Infineon Technologies - MB90347ESPMC-GS-283E1 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	Obsolete
Core Processor	F²MC-16LX
Core Size	16-Bit
Speed	24MHz
Connectivity	CANbus, EBI/EMI, LINbus, SCI, UART/USART
Peripherals	DMA, POR, WDT
Number of I/O	82
Program Memory Size	128KB (128K x 8)
Program Memory Type	Mask ROM
EEPROM Size	-
RAM Size	6K x 8
Voltage - Supply (Vcc/Vdd)	3.5V ~ 5.5V
Data Converters	A/D 16x8/10b
Oscillator Type	External
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/mb90347espmc-gs-283e1

1. Product Lineup

Part Number / Parameter	MB90V340E-101, MB90V340E-102	MB90F342E(S), MB90F342CE(S), MB90F345E(S), MB90F345CE(S), MB90F346E(S), MB90F346CE(S), MB90F347E(S), MB90F347CE(S), MB90F349E(S), MB90F349CE(S)	MB90341E(S), MB90341CE(S), MB90342E(S), MB90342CE(S), MB90346E(S), MB90346CE(S), MB90347E(S), MB90347CE(S), MB90348E(S), MB90348CE(S), MB90349E(S), MB90349CE(S)
Type	Evaluation products	Flash memory products	MASK ROM products
CPU	F^2MC-16LX CPU		
System clock	On-chip PLL clock multiplier (×1, ×2, ×3, ×4, ×6, 1/2 when PLL stops) Minimum instruction execution time : 42 ns (4 MHz osc. PLL × 6)		
ROM	External	512 Kbytes : MB90F345E(S), MB90F345CE(S) 256 Kbytes : MB90F342E(S), MB90F342CE(S), MB90F349E(S), MB90F349CE(S) 128 Kbytes : MB90F347E(S), MB90F347CE(S) 64 Kbytes : MB90F346E(S), MB90F346CE(S)	256 Kbytes : MB90342E(S), MB90342CE(S), MB90349E(S), MB90349CE(S) 128 Kbytes : MB90341E(S), MB90341CE(S), MB90347E(S), MB90347CE(S), MB90348E(S), MB90348CE(S) 64 Kbytes : MB90346E(S), MB90346CE(S)
RAM	30 Kbytes	20 Kbytes : MB90F345E(S), MB90F345CE(S) 16 Kbytes : MB90F342E(S), MB90F342CE(S), MB90F349E(S), MB90F349CE(S) 6 Kbytes : MB90F347E(S), MB90F347CE(S) 2 Kbytes : MB90F346E(S), MB90F346CE(S)	16 Kbytes : MB90341E(S), MB90341CE(S), MB90342E(S), MB90342CE(S), MB90348E(S), MB90348CE(S), MB90349E(S), MB90349CE(S) 6 Kbytes : MB90347E(S), MB90347CE(S) 2 Kbytes : MB90346E(S), MB90346CE(S)
Emulator-specific power supply*	Yes	—	
Technology	0.35 μm CMOS with regulator for built-in power supply	0.35 μm CMOS with built-in power supply regulator + Flash memory with Charge pump for programming voltage	
Operating voltage range	5 V ± 10%	3.5 V to 5.5 V : When normal operating (not using A/D converter) 4.0 V to 5.5 V : When using the A/D converter/Flash programming 4.5 V to 5.5 V : When using the external bus	
Temperature range	—	−40°C to +105°C	
Package	PGA-299	QFP-100, LQFP-100	
LIN-UART	5 channels	4 channels	
	Wide range of baud rate settings using a dedicated baud rate generator (reload timer) Special synchronous options for adapting to different synchronous serial protocols LIN functionality working either as master or slave LIN device		
I^2C (400 kbps)	2 channels	Devices with a C suffix in the part number : 2 channels Devices without a C suffix in the part number : —	

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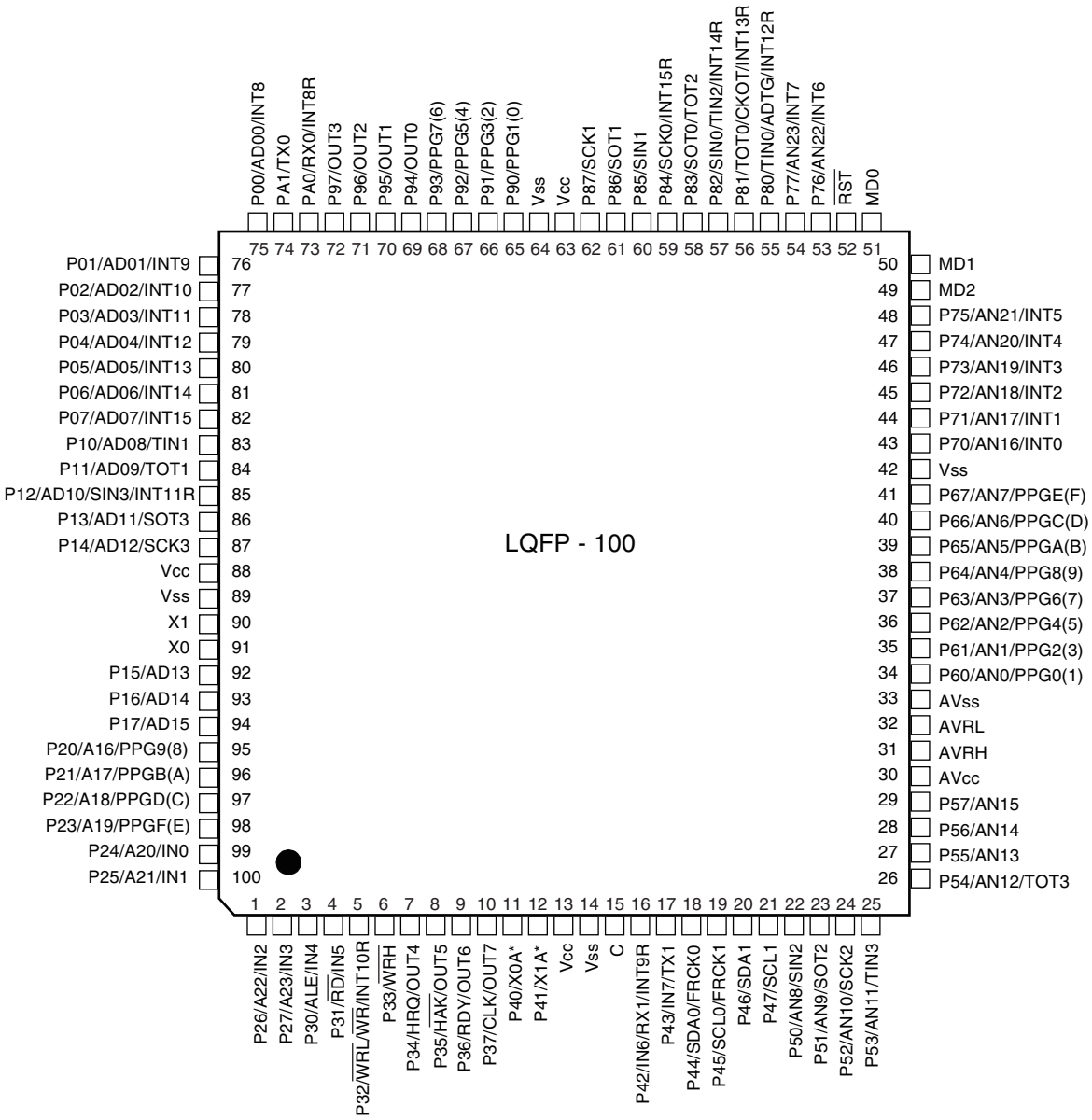
(TOP VIEW)



(FPT-100P-M20)

* : X0A, X1A : devices without an S suffix in the part number
P40, P41 : devices with an S suffix in the part number

Pin No.		Pin name	I/O Circuit type*3	Function
QFP100*1	LQFP100*2			
61	59	P84	F	General purpose I/O pin.
		SCK0		Clock I/O pin for UART0
		INT15R		External interrupt request input pin
62	60	P85	M	General purpose I/O pin.
		SIN1		Serial data input pin for UART1
63	61	P86	F	General purpose I/O pin.
		SOT1		Serial data output pin for UART1
64	62	P87	F	General purpose I/O pin.
		SCK1		Clock I/O pin for UART1
65	63	V_{CC}	—	Power (3.5 V to 5.5 V) input pin
66	64	V_{SS}	—	GND pin
67 to 70	65 to 68	P90 to P93	F	General purpose I/O pins
		PPG1, 3, 5, 7		Output pins for PPGs
71 to 74	69 to 72	P94 to P97	F	General purpose I/O pins
		OUT0 to OUT3		Waveform output pins for output compares. This function is enabled when the OCU enables waveform output.
75	73	PA0	F	General purpose I/O pin.
		RX0		RX input pin for CAN0 Interface
		INT8R		External interrupt request input pin
76	74	PA1	F	General purpose I/O pin.
		TX0		TX Output pin for CAN0
77 to 84	75 to 82	P00 to P07	G	General purpose I/O pins. The register can be set to select whether to use a pull-up resistor. This function is enabled in single-chip mode.
		AD00 to AD07		I/O pins for 8 lower bits of the external address/data bus. This function is enabled when the external bus is enabled.
		INT8 to INT15		External interrupt request input pins.
85	83	P10	G	General purpose I/O pin. The register can be set to select whether to use a pull-up resistor. This function is enabled in single-chip mode.
		AD08		I/O pin for the external address/data bus. This function is enabled when the external bus is enabled.
		TIN1		Event input pin for the reload timer

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5. Sequence for Turning On the Power Supply to the A/D Converter and Analog Inputs

Make sure to turn on the A/D converter power supply (AV_{CC}, AVRH, AVRL) and analog inputs (AN0 to AN23) after turning-on the digital power supply (V_{CC}).

Turn-off the digital power after turning off the A/D converter supply and analog inputs. In this case, make sure that the voltage does not exceed AVRH or AV_{CC} (turning on/off the analog and digital power supplies simultaneously is acceptable).

6. Connection of Unused A/D Converter Pins when the A/D Converter is Used

Connect unused pins of A/D converter to $AV_{CC} = V_{CC}$, $AV_{SS} = AVRH = AVRL = V_{SS}$.

7. Crystal Oscillator Circuit

The X0, X1 pins and X0A, X1A pins may be possible causes of abnormal operation. Make sure to provide bypass capacitors via the shortest distance from X0, X1 pins and X0A, X1A pins, crystal oscillator (or ceramic oscillator) and ground lines, and make sure, to the utmost effort, that the oscillation circuit lines 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.

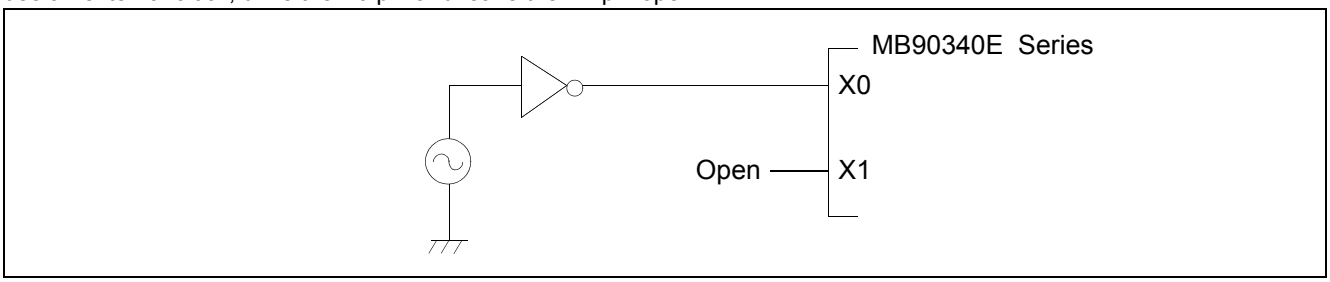
For each of the mass-production products, request an oscillator evaluation from the manufacturer of the oscillator you are using.

8. Pull-up/down resistors

The MB90340E Series does not support internal pull-up/down resistors (except for the pull-up resistors built into ports 0 to 3). Use external components where needed.

9. Using external clock

To use an external clock, drive the X0 pin and leave the X1 pin open.



10. Precautions when not using a sub clock signal

If you do not connect pins X0A and X1A to an oscillator, use pull-down handling on the X0A pin, and leave the X1A pin open.

11. Notes on operation in PLL clock mode

If PLL clock mode is selected, the microcontroller attempt to be working with the self-oscillating circuit even when there is no external oscillator or the external clock input is stopped. Performance of this operation, however, cannot be guaranteed.

12. Notes on Power-On

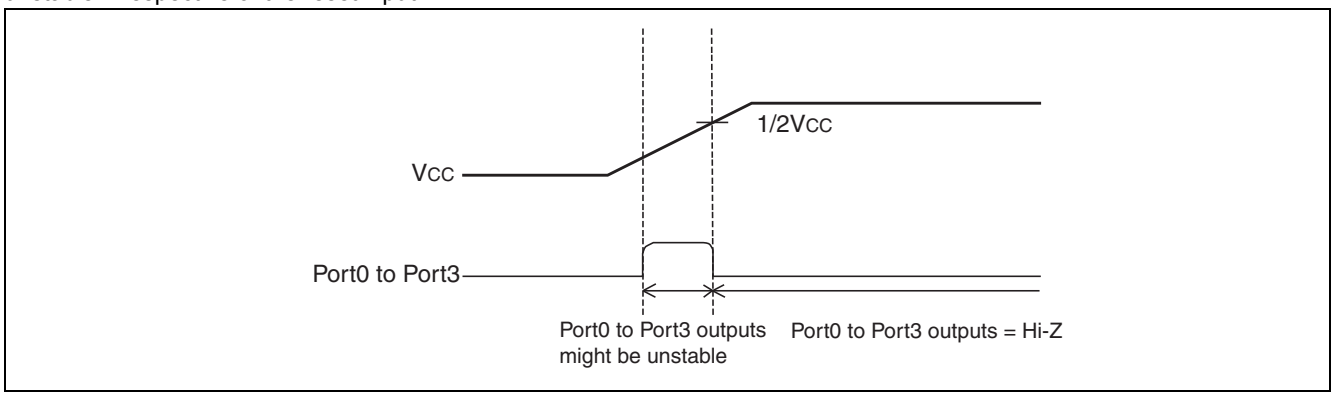
To prevent the internal regulator circuit from malfunctioning, set the voltage rise time during power-on to 50 µs or more (0.2 V to 2.7 V)

13.Stabilization of power supply voltage

A sudden change in the supply voltage may cause the device to malfunction even within the V_{CC} supply voltage operating range. Therefore, the V_{CC} supply voltage should be stabilized. For reference, the supply voltage should be controlled so that V_{CC} ripple variations (peak- to-peak values) at commercial frequencies (50 MHz/60 MHz) fall below 10% of the standard V_{CC} supply voltage and the coefficient of fluctuation does not exceed 0.1 V/ms at instantaneous power switching.

14.Port 0 to Port 3 Output During Power-on (External-bus Mode)

As shown below, when the power is turned on in External-Bus mode, there is a possibility that output signal of Port 0 to Port 3 might be unstable irrespective of the reset input.



15.Notes on Using the CAN Function

To use the CAN function, please set the DIRECT bit of the CAN Direct Mode Register (CDMR) to 1.

16.Flash Security Function (except for MB90F346E)

A security bit is located in the area of the flash memory.
If protection code 01_H is written in the security bit, the flash memory is in the protected state by security.
Therefore please do not write 01_H in this address if you do not use the security function.
Refer to following table for the address of the security bit.

	Flash memory size	Address of the security bit
MB90F347E	Embedded 1 Mbit Flash Memory	$FE0001_H$
MB90F342E MB90F349E	Embedded 2 Mbits Flash Memory	$FC0001_H$
MB90F345E	Embedded 4 Mbits Flash Memory	$F80001_H$

17.Serial Communication

There is a possibility to receive wrong data due to the noise or other causes on the serial communication.
Therefore, design a printed circuit board so as to avoid noise.
Retransmit the data if an error occurs because of applying the checksum to the last data in consideration of receiving wrong data due to the noise.

8. I/O Map

Address	Register	Abbreviation	Access	Resource name	Initial value
000000_H	Port 0 Data Register	PDR0	R/W	Port 0	$XXXXXXXX_B$
000001_H	Port 1 Data Register	PDR1	R/W	Port 1	$XXXXXXXX_B$
000002_H	Port 2 Data Register	PDR2	R/W	Port 2	$XXXXXXXX_B$
000003_H	Port 3 Data Register	PDR3	R/W	Port 3	$XXXXXXXX_B$
000004_H	Port 4 Data Register	PDR4	R/W	Port 4	$XXXXXXXX_B$
000005_H	Port 5 Data Register	PDR5	R/W	Port 5	$XXXXXXXX_B$
000006_H	Port 6 Data Register	PDR6	R/W	Port 6	$XXXXXXXX_B$
000007_H	Port 7 Data Register	PDR7	R/W	Port 7	$XXXXXXXX_B$
000008_H	Port 8 Data Register	PDR8	R/W	Port 8	$XXXXXXXX_B$
000009_H	Port 9 Data Register	PDR9	R/W	Port 9	$XXXXXXXX_B$
$00000A_H$	Port A Data Register	PDRA	R/W	Port A	$XXXXXXXX_B$
$00000B_H$	Port 5 Analog Input Enable Register	ADER5	R/W	Port 5, A/D	11111111_B
$00000C_H$	Port 6 Analog Input Enable Register	ADER6	R/W	Port 6, A/D	11111111_B
$00000D_H$	Port 7 Analog Input Enable Register	ADER7	R/W	Port 7, A/D	11111111_B
$00000E_H$	Input Level Select Register 0	ILSR0	R/W	Ports	$XXXXXXXX_B$
$00000F_H$	Input Level Select Register 1	ILSR1	R/W	Ports	$XXXX0XXX_B$
000010_H	Port 0 Direction Register	DDR0	R/W	Port 0	00000000_B
000011_H	Port 1 Direction Register	DDR1	R/W	Port 1	00000000_B
000012_H	Port 2 Direction Register	DDR2	R/W	Port 2	00000000_B
000013_H	Port 3 Direction Register	DDR3	R/W	Port 3	00000000_B
000014_H	Port 4 Direction Register	DDR4	R/W	Port 4	00000000_B
000015_H	Port 5 Direction Register	DDR5	R/W	Port 5	00000000_B
000016_H	Port 6 Direction Register	DDR6	R/W	Port 6	00000000_B
000017_H	Port 7 Direction Register	DDR7	R/W	Port 7	00000000_B
000018_H	Port 8 Direction Register	DDR8	R/W	Port 8	00000000_B
000019_H	Port 9 Direction Register	DDR9	R/W	Port 9	00000000_B
$00001A_H$	Port A Direction Register	DDRA	R/W	Port A	00000100_B
$00001B_H$	Reserved				
$00001C_H$	Port 0 Pull-up Control Register	PUCR0	R/W	Port 0	00000000_B
$00001D_H$	Port 1 Pull-up Control Register	PUCR1	R/W	Port 1	00000000_B
$00001E_H$	Port 2 Pull-up Control Register	PUCR2	R/W	Port 2	00000000_B
$00001F_H$	Port 3 Pull-up Control Register	PUCR3	W, R/W	Port 3	00000000_B

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Address	Register	Abbreviation	Access	Resource name	Initial value
007924_H	Input Capture 2	IPCP2	R	Input Capture 2/3	$XXXXXXXX_B$
007925_H	Input Capture 2	IPCP2	R		$XXXXXXXX_B$
007926_H	Input Capture 3	IPCP3	R		$XXXXXXXX_B$
007927_H	Input Capture 3	IPCP3	R		$XXXXXXXX_B$
007928_H	Input Capture 4	IPCP4	R	Input Capture 4/5	$XXXXXXXX_B$
007929_H	Input Capture 4	IPCP4	R		$XXXXXXXX_B$
$00792A_H$	Input Capture 5	IPCP5	R		$XXXXXXXX_B$
$00792B_H$	Input Capture 5	IPCP5	R		$XXXXXXXX_B$
$00792C_H$	Input Capture 6	IPCP6	R	Input Capture 6/7	$XXXXXXXX_B$
$00792D_H$	Input Capture 6	IPCP6	R		$XXXXXXXX_B$
$00792E_H$	Input Capture 7	IPCP7	R		$XXXXXXXX_B$
$00792F_H$	Input Capture 7	IPCP7	R		$XXXXXXXX_B$
007930_H	Output Compare 0	OCCP0	R/W	Output Compare 0/1	$XXXXXXXX_B$
007931_H	Output Compare 0	OCCP0	R/W		$XXXXXXXX_B$
007932_H	Output Compare 1	OCCP1	R/W		$XXXXXXXX_B$
007933_H	Output Compare 1	OCCP1	R/W		$XXXXXXXX_B$
007934_H	Output Compare 2	OCCP2	R/W	Output Compare 2/3	$XXXXXXXX_B$
007935_H	Output Compare 2	OCCP2	R/W		$XXXXXXXX_B$
007936_H	Output Compare 3	OCCP3	R/W		$XXXXXXXX_B$
007937_H	Output Compare 3	OCCP3	R/W		$XXXXXXXX_B$
007938_H	Output Compare 4	OCCP4	R/W	Output Compare 4/5	$XXXXXXXX_B$
007939_H	Output Compare 4	OCCP4	R/W		$XXXXXXXX_B$
$00793A_H$	Output Compare 5	OCCP5	R/W		$XXXXXXXX_B$
$00793B_H$	Output Compare 5	OCCP5	R/W		$XXXXXXXX_B$
$00793C_H$	Output Compare 6	OCCP6	R/W	Output Compare 6/7	$XXXXXXXX_B$
$00793D_H$	Output Compare 6	OCCP6	R/W		$XXXXXXXX_B$
$00793E_H$	Output Compare 7	OCCP7	R/W		$XXXXXXXX_B$
$00793F_H$	Output Compare 7	OCCP7	R/W		$XXXXXXXX_B$
007940_H	Timer Data 0	TCDT0	R/W	Free-run Timer 0	00000000_B
007941_H	Timer Data 0	TCDT0	R/W		00000000_B
007942_H	Timer Control Status 0	TCCSL0	R/W		00000000_B
007943_H	Timer Control Status 0	TCCSH0	R/W		$0XXXXXXX_B$
007944_H	Timer Data 1	TCDT1	R/W	Free-run Timer 1	00000000_B
007945_H	Timer Data 1	TCDT1	R/W		00000000_B
007946_H	Timer Control Status 1	TCCSL1	R/W		00000000_B
007947_H	Timer Control Status 1	TCCSH1	R/W		$0XXXXXXX_B$

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Address	Register	Abbreviation	Access	Resource name	Initial value
$0079E0_H$	Detect Address Setting 0	PADR0	R/W	Address Match Detection 0	$XXXXXXXX_B$
$0079E1_H$	Detect Address Setting 0	PADR0	R/W		$XXXXXXXX_B$
$0079E2_H$	Detect Address Setting 0	PADR0	R/W		$XXXXXXXX_B$
$0079E3_H$	Detect Address Setting 1	PADR1	R/W		$XXXXXXXX_B$
$0079E4_H$	Detect Address Setting 1	PADR1	R/W		$XXXXXXXX_B$
$0079E5_H$	Detect Address Setting 1	PADR1	R/W		$XXXXXXXX_B$
$0079E6_H$	Detect Address Setting 2	PADR2	R/W		$XXXXXXXX_B$
$0079E7_H$	Detect Address Setting 2	PADR2	R/W		$XXXXXXXX_B$
$0079E8_H$	Detect Address Setting 2	PADR2	R/W		$XXXXXXXX_B$
$0079E9_H$ to $0079EF_H$	Reserved				
$0079F0_H$	Detect Address Setting 3	PADR3	R/W	Address Match Detection 1	$XXXXXXXX_B$
$0079F1_H$	Detect Address Setting 3	PADR3	R/W		$XXXXXXXX_B$
$0079F2_H$	Detect Address Setting 3	PADR3	R/W		$XXXXXXXX_B$
$0079F3_H$	Detect Address Setting 4	PADR4	R/W		$XXXXXXXX_B$
$0079F4_H$	Detect Address Setting 4	PADR4	R/W		$XXXXXXXX_B$
$0079F5_H$	Detect Address Setting 4	PADR4	R/W		$XXXXXXXX_B$
$0079F6_H$	Detect Address Setting 5	PADR5	R/W		$XXXXXXXX_B$
$0079F7_H$	Detect Address Setting 5	PADR5	R/W		$XXXXXXXX_B$
$0079F8_H$	Detect Address Setting 5	PADR5	R/W		$XXXXXXXX_B$
$0079F9_H$ to $0079FF_H$	Reserved				
$007A00_H$ to $007AFF_H$	Reserved for CAN Controller 0. Refer to “CAN Controllers				
$007B00_H$ to $007BFF_H$	Reserved for CAN Controller 0. Refer to “CAN Controllers”				
$007C00_H$ to $007CFF_H$	Reserved for CAN Controller 1. Refer to “CAN Controllers”				
$007D00_H$ to $007DFF_H$	Reserved for CAN Controller 1. Refer to “CAN Controllers”				
$007E00_H$ to $007FFF_H$	Reserved				

Note:
- Initial value of “X” represents unknown value.
- Any write access to reserved addresses in I/O map should not be performed. A read access to reserved addresses results in reading “X”.

11. Electrical Characteristics

11.1 Absolute Maximum Ratings

Parameter	Symbol	Rating		Unit	Remarks
		Min	Max		
Power supply voltage*1	V_{CC}	$V_{SS} - 0.3$	$V_{SS} + 6.0$	V	
	AV_{CC}	$V_{SS} - 0.3$	$V_{SS} + 6.0$	V	$V_{CC} = AV_{CC}$*2
	AVRH, AVRL	$V_{SS} - 0.3$	$V_{SS} + 6.0$	V	$AV_{CC} \geq$ AVRH, $AV_{CC} \geq$ AVRL, AVRH $\geq$ AVRL
Input voltage*1	V_I	$V_{SS} - 0.3$	$V_{SS} + 6.0$	V	*3
Output voltage*1	V_O	$V_{SS} - 0.3$	$V_{SS} + 6.0$	V	*3
Maximum Clamp Current	I_{CLAMP}	−4.0	+4.0	mA	*5
Total Maximum Clamp Current	$\Sigma\lvert I_{CLAMP}\rvert$	—	40	mA	*5
“L” level maximum output current	I_{OL}	—	15	mA	*4, *6
“L” level average output current	I_{OLAV}	—	4	mA	*4, *7
“L” level maximum overall output current	ΣI_{OL}	—	100	mA	*4
“L” level average overall output current	ΣI_{OLAV}	—	50	mA	*4, *8
“H” level maximum output current	I_{OH}	—	−15	mA	*4, *6
“H” level average output current	I_{OHAV}	—	−4	mA	*4, *7
“H” level maximum overall output current	ΣI_{OH}	—	−100	mA	*4
“H” level average overall output current	ΣI_{OHAV}	—	−50	mA	*4, *8
Power consumption	P_D	—	450	mW	
Operating temperature	T_A	−40	+105	°C	
Storage temperature	T_{STG}	−55	+150	°C	

*1: This parameter is based on $V_{SS} = AV_{SS} = 0$ V

*2: Set AV_{CC} and V_{CC} to the same voltage. Make sure that AV_{CC} does not exceed V_{CC} and that the voltage at the analog inputs does not exceed AV_{CC} when the power is switched on.

*3: V_I and V_O should not exceed $V_{CC} + 0.3$ V. V_I should not exceed the specified ratings. However if the maximum current to/from an input is limited by some means with external components, the I_{CLAMP} rating supersedes the V_I rating.

*4: Applicable to pins: P00 to P07, P10 to P17, P20 to P27, P30 to P37, P40 to P47, P50 to P57, P60 to P67, P70 to P77, P80 to P87, P90 to P97, PA0, PA1

*5:
- Applicable to pins: P00 to P07, P10 to P17, P20 to P27, P30 to P37, P40 to P47, P50 to P57 (Evaluation device : P50 to P55) , P60 to P67, P70 to P77, P80 to P87, P90 to P97, PA0 to PA1
- Use within recommended operating conditions.
- Use with DC voltage (current)
- The +B signal should always be applied by using 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 the rated value, 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 V_{CC} pin, and this may affect other devices.

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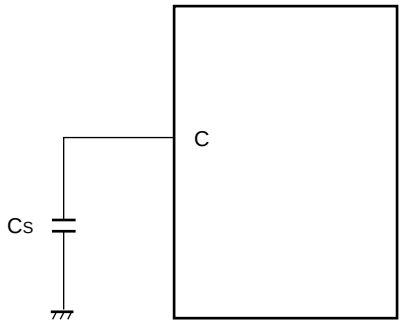
11.2 Recommended Operating Conditions

(V_{SS} = AV_{SS} = 0 V)

Parameter	Symbol	Value			Unit	Remarks
		Min	Typ	Max		
Power supply voltage	V_{CC}, AV_{CC}	4.0	5.0	5.5	V	Under normal operation
		3.5	5.0	5.5	V	Under normal operation, when not using the A/D converter and not Flash programming.
		4.5	5.0	5.5	V	When External bus is used.
		3.0	—	5.5	V	Maintains RAM data in stop mode
Smoothing capacitor	C_S	0.1	—	1.0	µF	Use a ceramic capacitor or capacitor of better AC characteristics. Capacitor at the V_{CC} should be greater than this capacitor.
Operating temperature	T_A	−40	—	+105	°C	

C Pin Connection Diagram



WARNING: The recommended operating conditions are required in order to ensure the normal operation of the semiconductor device. All of the device's electrical characteristics are warranted when the device is operated within these ranges.

Always use semiconductor devices within their recommended operating condition ranges. Operation outside these ranges may adversely affect reliability and could result in device failure.

No warranty is made with respect to uses, operating conditions, or combinations not represented on the data sheet. Users considering application outside the listed conditions are advised to contact their representatives beforehand.

11.3 DC Characteristics

($T_A = -40°C$ to $+105°C$, $V_{CC} = 5.0\ V \pm 10\%$, $f_{CP} \leq 24$ MHz, $V_{SS} = AV_{SS} = 0\ V$)

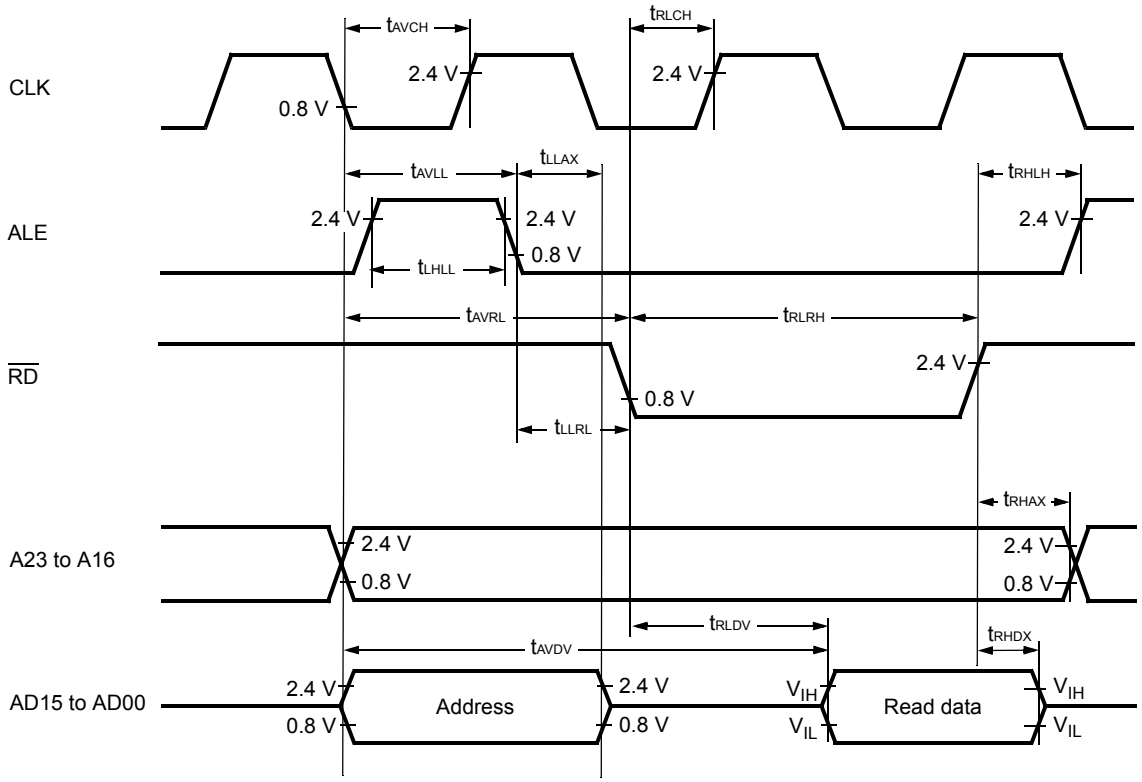
Parameter	Symbol	Pin	Condition	Value			Unit	Remarks
				Min	Typ	Max		
Input H voltage (At V_{CC} = 5 V ± 10%)	V_{IHS}	—	—	0.8 V_{CC}	—	V_{CC} + 0.3	V	Port inputs if CMOS hysteresis input levels are selected (except P12, P44, P45, P46, P47, P50, P82, P85)
	V_{IHA}	—	—	0.8 V_{CC}	—	V_{CC} + 0.3	V	Port inputs if Automotive input levels are selected
	V_{IHT}	—	—	2.0	—	V_{CC} + 0.3	V	Port inputs if TTL input levels are selected
	V_{IHS}	—	—	0.7 V_{CC}	—	V_{CC} + 0.3	V	P12, P50, P82, P85 inputs if CMOS input levels are selected
	V_{IHI}	—	—	0.7 V_{CC}	—	V_{CC} + 0.3	V	P44, P45, P46, P47 inputs if CMOS hysteresis input levels are selected
	V_{IHR}	—	—	0.8 V_{CC}	—	V_{CC} + 0.3	V	$\overline{RST}$ input pin (CMOS hysteresis)
	V_{IHM}	—	—	V_{CC} − 0.3	—	V_{CC} + 0.3	V	MD input pin
Input L voltage (At V_{CC} = 5 V ± 10%)	V_{ILS}	—	—	V_{SS} − 0.3	—	0.2 V_{CC}	V	Port inputs if CMOS hysteresis input levels are selected (except P12, P44, P45, P46, P47, P50, P82, P85)
	V_{ILA}	—	—	V_{SS} − 0.3	—	0.5 V_{CC}	V	Port inputs if Automotive input levels are selected
	V_{ILT}	—	—	V_{SS} − 0.3	—	0.8	V	Port inputs if TTL input levels are selected
	V_{ILS}	—	—	V_{SS} − 0.3	—	0.3 V_{CC}	V	P12, P50, P82, P85 inputs if CMOS input levels are selected
	V_{ILI}	—	—	V_{SS} − 0.3	—	0.3 V_{CC}	V	P44, P45, P46, P47 inputs if CMOS hysteresis input levels are selected
	V_{ILR}	—	—	V_{SS} − 0.3	—	0.2 V_{CC}	V	$\overline{RST}$ input pin (CMOS hysteresis)
	V_{ILM}	—	—	V_{SS} − 0.3	—	V_{SS} + 0.3	V	MD input pin
Output H voltage	V_{OH}	Normal outputs	V_{CC} = 4.5 V, I_{OH} = −4.0 mA	V_{CC} − 0.5	—	—	V	
Output H voltage	V_{OHI}	I^2C current outputs	V_{CC} = 4.5 V, I_{OH} = −3.0 mA	V_{CC} − 0.5	—	—	V	
Output L voltage	V_{OL}	Normal outputs	V_{CC} = 4.5 V, I_{OL} = 4.0 mA	—	—	0.4	V	
Output L voltage	V_{OLI}	I^2C current outputs	V_{CC} = 4.5 V, I_{OL} = 3.0 mA	—	—	0.4	V	

(Continued)

11.4.5 Bus Timing (Read)

(T_A = −40°C to +105°C, V_{CC} = 5.0 V ± 10%, V_{SS} = 0.0 V, f_{CP} ≤ 24 MHz)

Parameter	Symbol	Pin	Condition	Value		Unit
				Min	Max	
ALE pulse width	t_{LHLL}	ALE		$t_{CP}/2 - 10$	—	ns
Valid address → ALE ↓ time	t_{AVLL}	ALE, A23 to A16, AD15 to AD00		$t_{CP}/2 - 20$	—	ns
ALE ↓ → Address valid time	t_{LLAX}	ALE, AD15 to AD00		$t_{CP}/2 - 15$	—	ns
Valid address → $\overline{RD}$ ↓ time	t_{AVRL}	A23 to A16, AD15 to AD00, $\overline{RD}$		$t_{CP} - 15$	—	ns
Valid address → Valid data input	t_{AVDV}	A23 to A16, AD15 to AD00		—	$5\ t_{CP}/2 - 60$	ns
$\overline{RD}$ pulse width	t_{RLRH}	$\overline{RD}$	—	$3\ t_{CP}/2 - 20$	—	ns
$\overline{RD}$ ↓ → Valid data input	t_{RLDV}	$\overline{RD}$, AD15 to AD00		—	$3\ t_{CP}/2 - 50$	ns
$\overline{RD}$ ↑ → Data hold time	t_{RHDX}	$\overline{RD}$, AD15 to AD00		0	—	ns
$\overline{RD}$ ↑ → ALE ↑ time	t_{RHLH}	$\overline{RD}$, ALE		$t_{CP}/2 - 15$	—	ns
$\overline{RD}$ ↑ → Address valid time	t_{RHAX}	$\overline{RD}$, A23 to A16		$t_{CP}/2 - 10$	—	ns
Valid address → CLK ↑ time	t_{AVCH}	A23 to A16, AD15 to AD00, CLK		$t_{CP}/2 - 16$	—	ns
$\overline{RD}$ ↓ → CLK ↑ time	t_{RLCH}	$\overline{RD}$, CLK		$t_{CP}/2 - 15$	—	ns
ALE ↓ → $\overline{RD}$ ↓ time	t_{LLRL}	ALE, $\overline{RD}$		$t_{CP}/2 - 15$	—	ns

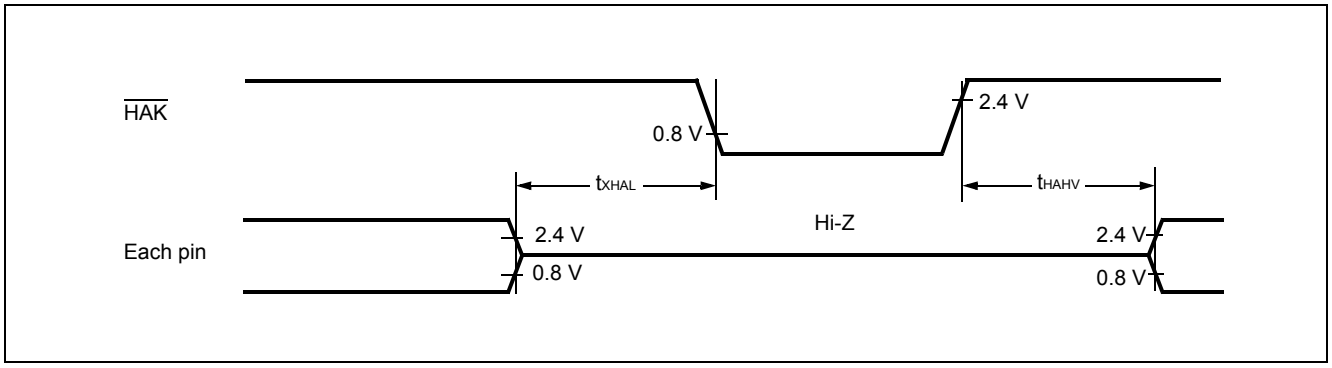


11.4.8 Hold Timing

($T_A = -40°C$ to $+105°C$, $V_{CC} = 5.0\ V \pm 10\%$, $V_{SS} = 0.0\ V$, $f_{CP} \leq 24$ MHz)

Parameter	Symbol	Pin	Condition	Value		Unit
				Min	Max	
Pin floating → $\overline{HAK}$ ↓ time	t_{XHAL}	$\overline{HAK}$	—	30	t_{CP}	ns
$\overline{HAK}$ ↑ time → Pin valid time	t_{HAHV}	$\overline{HAK}$		t_{CP}	2 t_{CP}	ns

Note: : There is more than 1 cycle from when HRQ reads in until the $\overline{HAK}$ is changed.

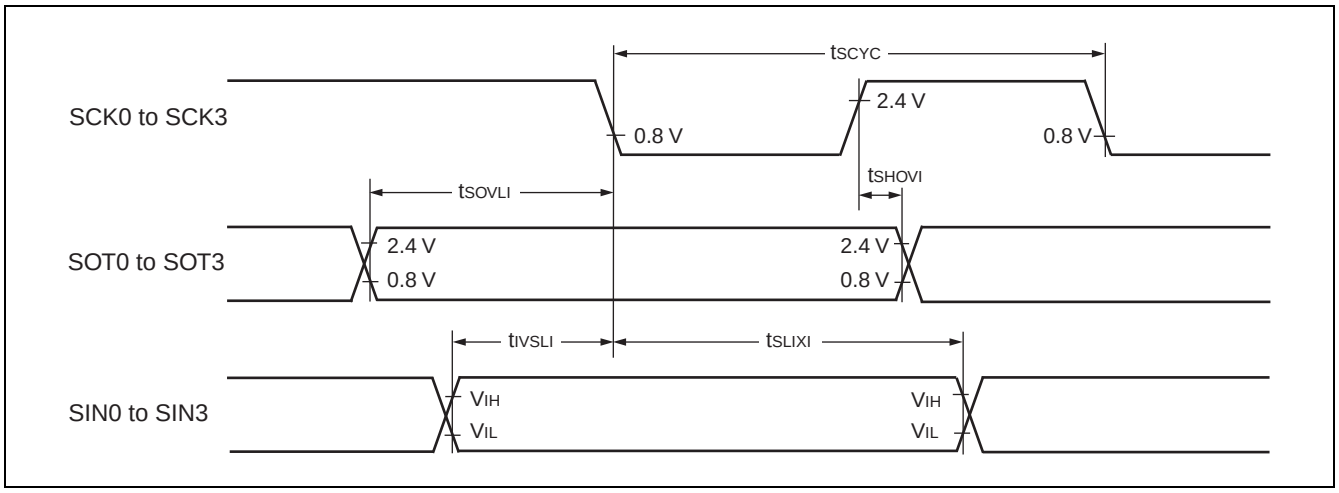


■ **Bit setting: ESCR:SCES = 0, ECCR:SCDE = 1**

(T_A = −40°C to +105°C, V_{CC} = 5.0 V ± 10%, f_{CP} ≤ 24 MHz, V_{SS} = 0 V)

Parameter	Symbol	Pin	Condition	Value		Unit
				Min	Max	
Serial clock cycle time	t_{SCYC}	SCK0 to SCK3	Internal clock operation output pins are C_L = 80 pF + 1 TTL.	5 t_{CP}	—	ns
SCK ↑ → SOT delay time	t_{SHOVI}	SCK0 to SCK3, SOT0 to SOT3		−50	+50	ns
Valid SIN → SCK ↓	t_{IVSLI}	SCK0 to SCK3, SIN0 to SIN3		t_{CP} + 80	—	ns
SCK ↓ → Valid SIN hold time	t_{SLIXI}	SCK0 to SCK3, SIN0 to SIN3		0	—	ns
SOT → SCK ↓ delay time	t_{SOVLI}	SCK0 to SCK3, SOT0 to SOT3		3 t_{CP} − 70	—	ns

Note:
- C_L is load capacity value of pins when testing.
- t_{CP} is internal operating clock cycle time (machine clock) . Refer to "Clock Timing".



11.5 A/D Converter

(T_A = −40°C to +105°C, 3.0 V≤ AVRH − AVRL, V_{CC} = AV_{CC} = 5.0 V ± 10%, f_{CP}≤ 24 MHz, V_{SS} = AV_{SS} = 0 V)

Parameter	Symbol	Pin	Value			Unit	Remarks
			Min	Typ	Max		
Resolution	—	—	—	—	10	bit	
Total error	—	—	—	—	±3.0	LSB	
Nonlinearity error	—	—	—	—	±2.5	LSB	
Differential nonlinearity error	—	—	—	—	±1.9	LSB	
Zero reading voltage	V_{OT}	AN0 to AN23	AVRL − 1.5 × LSB	AVRL + 0.5 × LSB	AVRL + 2.5 × LSB	V	
Full scale reading voltage	V_{FST}	AN0 to AN23	AVRH − 3.5 × LSB	AVRH − 1.5 × LSB	AVRH + 0.5 × LSB	V	
Compare time	—	—	1.0	—	16500	µs	4.5 V≤ AV_{CC}≤ 5.5 V
			2.0				4.0 V≤ AV_{CC} < 4.5 V
Sampling time	—	—	0.5	—	∞	µs	4.5 V≤ AV_{CC}≤ 5.5 V
			1.2				4.0 V≤ AV_{CC} < 4.5 V
Analog port input current	I_{AIN}	AN0 to AN23	−0.3	—	+0.3	µA	
Analog input voltage range	V_{AIN}	AN0 to AN23	AVRL	—	AVRH	V	
Reference voltage range	—	AVRH	AVRL + 2.7	—	AV_{CC}	V	
	—	AVRL	0	—	AVRH − 2.7	V	
Power supply current	I_A	AV_{CC}	—	3.5	7.5	mA	
	I_{AH}	AV_{CC}	—	—	5	µA	*
Reference voltage current	I_R	AVRH	—	600	900	µA	
	I_{RH}	AVRH	—	—	5	µA	*
Offset between input channels	—	AN0 to AN23	—	—	4	LSB	

*: If the A/D convertor is not operating, a current when CPU is stopped is applicable (V_{CC} = AV_{CC} = AVRH = 5.0 V) .
Note: : The accuracy gets worse as |AVRH − AVRL| becomes smaller.

11.6 Definition of A/D Converter Terms

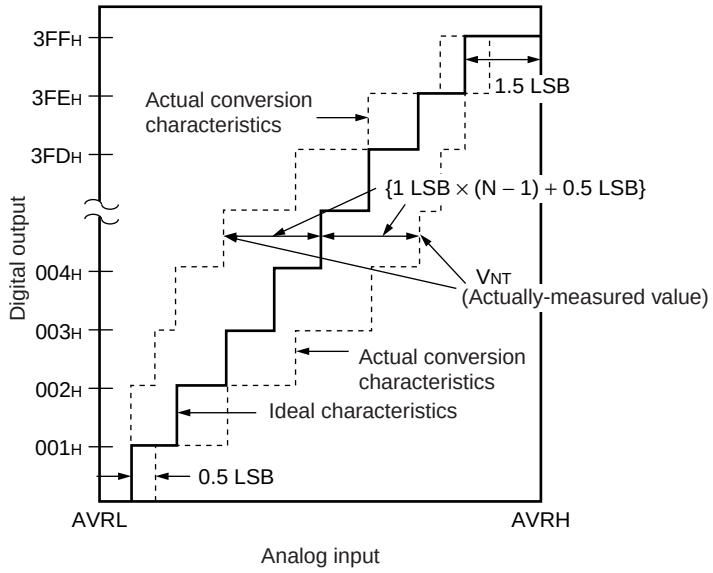
Resolution : Analog variation that is recognized by the A/D converter.

Non linearity error : The deviation between the actual conversion characteristics and a line that joins the zero-transition line (“00 0000 0000” ← → “00 0000 0001”) to the full-scale transition line (“11 1111 1110” ← → “11 1111 1111”) .

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

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

Total error



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

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

N : Value of the digital output from the A/D converter

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

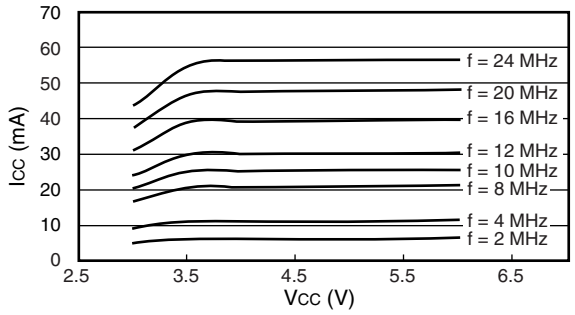
V_{FST} (Ideal value) = AVRH − 1.5 LSB [V]

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

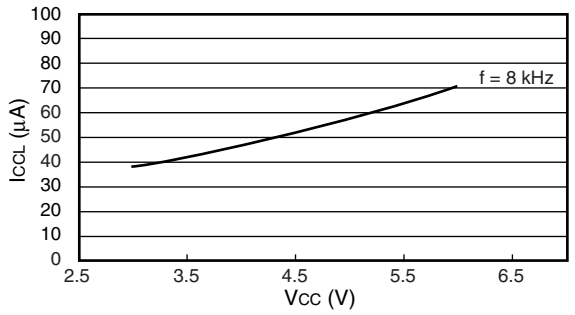
(Continued)

■ MB90F342E, MB90F342ES, MB90F342CE, MB90F342CES

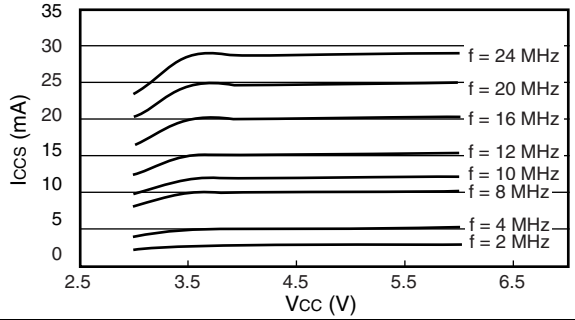
$I_{CC} - V_{CC}$
$T_A = +25°C$, external clock operation f = Internal operation frequency



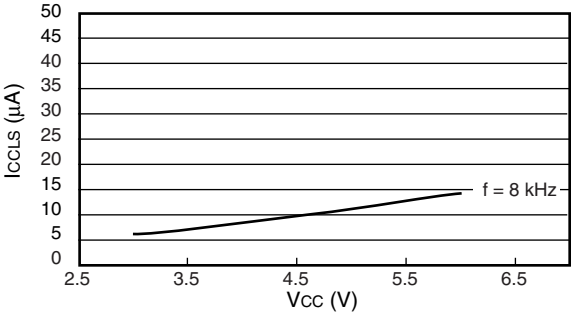
$I_{CCL} - V_{CC}$
$T_A = +25°C$, external clock operation f = Internal operation frequency



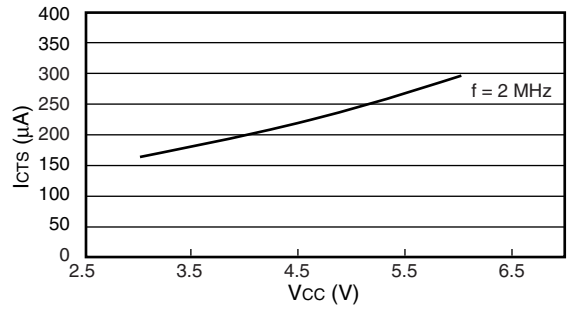
$I_{CCS} - V_{CC}$
$T_A = +25°C$, external clock operation f = Internal operation frequency



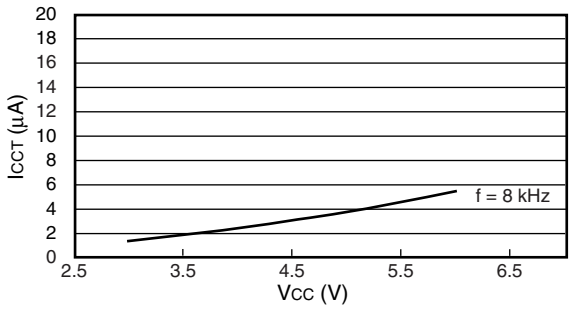
$I_{CCLS} - V_{CC}$
$T_A = +25°C$, external clock operation f = Internal operation frequency



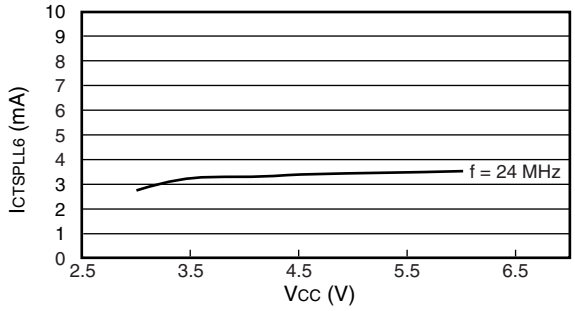
$I_{CTS} - V_{CC}$
$T_A = +25°C$, external clock operation f = Internal operation frequency



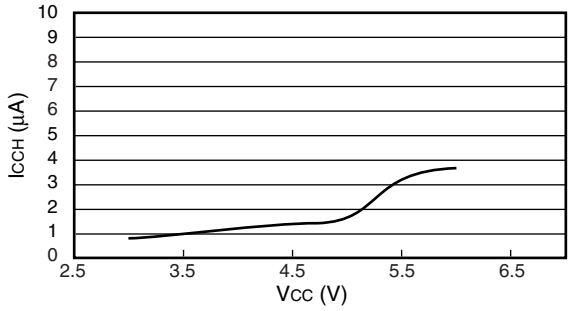
$I_{CCT} - V_{CC}$
$T_A = +25°C$, external clock operation f = Internal operation frequency



$I_{CTSPLL6} - V_{CC}$
$T_A = +25°C$, external clock operation f = Internal operation frequency



$I_{CCH} - V_{CC}$
$T_A = +25°C$, stopped



13. Ordering Information

Part number	Package	Remarks
MB90F342EPF	100-pin plastic QFP (FPT-100P-M06)	
MB90F342ESPF		
MB90F342CEPF		
MB90F342CESPF		
MB90F342EPMC	100-pin plastic LQFP (FPT-100P-M20)	
MB90F342ESPMC		
MB90F342CEPMC		
MB90F342CESPMC		
MB90F345EPF	100-pin plastic QFP (FPT-100P-M06)	
MB90F345ESPF		
MB90F345CEPF		
MB90F345CESPF		
MB90F345EPMC	100-pin plastic LQFP (FPT-100P-M20)	
MB90F345ESPMC		
MB90F345CEPMC		
MB90F345CESPMC		
MB90F346EPF	100-pin plastic QFP (FPT-100P-M06)	
MB90F346ESPF		
MB90F346CEPF		
MB90F346CESPF		
MB90F346EPMC	100-pin plastic LQFP (FPT-100P-M20)	
MB90F346ESPMC		
MB90F346CEPMC		
MB90F346CESPMC		

(Continued)

Part number	Package	Remarks
MB90F347EPF	100-pin plastic QFP (FPT-100P-M06)	
MB90F347ESPF		
MB90F347CEPF		
MB90F347CESPF		
MB90F347EPMC	100-pin plastic LQFP (FPT-100P-M20)	
MB90F347ESPMC		
MB90F347CEPMC		
MB90F347CESPMC		
MB90F349EPF	100-pin plastic QFP (FPT-100P-M06)	
MB90F349ESPF		
MB90F349CEPF		
MB90F349CESPF		
MB90F349EPMC	100-pin plastic LQFP (FPT-100P-M20)	
MB90F349ESPMC		
MB90F349CEPMC		
MB90F349CESPMC		
MB90341EPF	100-pin plastic QFP (FPT-100P-M06)	
MB90341ESPF		
MB90341CEPF		
MB90341CESPF		
MB90341EPMC	100-pin plastic LQFP (FPT-100P-M20)	
MB90341ESPMC		
MB90341CEPMC		
MB90341CESPMC		
MB90342EPF	100-pin plastic QFP (FPT-100P-M06)	
MB90342ESPF		
MB90342CEPF		
MB90342CESPF		
MB90342EPMC	100-pin plastic LQFP (FPT-100P-M20)	
MB90342ESPMC		
MB90342CEPMC		
MB90342CESPMC		

(Continued)

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Part number	Package	Remarks
MB90346EPF	100-pin plastic QFP (FPT-100P-M06)	
MB90346ESPF		
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MB90347CEPMC		
MB90347CESPMC		
MB90348EPF	100-pin plastic QFP (FPT-100P-M06)	
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MB90348CESPF		
MB90348EPMC	100-pin plastic LQFP (FPT-100P-M20)	
MB90348ESPMC		
MB90348CEPMC		
MB90348CESPMC		
MB90349EPF	100-pin plastic QFP (FPT-100P-M06)	
MB90349ESPF		
MB90349CEPF		
MB90349CESPF		
MB90349EPMC	100-pin plastic LQFP (FPT-100P-M20)	
MB90349ESPMC		
MB90349CEPMC		
MB90349CESPMC		
MB90V340E-101CR	299-pin ceramic PGA (PGA-299C-A01)	For evaluation
MB90V340E-102CR		