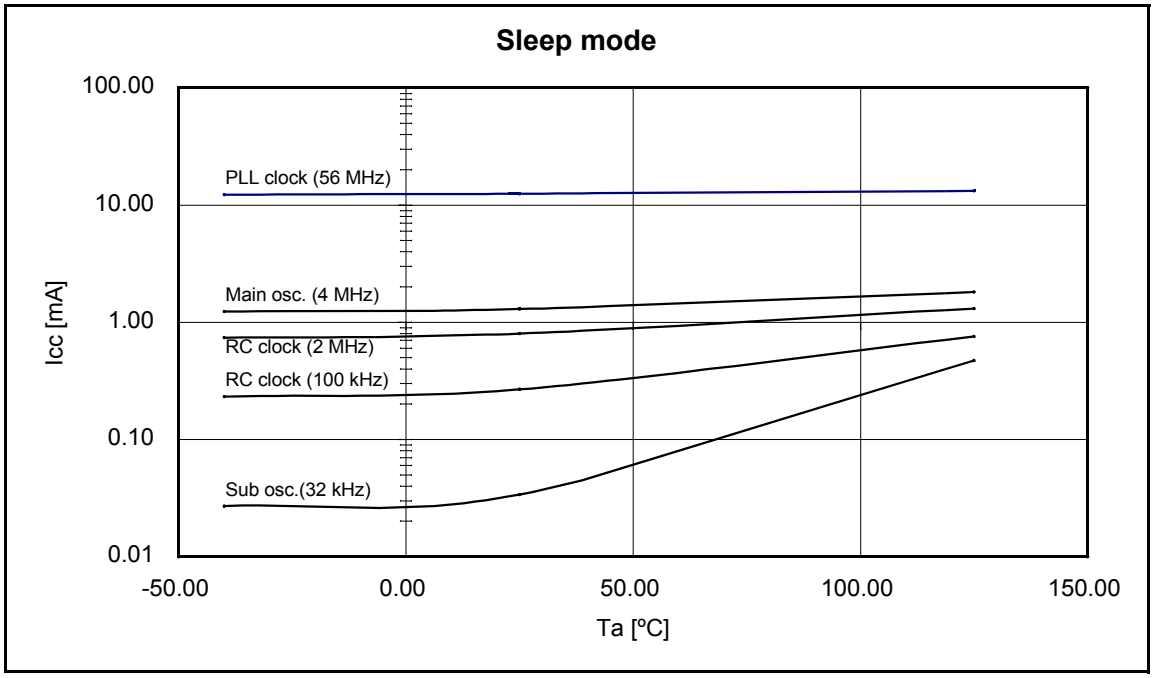
In the following figure, the occurrence of a low voltage condition is illustrated. For a detailed description of the reset and startup behavior, please refer to the corresponding hardware manual chapter.



15. Example Characteristics

The diagrams below show the characteristics of one measured sample with typical process parameters.





18.1 MCU with CAN Controller

Part number	Flash/ROM	Subclock	Persistent Low Voltage Reset	Package
MB96F347YSB PQC-GSE2	Flash A (416KB)	No	Yes	100 pin Plastic QFP (FPT-100P-M22)
MB96F347RSB PQC-GSE2			No	
MB96F347YWB PQC-GSE2		Yes	Yes	
MB96F347RWB PQC-GSE2			No	
MB96F347YSB PMC-GSE2		No	Yes	100 pin Plastic LQFP (FPT-100P-M20)
MB96F347RSB PMC-GSE2			No	
MB96F347YWB PMC-GSE2		Yes	Yes	
MB96F347RWB PMC-GSE2			No	
MB96F348YSB PQC-GSE2	Flash A (544KB)	No	Yes	100 pin Plastic QFP (FPT-100P-M22)
MB96F348RSB PQC-GSE2			No	
MB96F348YWB PQC-GSE2		Yes	Yes	
MB96F348RWB PQC-GSE2			No	
MB96F348YSB PMC-GSE2		No	Yes	100 pin Plastic LQFP (FPT-100P-M20)
MB96F348RSB PMC-GSE2			No	
MB96F348YWB PMC-GSE2		Yes	Yes	
MB96F348RWB PMC-GSE2			No	
MB96F348TSC PQC-GSE2	Flash A (544KB) Flash B (32KB)	No	Yes	100 pin Plastic QFP (FPT-100P-M22)
MB96F348HSC PQC-GSE2			No	
MB96F348TWC PQC-GSE2		Yes	Yes	
MB96F348HWC PQC-GSE2			No	
MB96F348TSC PMC-GSE2		No	Yes	100 pin Plastic LQFP (FPT-100P-M20)
MB96F348HSC PMC-GSE2			No	
MB96F348TWC PMC-GSE2		Yes	Yes	
MB96F348HWC PMC-GSE2			No	
MB96V300BRB-ES(for evaluation)	Emulated by ext. RAM	Yes	No	416 pin Plastic BGA (BGA-416P-M02)

18.2 MCU without CAN Controller

Part number	Flash/ROM	Subclock	Package
MB96F346ASB PQC-GSE2	Flash A (288KB)	No	100 pin Plastic QFP (FPT-100P-M22)
MB96F346AWB PQC-GSE2		Yes	
MB96F346ASB PMC-GSE2		No	100 pin Plastic LQFP (FPT-100P-M20)
MB96F346AWB PMC-GSE2		Yes	
MB96F347ASB PQC-GSE2	Flash A (416KB)	No	100 pin Plastic QFP (FPT-100P-M22)
MB96F347AWB PQC-GSE2		Yes	
MB96F347ASB PMC-GSE2		No	100 pin Plastic LQFP (FPT-100P-M20)
MB96F347AWB PMC-GSE2		Yes	
MB96F348ASB PQC-GSE2	Flash A (544KB)	No	100 pin Plastic QFP (FPT-100P-M22)
MB96F348AWB PQC-GSE2		Yes	
MB96F348ASB PMC-GSE2		No	100 pin Plastic LQFP (FPT-100P-M20)
MB96F348AWB PMC-GSE2		Yes	
MB96F348CSC PQC-GSE2	Flash A (544KB) Flash B (32KB)	No	100 pin Plastic QFP (FPT-100P-M22)
MB96F348CWC PQC-GSE2		Yes	
MB96F348CSC PMC-GSE2		No	100 pin Plastic LQFP (FPT-100P-M20)
MB96F348CWC PMC-GSE2		Yes	

[1]: These devices are under development and specification is preliminary. These products under development may change its specification without notice.

This datasheet is also valid for the following outdated devices:

MB96F346YSA, MB96F346RSA, MB96F346YWA, MB96F346RWA,
MB96F347YSA, MB96F347RSA, MB96F347YWA, MB96F347RWA,
MB96F348YSA, MB96F348RSA, MB96F348YWA, MB96F348RWA,
MB96F348TSB, MB96F348HSB, MB96F348TWB, MB96F348HWB,
MB96F346ASA, MB96F346AWA,
MB96F347ASA, MB96F347AWA,
MB96F348ASA, MB96F348AWA,
MB96F348CSB, MB96F348CWB