Features

- High Performance, Low Power AVR ® 8-bit Microcontroller
- Advanced RISC Architecture
  - 131 Powerful Instructions - Most Single Clock Cycle Execution
  - 32 x 8 General Purpose Working Registers
  - Fully Static Operation
  - Up to 1 MIPS throughput per MHz
  - On-chip 2-cycle Multiplier
- Data and Non-Volatile Program Memory
  - 16/32/64K Bytes Flash of In-System Programmable Program Memory
  - 512B/1K/2K Bytes of In-System Programmable EEPROM
  - 1/2/4K Bytes Internal SRAM
  - Write/Erase Cycles: 10,000 Flash/ 100,000 EEPROM
  - Data Retention: 20 years at 85°C/ 100 years at 25°C(1)
  - Optional Boot Code Section with Independent Lock Bits
    - In-System Programming by On-chip Boot Program
    - True Read-While-Write Operation
  - Programming Lock for Flash Program and EEPROM Data Security
- On Chip Debug Interface (debugWIRE)
- CAN 2.0A/B with 6 Message Objects - ISO 16845 Certified
- LIN 2.1 and 1.3 Controller or 8-Bit UART
- One 12-bit High Speed PSC (Power Stage Controller)
  - Non Overlapping Inverted PWM Output Pins With Flexible Dead-Time
  - Variable PWM duty Cycle and Frequency
  - Synchronous Update of all PWM Registers
  - Auto Stop Function for Emergency Event
- Peripheral Features
  - One 8-bit General purpose Timer/Counter with Separate Prescaler, Compare Mode and Capture Mode
  - One 16-bit General purpose Timer/Counter with Separate Prescaler, Compare Mode and Capture Mode
  - One Master/Slave SPI Serial Interface
  - 10-bit ADC
    - Up To 11 Single Ended Channels and 3 Fully Differential ADC Channel Pairs
    - Programmable Gain (5x, 10x, 20x, 40x) on Differential Channels
    - Internal Reference Voltage
    - Direct Power Supply Voltage Measurement
  - 10-bit DAC for Variable Voltage Reference (Comparators, ADC)
  - Four Analog Comparators with Variable Threshold Detection
  - 100µA ±2% Current Source (LIN Node Identification)
  - Interrupt and Wake-up on Pin Change
  - Programmable Watchdog Timer with Separate On-Chip Oscillator
  - On-chipTemperature Sensor
- Special Microcontroller Features
  - Low Power Idle, Noise Reduction, and Power Down Modes
  - Power On Reset and Programmable Brown Out Detection
  - In-System Programmable via SPI Port
  - High Precision Crystal Oscillator for CAN Operations (16 MHz)
  - Internal Calibrated RC Oscillator (8 MHz)
  - On-chip PLL for fast PWM (32 MHz, 64 MHz) and CPU (16 MHz)
- Operating Voltage: 2.7V - 5.5V
- Extended Operating Temperature:
  - -40°C to +85°C
- Core Speed Grade:
  - 0 - 8MHz @ 2.7 - 4.5V
  - 0 - 16MHz @ 4.5 - 5.5V

Note: 1. See “Data Retention” on page 9 for details.

8-bit AVR® Microcontroller with 16/32/64K Bytes In-System Programmable Flash

ATmega16M1
ATmega32M1
ATmega64M1

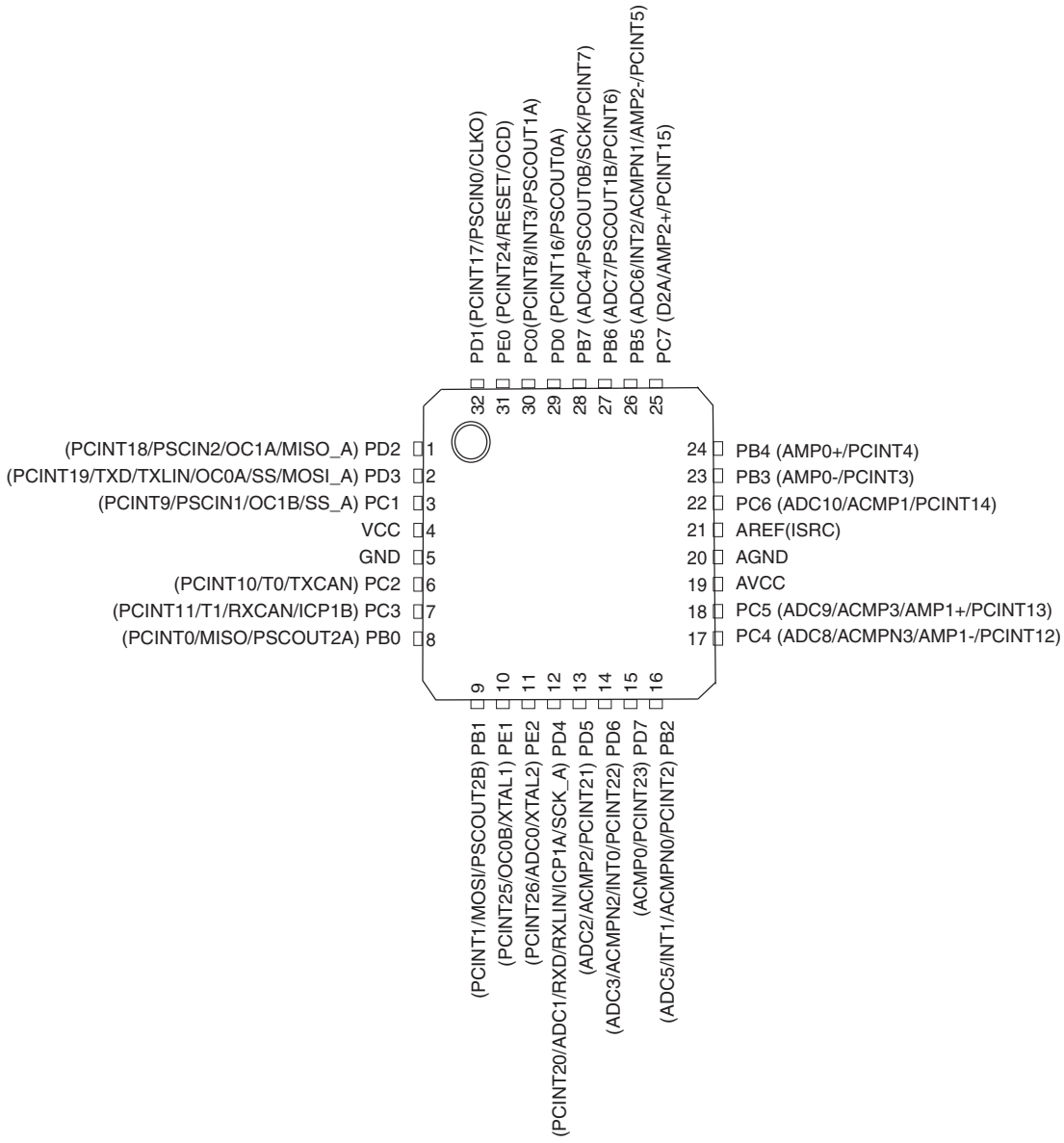
Preliminary

Summary

8209AS–AVR–08/09

1. Pin Configurations

Figure 1-1. ATmega16M1/32M1/64M1 TQFP32/QFN32 (7*7 mm) Package.



1.1 Pin Descriptions

Table 1-1. Pin out description

QFN32 Pin Number	Mnemonic	Type	Name, Function & Alternate Function
5	GND	Power	**Ground:** 0V reference
20	AGND	Power	**Analog Ground:** 0V reference for analog part
4	VCC	Power	**Power Supply**
19	AVCC	Power	**Analog Power Supply:** This is the power supply voltage for analog part For a normal use this pin must be connected.
21	AREF	Power	**Analog Reference :** reference for analog converter . This is the reference voltage of the A/D converter. As output, can be used by external analog ISRC (Current Source Output)
8	PB0	I/O	MISO (SPI Master In Slave Out) PSCOUT2A(1) (PSC Module 2 Output A) PCINT0 (Pin Change Interrupt 0)
9	PB1	I/O	MOSI (SPI Master Out Slave In) PSCOUT2B(1) (PSC Module 2 Output B) PCINT1 (Pin Change Interrupt 1)
16	PB2	I/O	ADC5 (Analog Input Channel 5) INT1 (External Interrupt 1 Input) ACMPN0 (Analog Comparator 0 Negative Input) PCINT2 (Pin Change Interrupt 2)
23	PB3	I/O	AMP0- (Analog Differential Amplifier 0 Negative Input) PCINT3 (Pin Change Interrupt 3)
24	PB4	I/O	AMP0+ (Analog Differential Amplifier 0 Positive Input) PCINT4 (Pin Change Interrupt 4)
26	PB5	I/O	ADC6 (Analog Input Channel 6) INT2 (External Interrupt 2 Input) ACMPN1 (Analog Comparator 1 Negative Input) AMP2- (Analog Differential Amplifier 2 Negative Input) PCINT5 (Pin Change Interrupt 5)
27	PB6	I/O	ADC7 (Analog Input Channel 7) PSCOUT1B(1) (PSC Module 1 Output A) PCINT6 (Pin Change Interrupt 6)
28	PB7	I/O	ADC4 (Analog Input Channel 4) PSCOUT0B(1) (PSC Module 0 Output B) SCK (SPI Clock) PCINT7 (Pin Change Interrupt 7)
30	PC0	I/O	PSCOUT1A(1) (PSC Module 1 Output A) INT3 (External Interrupt 3 Input) PCINT8 (Pin Change Interrupt 8)

Table 1-1. Pin out description (Continued)

QFN32 Pin Number	Mnemonic	Type	Name, Function & Alternate Function
3	PC1	I/O	PSCIN1 (PSC Digital Input 1) OC1B (Timer 1 Output Compare B) SS_A (Alternate SPI Slave Select) PCINT9 (Pin Change Interrupt 9)
6	PC2	I/O	T0 (Timer 0 clock input) TXCAN (CAN Transmit Output) PCINT10 (Pin Change Interrupt 10)
7	PC3	I/O	T1 (Timer 1 clock input) RXCAN (CAN Receive Input) ICP1B (Timer 1 input capture alternate B input) PCINT11 (Pin Change Interrupt 11)
17	PC4	I/O	ADC8 (Analog Input Channel 8) AMP1- (Analog Differential Amplifier 1 Negative Input) ACMPN3 (Analog Comparator 3 Negative Input) PCINT12 (Pin Change Interrupt 12)
18	PC5	I/O	ADC9 (Analog Input Channel 9) AMP1+ (Analog Differential Amplifier 1 Positive Input) ACMP3 (Analog Comparator 3 Positive Input) PCINT13 (Pin Change Interrupt 13)
22	PC6	I/O	ADC10 (Analog Input Channel 10) ACMP1 (Analog Comparator 1 Positive Input) PCINT14 (Pin Change Interrupt 14)
25	PC7	I/O	D2A (DAC output) AMP2+ (Analog Differential Amplifier 2 Positive Input) PCINT15 (Pin Change Interrupt 15)
29	PD0	I/O	PSCOUT0A[1] (PSC Module 0 Output A) PCINT16 (Pin Change Interrupt 16)
32	PD1	I/O	PSCIN0 (PSC Digital Input 0) CLKO (System Clock Output) PCINT17 (Pin Change Interrupt 17)
1	PD2	I/O	OC1A (Timer 1 Output Compare A) PSCIN2 (PSC Digital Input 2) MISO_A (Programming & alternate SPI Master In Slave Out) PCINT18 (Pin Change Interrupt 18)
2	PD3	I/O	TXD (UART Tx data) TXLIN (LIN Transmit Output) OC0A (Timer 0 Output Compare A) SS (SPI Slave Select) MOSI_A (Programming & alternate Master Out SPI Slave In) PCINT19 (Pin Change Interrupt 19)

Table 1-1. Pin out description (Continued)

QFN32 Pin Number	Mnemonic	Type	Name, Function & Alternate Function
12	PD4	I/O	ADC1 (Analog Input Channel 1) RXD (UART Rx data) RXLIN (LIN Receive Input) ICP1A (Timer 1 input capture alternate A input) SCK_A (Programming & alternate SPI Clock) PCINT20 (Pin Change Interrupt 20)
13	PD5	I/O	ADC2 (Analog Input Channel 2) ACMP2 (Analog Comparator 2 Positive Input) PCINT21 (Pin Change Interrupt 21)
14	PD6	I/O	ADC3 (Analog Input Channel 3) ACMPN2 (Analog Comparator 2 Negative Input) INT0 (External Interrupt 0 Input) PCINT22 (Pin Change Interrupt 22)
15	PD7	I/O	ACMP0 (Analog Comparator 0 Positive Input) PCINT23 (Pin Change Interrupt 23)
31	PE0	I/O or I	RESET (Reset Input) OCD (On Chip Debug I/O) PCINT24 (Pin Change Interrupt 24)
10	PE1	I/O	XTAL1 (XTAL Input) OC0B (Timer 0 Output Compare B) PCINT25 (Pin Change Interrupt 25)
11	PE2	I/O	XTAL2 (XTAL Output) ADC0 (Analog Input Channel 0) PCINT26 (Pin Change Interrupt 26)

Note: 1. Only for Atmega32M1/64M1.

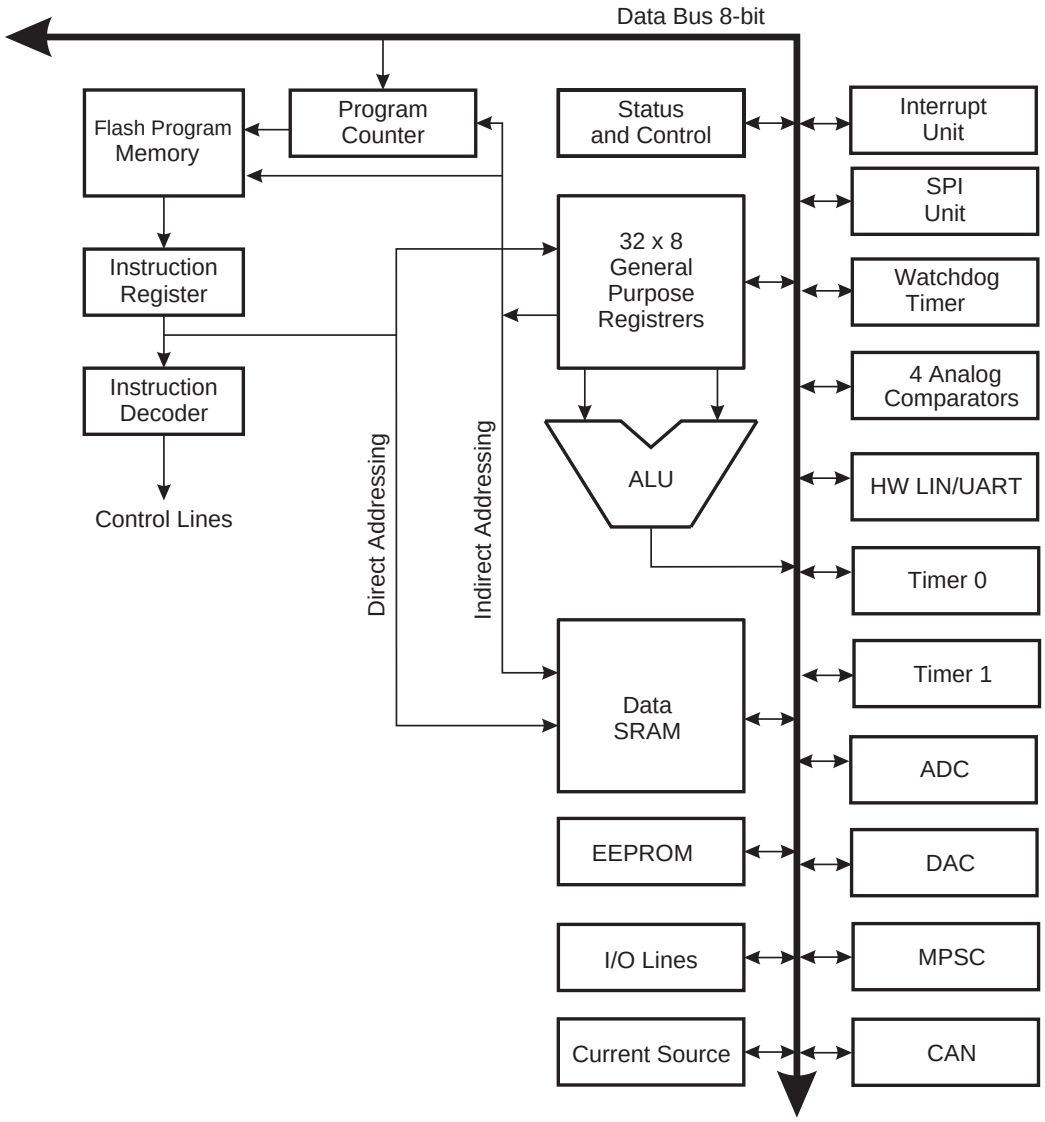
2. On the engineering samples, the ACMPN3 alternate function is not located on PC4. It is located on PE2.

2. Overview

The ATmega16M1/32M1/64M1 is a low-power CMOS 8-bit microcontroller based on the AVR enhanced RISC architecture. By executing powerful instructions in a single clock cycle, the ATmega16M1/32M1/64M1 achieves throughputs approaching 1 MIPS per MHz allowing the system designer to optimize power consumption versus processing speed.

2.1 Block Diagram

Figure 2-1. Block Diagram



The AVR core combines a rich instruction set with 32 general purpose working registers. All the 32 registers are directly connected to the Arithmetic Logic Unit (ALU), allowing two independent registers to be accessed in one single instruction executed in one clock cycle. The resulting architecture is more code efficient while achieving throughputs up to ten times faster than conventional CISC microcontrollers.

The ATmega16M1/32M1/64M1 provides the following features: 16/32/64K bytes of In-System Programmable Flash with Read-While-Write capabilities, 512B/1K/2K bytes EEPROM, 1/2/4K bytes SRAM, 27 general purpose I/O lines, 32 general purpose working registers, one Motor Power Stage Controller, two flexible Timer/Counters with compare modes and PWM, one UART with HW LIN, an 11-channel 10-bit ADC with two differential input stages with programmable gain, a 10-bit DAC, a programmable Watchdog Timer with Internal Individual Oscillator, an SPI serial port, an On-chip Debug system and four software selectable power saving modes.

The Idle mode stops the CPU while allowing the SRAM, Timer/Counters, SPI ports, CAN, LIN/UART and interrupt system to continue functioning. The Power-down mode saves the register contents but freezes the Oscillator, disabling all other chip functions until the next interrupt or Hardware Reset. The ADC Noise Reduction mode stops the CPU and all I/O modules except ADC, to minimize switching noise during ADC conversions. In Standby mode, the Crystal/Resonator Oscillator is running while the rest of the device is sleeping. This allows very fast start-up combined with low power consumption.

The device is manufactured using Atmel's high-density nonvolatile memory technology. The On-chip ISP Flash allows the program memory to be reprogrammed in-system through an SPI serial interface, by a conventional nonvolatile memory programmer, or by an On-chip Boot program running on the AVR core. The boot program can use any interface to download the application program in the application Flash memory. Software in the Boot Flash section will continue to run while the Application Flash section is updated, providing true Read-While-Write operation. By combining an 8-bit RISC CPU with In-System Self-Programmable Flash on a monolithic chip, the Atmel ATmega16M1/32M1/64M1 is a powerful microcontroller that provides a highly flexible and cost effective solution to many embedded control applications.

The ATmega16M1/32M1/64M1 AVR is supported with a full suite of program and system development tools including: C compilers, macro assemblers, program debugger/simulators, in-circuit emulators, and evaluation kits.

2.2 Pin Descriptions

2.2.1 VCC

Digital supply voltage.

2.2.2 GND

Ground.

2.2.3 Port B (PB7..PB0)

Port B is an 8-bit bi-directional I/O port with internal pull-up resistors (selected for each bit). The Port B output buffers have symmetrical drive characteristics with both high sink and source capability. As inputs, Port B pins that are externally pulled low will source current if the pull-up resistors are activated. The Port B pins are tri-stated when a reset condition becomes active, even if the clock is not running.

Port B also serves the functions of various special features of the ATmega16M1/32M1/64M1 as listed on page 72.

2.2.4 Port C (PC7..PC0)

Port C is an 8-bit bi-directional I/O port with internal pull-up resistors (selected for each bit). The Port C output buffers have symmetrical drive characteristics with both high sink and source capability. As inputs, Port C pins that are externally pulled low will source current if the pull-up resistors are activated. The Port C pins are tri-stated when a reset condition becomes active, even if the clock is not running.

Port C also serves the functions of special features of the ATmega16M1/32M1/64M1 as listed on page 75.

2.2.5 Port D (PD7..PD0)

Port D is an 8-bit bi-directional I/O port with internal pull-up resistors (selected for each bit). The Port D output buffers have symmetrical drive characteristics with both high sink and source capability. As inputs, Port D pins that are externally pulled low will source current if the pull-up resistors are activated. The Port D pins are tri-stated when a reset condition becomes active, even if the clock is not running.

Port D also serves the functions of various special features of the ATmega16M1/32M1/64M1 as listed on page 79.

2.2.6 Port E (PE2..0) $\overline{\text{RESET}}$/ XTAL1/ XTAL2

Port E is an 3-bit bi-directional I/O port with internal pull-up resistors (selected for each bit). The Port E output buffers have symmetrical drive characteristics with both high sink and source capability. As inputs, Port E pins that are externally pulled low will source current if the pull-up resistors are activated. The Port E pins are tri-stated when a reset condition becomes active, even if the clock is not running.

If the RSTDISBL Fuse is programmed, PE0 is used as an I/O pin. Note that the electrical characteristics of PE0 differ from those of the other pins of Port E.

If the RSTDISBL Fuse is unprogrammed, PE0 is used as a Reset input. A low level on this pin for longer than the minimum pulse length will generate a Reset, even if the clock is not running. The minimum pulse length is given in “System and Reset Characteristics” on page 313. Shorter pulses are not guaranteed to generate a Reset.

Depending on the clock selection fuse settings, PE1 can be used as input to the inverting Oscillator amplifier and input to the internal clock operating circuit.

Depending on the clock selection fuse settings, PE2 can be used as output from the inverting Oscillator amplifier.

The various special features of Port E are elaborated in “Alternate Functions of Port E” on page 82 and “Clock Systems and their Distribution” on page 27.

2.2.7 AVCC

AVCC is the supply voltage pin for the A/D Converter, D/A Converter, Current source. It should be externally connected to V_{CC}, even if the ADC, DAC are not used. If the ADC is used, it should be connected to V_{CC} through a low-pass filter.

2.2.8 AREF

This is the analog reference pin for the A/D Converter.

3. Disclaimer

Typical values contained in this datasheet are based on simulations and characterization of other AVR microcontrollers manufactured on the same process technology. Min and Max values will be available after the device is characterized.

4. Resources

A comprehensive set of development tools, application notes and datasheets are available for download on http://www.atmel.com/avr.

5. Data Retention

Reliability Qualification results show that the projected data retention failure rate is much less than 1 PPM over 20 years at 85°C or 100 years at 25°C.

6. Register Summary

Address	Name	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Page
(0xFF)	**Reserved**	–	–	–	–	–	–	–	–	
(0xFE)	**Reserved**	–	–	–	–	–	–	–	–	
(0xFD)	**Reserved**	–	–	–	–	–	–	–	–	
(0xFC)	**Reserved**	–	–	–	–	–	–	–	–	
(0xFB)	**Reserved**	–	–	–	–	–	–	–	–	
(0xFA)	**CANMSG**	MSG 7	MSG 6	MSG 5	MSG 4	MSG 3	MSG 2	MSG 1	MSG 0	page 197
(0xF9)	**CANSTMPH**	TIMSTM15	TIMSTM14	TIMSTM13	TIMSTM12	TIMSTM11	TIMSTM10	TIMSTM9	TIMSTM8	page 197
(0xF8)	**CANSTMPL**	TIMSTM7	TIMSTM6	TIMSTM5	TIMSTM4	TIMSTM3	TIMSTM2	TIMSTM1	TIMSTM0	page 197
(0xF7)	**CANIDM1**	IDMSK28	IDMSK27	IDMSK26	IDMSK25	IDMSK24	IDMSK23	IDMSK22	IDMSK21	page 196
(0xF6)	**CANIDM2**	IDMSK20	IDMSK19	IDMSK18	IDMSK17	IDMSK16	IDMSK15	IDMSK14	IDMSK13	page 196
(0xF5)	**CANIDM3**	IDMSK12	IDMSK11	IDMSK10	IDMSK9	IDMSK8	IDMSK7	IDMSK6	IDMSK5	page 196
(0xF4)	**CANIDM4**	IDMSK4	IDMSK3	IDMSK2	IDMSK1	IDMSK0	RTRMSK	–	IDEMSK	page 196
(0xF3)	**CANIDT1**	IDT28	IDT27	IDT26	IDT25	IDT24	IDT23	IDT22	IDT21	page 194
(0xF2)	**CANIDT2**	IDT20	IDT19	IDT18	IDT17	IDT16	IDT15	IDT14	IDT13	page 194
(0xF1)	**CANIDT3**	IDT12	IDT11	IDT10	IDT9	IDT8	IDT7	IDT6	IDT5	page 194
(0xF0)	**CANIDT4**	IDT4	IDT3	IDT2	IDT1	IDT0	RTRTAG	RB1TAG	RB0TAG	page 194
(0xEF)	**CANCDMOB**	CONMOB1	CONMOB0	RPLV	IDE	DLC3	DLC2	DLC1	DLC0	page 193
(0xEE)	**CANSTMOB**	DLCW	TXOK	RXOK	BERR	SERR	CERR	FERR	AERR	page 192
(0xED)	**CANPAGE**	MOBNB3	MOBNB2	MOBNB1	MOBNB0	$\overline{\text{AINC}}$	INDX2	INDX1	INDX0	page 192
(0xEC)	**CANHPMOB**	HPMOB3	HPMOB2	HPMOB1	HPMOB0	CGP3	CGP2	CGP1	CGP0	page 191
(0xEB)	**CANREC**	REC7	REC6	REC5	REC4	REC3	REC2	REC1	REC0	page 191
(0xEA)	**CANTEC**	TEC7	TEC6	TEC5	TEC4	TEC3	TEC2	TEC1	TEC0	page 191
(0xE9)	**CANTTCH**	TIMTTC15	TIMTTC14	TIMTTC13	TIMTTC12	TIMTTC11	TIMTTC10	TIMTTC9	TIMTTC8	page 191
(0xE8)	**CANTTCL**	TIMTTC7	TIMTTC6	TIMTTC5	TIMTTC4	TIMTTC3	TIMTTC2	TIMTTC1	TIMTTC0	page 191
(0xE7)	**CANTIMH**	CANTIM15	CANTIM14	CANTIM13	CANTIM12	CANTIM11	CANTIM10	CANTIM9	CANTIM8	page 191
(0xE6)	**CANTIML**	CANTIM7	CANTIM6	CANTIM5	CANTIM4	CANTIM3	CANTIM2	CANTIM1	CANTIM0	page 191
(0xE5)	**CANTCON**	TPRSC7	TPRSC6	TPRSC5	TPRSC4	TPRSC3	TPRSC2	TRPSC1	TPRSC0	page 190
(0xE4)	**CANBT3**	–	PHS22	PHS21	PHS20	PHS12	PHS11	PHS10	SMP	page 190
(0xE3)	**CANBT2**	–	SJW1	SJW0	–	PRS2	PRS1	PRS0	–	page 189
(0xE2)	**CANBT1**	–	BRP5	BRP4	BRP3	BRP2	BRP1	BRP0	–	page 188
(0xE1)	**CANSIT1**	–	–	–	–	–	–	–	–	page 188
(0xE0)	**CANSIT2**	–	–	SIT5	SIT4	SIT3	SIT2	SIT1	SIT0	page 188
(0xDF)	**CANIE1**	–	–	–	–	–	–	–	–	page 188
(0xDE)	**CANIE2**	–	–	IEMOB5	IEMOB4	IEMOB3	IEMOB2	IEMOB1	IEMOB0	page 188
(0xDD)	**CANEN1**	–	–	–	–	–	–	–	–	page 187
(0xDC)	**CANEN2**	–	–	ENMOB5	ENMOB4	ENMOB3	ENMOB2	ENMOB1	ENMOB0	page 187
(0xDB)	**CANGIE**	ENIT	ENBOFF	ENRX	ENTX	ENERR	ENBX	ENERG	ENOVRT	page 186
(0xDA)	**CANGIT**	CANIT	BOFFIT	OVRTIM	BXOK	SERG	CERG	FERG	AERG	page 185
(0xD9)	**CANGSTA**	–	OVRG	–	TXBSY	RXBSY	ENFG	BOFF	ERRP	page 184
(0xD8)	**CANGCON**	ABRQ	OVRQ	TTC	SYNTTC	LISTEN	TEST	ENA/$\overline{\text{STB}}$	SWRES	page 183
(0xD7)	**Reserved**	–	–	–	–	–	–	–	–	
(0xD6)	**Reserved**	–	–	–	–	–	–	–	–	
(0xD5)	**Reserved**	–	–	–	–	–	–	–	–	
(0xD4)	**Reserved**	–	–	–	–	–	–	–	–	
(0xD3)	**Reserved**	–	–	–	–	–	–	–	–	
(0xD2)	**LINDAT**	LDATA7	LDATA6	LDATA5	LDATA4	LDATA3	LDATA2	LDATA1	LDATA0	page 224
(0xD1)	**LINSEL**	–	–	–	–	/LAINC	LINDX2	LINDX1	LINDX0	page 223
(0xD0)	**LINIDR**	LP1	LP0	LID5 / LDL1	LID4 / LDL0	LID3	LID2	LID1	LID0	page 223
(0xCF)	**LINDLR**	LTXDL3	LTXDL2	LTXDL1	LTXDL0	LRXDL3	LRXDL2	LRXDL1	LRXDL0	page 222
(0xCE)	**LINBRRH**	–	–	–	–	LDIV11	LDIV10	LDIV9	LDIV8	page 222
(0xCD)	**LINBRRL**	LDIV7	LDIV6	LDIV5	LDIV4	LDIV3	LDIV2	LDIV1	LDIV0	page 222
(0xCC)	**LINBTR**	LDISR	–	LBT5	LBT4	LBT3	LBT2	LBT1	LBT0	page 222
(0xCB)	**LINERR**	LABORT	LTOERR	LOVERR	LFERR	LSERR	LPERR	LCERR	LBERR	page 221
(0xCA)	**LINENIR**	–	–	–	–	LENERR	LENIDOK	LENTXOK	LENRXOK	page 220
(0xC9)	**LINSIR**	LIDST2	LIDST1	LIDST0	LBUSY	LERR	LIDOK	LTXOK	LRXOK	page 219
(0xC8)	**LINCR**	LSWRES	LIN13	LCONF1	LCONF0	LENA	LCMD2	LCMD1	LCMD0	page 218
(0xC7)	**Reserved**	–	–	–	–	–	–	–	–	
(0xC6)	**Reserved**	–	–	–	–	–	–	–	–	
(0xC5)	**Reserved**	–	–	–	–	–	–	–	–	
(0xC4)	**Reserved**	–	–	–	–	–	–	–	–	
(0xC3)	**Reserved**	–	–	–	–	–	–	–	–	
(0xC2)	**Reserved**	–	–	–	–	–	–	–	–	
(0xC1)	**Reserved**	–	–	–	–	–	–	–	–	
(0xC0)	**Reserved**	–	–	–	–	–	–	–	–	
(0xBF)	**Reserved**	–	–	–	–	–	–	–	–	

Address	Name	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Page
(0xBE)	**Reserved**	–	–	–	–	–	–	–	–	
(0xBD)	**Reserved**	–	–	–	–	–	–	–	–	
(0xBC)[5]	**PIFR**	–	–	–	–	PEV2	PEV1	PEV0	PEOP	page 153
(0xBB)[5]	**PIM**	–	–	–	–	PEVE2	PEVE1	PEVE0	PEOPE	page 152
(0xBA)[5]	**PMIC2**	POVEN2	PISEL2	PELEV2	PFLTE2	PAOC2	PRFM22	PRFM21	PRFM20	page 151
(0xB9)[5]	**PMIC1**	POVEN1	PISEL1	PELEV1	PFLTE1	PAOC1	PRFM12	PRFM11	PRFM10	page 151
(0xB8)[5]	**PMIC0**	POVEN0	PISEL0	PELEV0	PFLTE0	PAOC0	PRFM02	PRFM01	PRFM00	page 151
(0xB7)[5]	**PCTL**	PPRE1	PPRE0	PCLKSEL	–	–	–	PCCYC	PRUN	page 151
(0xB6)[5]	**POC**	–	–	POEN2B	POEN2A	POEN1B	POEN1A	POEN0B	POEN0A	page 147
(0xB5)[5]	**PCNF**	–	–	PULOCK	PMODE	POPB	POPA	–	–	page 150
(0xB4)[5]	**PSYNC**	–	–	PSYNC21	PSYNC20	PSYNC11	PSYNC10	PSYNC01	PSYNC00	page 148
(0xB3)[5]	**POCR_RBH**	–	–	–	–	POCR_RB11	POCR_RB10	POCR_RB9	POCR_RB8	page 150
(0xB2)[5]	**POCR_RBL**	POCR_RB7	POCR_RB6	POCR_RB5	POCR_RB4	POCR_RB3	POCR_RB2	POCR_RB1	POCR_RB0	page 150
(0xB1)[5]	**POCR2SBH**	–	–	–	–	POCR2SB11	POCR2SB10	POCR2SB9	POCR2SB8	page 149
(0xB0)[5]	**POCR2SBL**	POCR2SB7	POCR2SB6	POCR2SB5	POCR2SB4	POCR2SB3	POCR2SB2	POCR2SB1	POCR2SB0	page 149
(0xAF)[5]	**POCR2RAH**	–	–	–	–	POCR2RA11	POCR2RA10	POCR2RA9	POCR2RA8	page 149
(0xAE)[5]	**POCR2RAL**	POCR2RA7	POCR2RA6	POCR2RA5	POCR2RA4	POCR2RA3	POCR2RA2	POCR2RA1	POCR2RA0	page 149
(0xAD)[5]	**POCR2SAH**	–	–	–	–	POCR2SA11	POCR2SA10	POCR2SA9	POCR2SA8	page 149
(0xAC)[5]	**POCR2SAL**	POCR2SA7	POCR2SA6	POCR2SA5	POCR2SA4	POCR2SA3	POCR2SA2	POCR2SA1	POCR2SA0	page 149
(0xAB)[5]	**POCR1SBH**	–	–	–	–	POCR1SB11	POCR1SB10	POCR1SB9	POCR1SB8	page 149
(0xAA)[5]	**POCR1SBL**	POCR1SB7	POCR1SB6	POCR1SB5	POCR1SB4	POCR1SB3	POCR1SB2	POCR1SB1	POCR1SB0	page 149
(0xA9)[5]	**POCR1RAH**	–	–	–	–	POCR1RA11	POCR1RA10	POCR1RA9	POCR1RA8	page 149
(0xA8)[5]	**POCR1RAL**	POCR1RA7	POCR1RA6	POCR1RA5	POCR1RA4	POCR1RA3	POCR1RA2	POCR1RA1	POCR1RA0	page 149
(0xA7)[5]	**POCR1SAH**	–	–	–	–	POCR1SA11	POCR1SA10	POCR1SA9	POCR1SA8	page 149
(0xA6)[5]	**POCR1SAL**	POCR1SA7	POCR1SA6	POCR1SA5	POCR1SA4	POCR1SA3	POCR1SA2	POCR1SA1	POCR1SA0	page 149
(0xA5)[5]	**POCR0SBH**	–	–	–	–	POCR0SB11	POCR0SB10	POCR0SB9	POCR0SB8	page 149
(0xA4)[5]	**POCR0SBL**	POCR0SB7	POCR0SB6	POCR0SB5	POCR0SB4	POCR0SB3	POCR0SB2	POCR0SB1	POCR0SB0	page 149
(0xA3)[5]	**POCR0RAH**	–	–	–	–	POCR0RA11	POCR0RA10	POCR0RA9	POCR0RA8	page 149
(0xA2)[5]	**POCR0RAL**	POCR0RA7	POCR0RA6	POCR0RA5	POCR0RA4	POCR0RA3	POCR0RA2	POCR0RA1	POCR0RA0	page 149
(0xA1)[5]	**POCR0SAH**	–	–	–	–	POCR0SA11	POCR0SA10	POCR0SA9	POCR0SA8	page 149
(0xA0)[5]	**POCR0SAL**	POCR0SA7	POCR0SA6	POCR0SA5	POCR0SA4	POCR0SA3	POCR0SA2	POCR0SA1	POCR0SA0	page 149
(0x9F)	**Reserved**	–	–	–	–	–	–	–	–	
(0x9E)	**Reserved**	–	–	–	–	–	–	–	–	
(0x9D)	**Reserved**	–	–	–	–	–	–	–	–	
(0x9C)	**Reserved**	–	–	–	–	–	–	–	–	
(0x9B)	**Reserved**	–	–	–	–	–	–	–	–	
(0x9A)	**Reserved**	–	–	–	–	–	–	–	–	
(0x99)	**Reserved**	–	–	–	–	–	–	–	–	
(0x98)	**Reserved**	–	–	–	–	–	–	–	–	
(0x97)	**AC3CON**	AC3EN	AC3IE	AC3IS1	AC3IS0	–	AC3M2	AC3M1	AC3M0	page 260
(0x96)	**AC2CON**	AC2EN	AC2IE	AC2IS1	AC2IS0	–	AC2M2	AC2M1	AC2M0	page 260
(0x95)	**AC1CON**	AC1EN	AC1IE	AC1IS1	AC1IS0	AC1ICE	AC1M2	AC1M1	AC1M0	page 259
(0x94)	**AC0CON**	AC0EN	AC0IE	AC0IS1	AC0IS0	ACCKSEL	AC0M2	AC0M1	AC0M0	page 258
(0x93)	**Reserved**	–	–	–	–	–	–	–	–	
(0x92)	**DACH**	- / DAC9	- / DAC8	- / DAC7	- / DAC6	- / DAC5	- / DAC4	DAC9 / DAC3	DAC8 / DAC2	page 268
(0x91)	**DACL**	DAC7 / DAC1	DAC6 /DAC0	DAC5 / -	DAC4 / -	DAC3 / -	DAC2 / -	DAC1 / -	DAC0 /	page 268
(0x90)	**DACON**	DAATE	DATS2	DATS1	DATS0	–	DALA	DAOE	DAEN	page 267
(0x8F)	**Reserved**	–	–	–	–	–	–	–	–	
(0x8E)	**Reserved**	–	–	–	–	–	–	–	–	
(0x8D)	**Reserved**	–	–	–	–	–	–	–	–	
(0x8C)	**Reserved**	–	–	–	–	–	–	–	–	
(0x8B)	**OCR1BH**	OCR1B15	OCR1B14	OCR1B13	OCR1B12	OCR1B11	OCR1B10	OCR1B9	OCR1B8	page 128
(0x8A)	**OCR1BL**	OCR1B7	OCR1B6	OCR1B5	OCR1B4	OCR1B3	OCR1B2	OCR1B1	OCR1B0	page 128
(0x89)	**OCR1AH**	OCR1A15	OCR1A14	OCR1A13	OCR1A12	OCR1A11	OCR1A10	OCR1A9	OCR1A8	page 128
(0x88)	**OCR1AL**	OCR1A7	OCR1A6	OCR1A5	OCR1A4	OCR1A3	OCR1A2	OCR1A1	OCR1A0	page 128
(0x87)	**ICR1H**	ICR115	ICR114	ICR113	ICR112	ICR111	ICR110	ICR19	ICR18	page 129
(0x86)	**ICR1L**	ICR17	ICR16	ICR15	ICR14	ICR13	ICR12	ICR11	ICR10	page 129
(0x85)	**TCNT1H**	TCNT115	TCNT114	TCNT113	TCNT112	TCNT111	TCNT110	TCNT19	TCNT18	page 128
(0x84)	**TCNT1L**	TCNT17	TCNT16	TCNT15	TCNT14	TCNT13	TCNT12	TCNT11	TCNT10	page 128
(0x83)	**Reserved**	–	–	–	–	–	–	–	–	
(0x82)	**TCCR1C**	FOC1A	FOC1B	–	–	–	–	–	–	page 127
(0x81)	**TCCR1B**	ICNC1	ICES1	–	WGM13	WGM12	CS12	CS11	CS10	page 126
(0x80)	**TCCR1A**	COM1A1	COM1A0	COM1B1	COM1B0	–	–	WGM11	WGM10	page 124
(0x7F)	**DIDR1**	–	AMP2PD	ACMP0D	AMP0PD	AMP0ND	ADC10D	ADC9D	ADC8D	page 248
(0x7E)	**DIDR0**	ADC7D	ADC6D	ADC5D	ADC4D	ADC3D	ADC2D	ADC1D	ADC0D	page 248
(0x7D)	**Reserved**	–	–	–	–	–	–	–	–	

Address	Name	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Page
(0x7C)	**ADMUX**	REFS1	REFS0	ADLAR	–	MUX3	MUX2	MUX1	MUX0	page 244
(0x7B)	**ADCSRB**	ADHSM	ISRCEN	AREFEN	–	ADTS3	ADTS2	ADTS1	ADTS0	page 246
(0x7A)	**ADCSRA**	ADEN	ADSC	ADATE	ADIF	ADIE	ADPS2	ADPS1	ADPS0	page 245
(0x79)	**ADCH**	- / ADC9	- / ADC8	- / ADC7	- / ADC6	- / ADC5	- / ADC4	ADC9 / ADC3	ADC8 / ADC2	page 247
(0x78)	**ADCL**	ADC7 / ADC1	ADC6 / ADC0	ADC5 / -	ADC4 / -	ADC3 / -	ADC2 / -	ADC1 / -	ADC0 /	page 247
(0x77)	**AMP2CSR**	AMP2EN	AMP2IS	AMP2G1	AMP2G0	AMPCMP2	AMP2TS2	AMP2TS1	AMP2TS0	page 250
(0x76)	**AMP1CSR**	AMP1EN	AMP1IS	AMP1G1	AMP1G0	AMPCMP1	AMP1TS2	AMP1TS1	AMP1TS0	page 250
(0x75)	**AMP0CSR**	AMP0EN	AMP0IS	AMP0G1	AMP0G0	AMPCMP0	AMP0TS2	AMP0TS1	AMP0TS0	page 249
(0x74)	**Reserved**	–	–	–	–	–	–	–	–	
(0x73)	**Reserved**	–	–	–	–	–	–	–	–	
(0x72)	**Reserved**	–	–	–	–	–	–	–	–	
(0x71)	**Reserved**	–	–	–	–	–	–	–	–	
(0x70)	**Reserved**	–	–	–	–	–	–	–	–	
(0x6F)	**TIMSK1**	–	–	ICIE1	–	–	OCIE1B	OCIE1A	TOIE1	page 129
(0x6E)	**TIMSK0**	–	–	–	–	–	OCIE0B	OCIE0A	TOIE0	page 101
(0x6D)	**PCMSK3**	–	–	–	–	–	PCINT26	PCINT25	PCINT24	page 63
(0x6C)	**PCMSK2**	PCINT23	PCINT22	PCINT21	PCINT20	PCINT19	PCINT18	PCINT17	PCINT16	page 64
(0x6B)	**PCMSK1**	PCINT15	PCINT14	PCINT13	PCINT12	PCINT11	PCINT10	PCINT9	PCINT8	page 64
(0x6A)	**PCMSK0**	PCINT7	PCINT6	PCINT5	PCINT4	PCINT3	PCINT2	PCINT1	PCINT0	page 64
(0x69)	**EICRA**	ISC31	ISC30	ISC21	ISC20	ISC11	ISC10	ISC01	ISC00	page 61
(0x68)	**Reserved**	–	–	–	–	–	–	–	–	
(0x67)	**Reserved**	–	–	–	–	–	–	–	–	
(0x66)	**OSCCAL**	–	CAL6	CAL5	CAL4	CAL3	CAL2	CAL1	CAL0	page 35
(0x65)	**Reserved**	–	–	–	–	–	–	–	–	
(0x64)	**PRR**	–	PRCAN	PRPSC	PRTIM1	PRTIM0	PRSPI	PRLIN	PRADC	page 42
(0x63)	**Reserved**	–	–	–	–	–	–	–	–	
(0x62)	**Reserved**	–	–	–	–	–	–	–	–	
(0x61)	**CLKPR**	CLKPCE	–	–	–	CLKPS3	CLKPS2	CLKPS1	CLKPS0	page 36
(0x60)	**WDTCSR**	WDIF	WDIE	WDP3	WDCE	WDE	WDP2	WDP1	WDP0	page 51
0x3F (0x5F)	**SREG**	I	T	H	S	V	N	Z	C	page 11
0x3E (0x5E)	**SPH**	SP15	SP14	SP13	SP12	SP11	SP10	SP9	SP8	page 14
0x3D (0x5D)	**SPL**	SP7	SP6	SP5	SP4	SP3	SP2	SP1	SP0	page 14
0x3C (0x5C)	**Reserved**	–	–	–	–	–	–	–	–	
0x3B (0x5B)	**Reserved**	–	–	–	–	–	–	–	–	
0x3A (0x5A)	**Reserved**	–	–	–	–	–	–	–	–	
0x39 (0x59)	**Reserved**	–	–	–	–	–	–	–	–	
0x38 (0x58)	**Reserved**	–	–	–	–	–	–	–	–	
0x37 (0x57)	**SPMCSR**	SPMIE	RWWSB	–	RWWSRE	BLBSET	PGWRT	PGERS	SPMEN	page 277
0x36 (0x56)	**Reserved**	–	–	–	–	–	–	–	–	
0x35 (0x55)	**MCUCR**	SPIPS	–	–	PUD	–	–	IVSEL	IVCE	page 58 & page 84
0x34 (0x54)	**MCUSR**	–	–	–	–	WDRF	BORF	EXTRF	PORF	page 51
0x33 (0x53)	**SMCR**	–	–	–	–	SM2	SM1	SM0	SE	page 38
0x32 (0x52)	**MSMCR**	Monitor Stop Mode Control Register								reserved
0x31 (0x51)	**MONDR**	Monitor Data Register								reserved
0x30 (0x50)	**ACSR**	AC3IF	AC2IF	AC1IF	AC0IF	AC3O	AC2O	AC1O	AC0O	page 262
0x2F (0x4F)	**Reserved**	–	–	–	–	–	–	–	–	
0x2E (0x4E)	**SPDR**	SPD7	SPD6	SPD5	SPD4	SPD3	SPD2	SPD1	SPD0	page 163
0x2D (0x4D)	**SPSR**	SPIF	WCOL	–	–	–	–	–	SPI2X	page 162
0x2C (0x4C)	**SPCR**	SPIE	SPE	DORD	MSTR	CPOL	CPHA	SPR1	SPR0	page 161
0x2B (0x4B)	**Reserved**	–	–	–	–	–	–	–	–	
0x2A (0x4A)	**Reserved**	–	–	–	–	–	–	–	–	
0x29 (0x49)	**PLLCSR**	-	-	-	-	-	PLLF	PLLE	PLOCK	page 35
0x28 (0x48)	**OCR0B**	OCR0B7	OCR0B6	OCR0B5	OCR0B4	OCR0B3	OCR0B2	OCR0B1	OCR0B0	page 101
0x27 (0x47)	**OCR0A**	OCR0A7	OCR0A6	OCR0A5	OCR0A4	OCR0A3	OCR0A2	OCR0A1	OCR0A0	page 101
0x26 (0x46)	**TCNT0**	TCNT07	TCNT06	TCNT05	TCNT04	TCNT03	TCNT02	TCNT01	TCNT00	page 101
0x25 (0x45)	**TCCR0B**	FOC0A	FOC0B	–	–	WGM02	CS02	CS01	CS00	page 100
0x24 (0x44)	**TCCR0A**	COM0A1	COM0A0	COM0B1	COM0B0	–	–	WGM01	WGM00	page 97
0x23 (0x43)	**GTCCR**	TSM	ICPSEL1	–	–	–	–	–	PSRSYNC	page 133
0x22 (0x42)	**EEARH**	–	–	–	–	–	–	EEAR9	EEAR8	page 22
0x21 (0x41)	**EEARL**	EEAR7	EEAR6	EEAR5	EEAR4	EEAR3	EEAR2	EEAR1	EEAR0	page 22
0x20 (0x40)	**EEDR**	EEDR7	EEDR6	EEDR5	EEDR4	EEDR3	EEDR2	EEDR1	EEDR0	page 22
0x1F (0x3F)	**EECR**	–	–	–	–	EERIE	EEMWE	EEWE	EERE	page 22
0x1E (0x3E)	**GPIOR0**	GPIOR07	GPIOR06	GPIOR05	GPIOR04	GPIOR03	GPIOR02	GPIOR01	GPIOR00	page 26
0x1D (0x3D)	**EIMSK**	–	–	–	–	INT3	INT2	INT1	INT0	page 61
0x1C (0x3C)	**EIFR**	–	–	–	–	INTF3	INTF2	INTF1	INTF0	page 62
0x1B (0x3B)	**PCIFR**	–	–	–	–	PCIF3	PCIF2	PCIF1	PCIF0	page 63

Address	Name	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Page
0x1A (0x3A)	**GPIOR2**	GPIOR27	GPIOR26	GPIOR25	GPIOR24	GPIOR23	GPIOR22	GPIOR21	GPIOR20	page 26
0x19 (0x39)	**GPIOR1**	GPIOR17	GPIOR16	GPIOR15	GPIOR14	GPIOR13	GPIOR12	GPIOR11	GPIOR10	page 26
0x18 (0x38)	**Reserved**	–	–	–	–	–	–	–	–	
0x17 (0x37)	**Reserved**	–	–	–	–	–	–	–	–	
0x16 (0x36)	**TIFR1**	–	–	ICF1	–	–	OCF1B	OCF1A	TOV1	page 130
0x15 (0x35)	**TIFR0**	–	–	–	–	–	OCF0B	OCF0A	TOV0	page 102
0x14 (0x34)	**Reserved**	–	–	–	–	–	–	–	–	
0x13 (0x33)	**Reserved**	–	–	–	–	–	–	–	–	
0x12 (0x32)	**Reserved**	–	–	–	–	–	–	–	–	
0x11 (0x31)	**Reserved**	–	–	–	–	–	–	–	–	
0x10 (0x30)	**Reserved**	–	–	–	–	–	–	–	–	
0x0F (0x2F)	**Reserved**	–	–	–	–	–	–	–	–	
0x0E (0x2E)	**PORTE**	–	–	–	–	–	PORTE2	PORTE1	PORTE0	page 85
0x0D (0x2D)	**DDRE**	–	–	–	–	–	DDE2	DDE1	DDE0	page 85
0x0C (0x2C)	**PINE**	–	–	–	–	–	PINE2	PINE1	PINE0	page 85
0x0B (0x2B)	**PORTD**	PORTD7	PORTD6	PORTD5	PORTD4	PORTD3	PORTD2	PORTD1	PORTD0	page 85
0x0A (0x2A)	**DDRD**	DDD7	DDD6	DDD5	DDD4	DDD3	DDD2	DDD1	DDD0	page 85
0x09 (0x29)	**PIND**	PIND7	PIND6	PIND5	PIND4	PIND3	PIND2	PIND1	PIND0	page 85
0x08 (0x28)	**PORTC**	PORTC7	PORTC6	PORTC5	PORTC4	PORTC3	PORTC2	PORTC1	PORTC0	page 84
0x07 (0x27)	**DDRC**	DDC7	DDC6	DDC5	DDC4	DDC3	DDC2	DDC1	DDC0	page 84
0x06 (0x26)	**PINC**	PINC7	PINC6	PINC5	PINC4	PINC3	PINC2	PINC1	PINC0	page 84
0x05 (0x25)	**PORTB**	PORTB7	PORTB6	PORTB5	PORTB4	PORTB3	PORTB2	PORTB1	PORTB0	page 84
0x04 (0x24)	**DDRB**	DDB7	DDB6	DDB5	DDB4	DDB3	DDB2	DDB1	DDB0	page 84
0x03 (0x23)	**PINB**	PINB7	PINB6	PINB5	PINB4	PINB3	PINB2	PINB1	PINB0	page 84
0x02 (0x22)	**Reserved**	–	–	–	–	–	–	–	–	
0x01 (0x21)	**Reserved**	–	–	–	–	–	–	–	–	
0x00 (0x20)	**Reserved**	–	–	–	–	–	–	–	–	

Note:
1. For compatibility with future devices, reserved bits should be written to zero if accessed. Reserved I/O memory addresses should never be written.
2. I/O Registers within the address range 0x00 - 0x1F are directly bit-accessible using the SBI and CBI instructions. In these registers, the value of single bits can be checked by using the SBIS and SBIC instructions.
3. Some of the status flags are cleared by writing a logical one to them. Note that, unlike most other AVRs, the CBI and SBI instructions will only operate on the specified bit, and can therefore be used on registers containing such status flags. The CBI and SBI instructions work with registers 0x00 to 0x1F only.
4. When using the I/O specific commands IN and OUT, the I/O addresses 0x00 - 0x3F must be used. When addressing I/O Registers as data space using LD and ST instructions, 0x20 must be added to these addresses. The ATmega16M1/32M1/64M1 is a complex microcontroller with more peripheral units than can be supported within the 64 location reserved in Opcode for the IN and OUT instructions. For the Extended I/O space from 0x60 - 0xFF in SRAM, only the ST/STS/STD and LD/LDS/LDD instructions can be used.
5. These registers are only available on ATmega32/64M1. For other products described in this datasheet, these locations are reserved.

7. Errata

7.1 Errata ATmega16M1

The revision letter in this section refers to revisions of the ATmega16M1 device.

7.1.1 Rev. A

Not samplet

7.2 Errata ATmega32M1

The revision letter in this section refers to revisions of the ATmega32M1 device.

7.2.1 Rev. A

Not samplet

7.3 Errata ATmega64M1

The revision letter in this section refers to revisions of the ATmega64M1 device.

7.3.1 Rev. A

Not samplet

8. Ordering Information

8.1 ATmega16M1

Speed	Power Supply	Ordering Code	Package	Operation Range
16MHz	2.7 - 5.5V	ATmega16M1 - AU	32A	Industrial (-40°C to 85°C)
		ATmega16M1 - MU	32M1-A	

Note: All packages are Pb free, fully LHF

Package Type	
32A	32-lead, Thin (1.0 mm) Plastic Quad Flat Package (TQFP)
32M1-A	32-pad, 5 x 5 x 1.0 body, Lead Pitch 0.50 mm Quad Flat No-Lead/Micro Lead Frame Package (QFN/MLF)

8.2 ATmega32M1

Speed	Power Supply	Ordering Code	Package	Operation Range
16MHz	2.7 - 5.5V	ATmega32M1 - AU	32A	Industrial (-40°C to 85°C)
		ATmega32M1 - MU	32M1-A	

Note: All packages are Pb free, fully LHF

Package Type	
32A	32-lead, Thin (1.0 mm) Plastic Quad Flat Package (TQFP)
32M1-A	32-pad, 5 x 5 x 1.0 body, Lead Pitch 0.50 mm Quad Flat No-Lead/Micro Lead Frame Package (QFN/MLF)

8.3 ATmega64M1

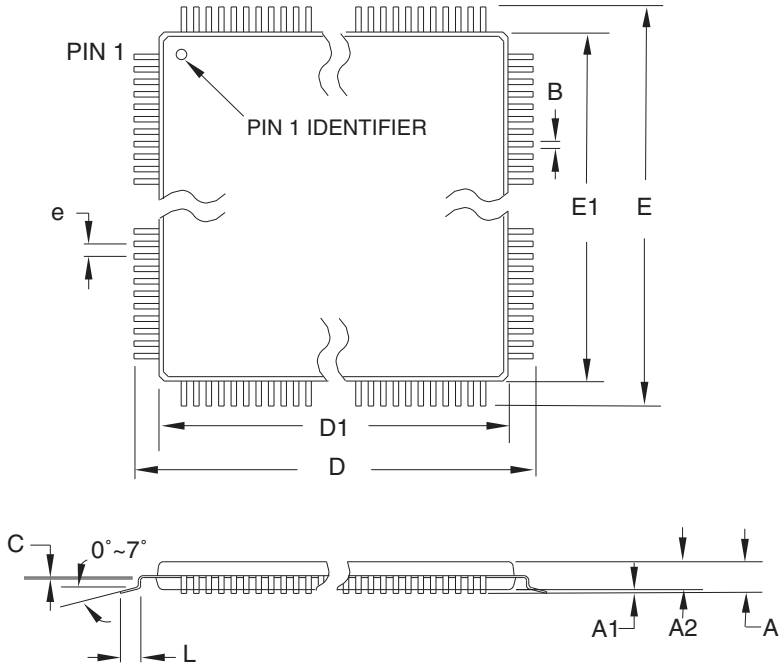
Speed	Power Supply	Ordering Code	Package	Operation Range
16MHz	2.7 - 5.5V	ATmega64M1 - AU	32A	Industrial (-40°C to 85°C)
		ATmega64M1 - MU	32M1-A	

Note: All packages are Pb free, fully LHF

Package Type	
32A	32-lead, Thin (1.0 mm) Plastic Quad Flat Package (TQFP)
32M1-A	32-pad, 5 x 5 x 1.0 body, Lead Pitch 0.50 mm Quad Flat No-Lead/Micro Lead Frame Package (QFN/MLF)

9. Packaging Information

9.1 32A



COMMON DIMENSIONS
(Unit of Measure = mm)

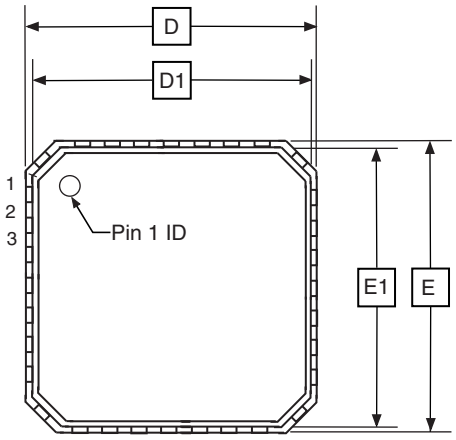
SYMBOL	MIN	NOM	MAX	NOTE
A	–	–	1.20	
A1	0.05	–	0.15	
A2	0.95	1.00	1.05	
D	8.75	9.00	9.25	
D1	6.90	7.00	7.10	Note 2
E	8.75	9.00	9.25	
E1	6.90	7.00	7.10	Note 2
B	0.30	–	0.45	
C	0.09	–	0.20	
L	0.45	–	0.75	
e	0.80 TYP			

Notes:
1. This package conforms to JEDEC reference MS-026, Variation ABA.
2. Dimensions D1 and E1 do not include mold protrusion. Allowable protrusion is 0.25 mm per side. Dimensions D1 and E1 are maximum plastic body size dimensions including mold mismatch.
3. Lead coplanarity is 0.10 mm maximum.

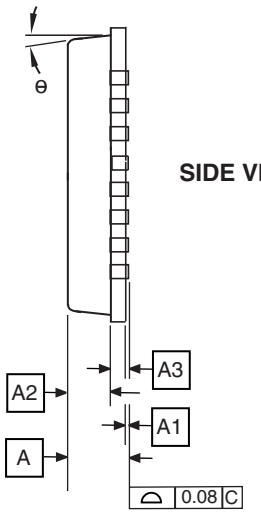
10/5/2001

	TITLE	DRAWING NO.	REV.
2325 Orchard Parkway San Jose, CA 95131	**32A,** 32-lead, 7 x 7 mm Body Size, 1.0 mm Body Thickness, 0.8 mm Lead Pitch, Thin Profile Plastic Quad Flat Package (TQFP)	32A	B

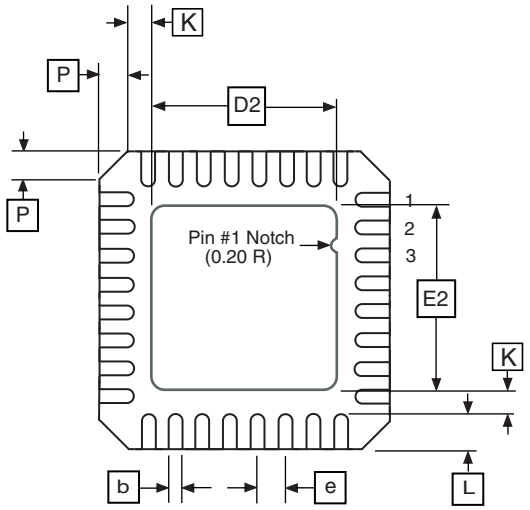
9.2 32M1-A



TOP VIEW



SIDE VIEW



BOTTOM VIEW

COMMON DIMENSIONS
(Unit of Measure = mm)

SYMBOL	MIN	NOM	MAX	NOTE
A	0.80	0.90	1.00	
A1	–	0.02	0.05	
A2	–	0.65	1.00	
A3		0.20 REF		
b	0.18	0.23	0.30	
D	4.90	5.00	5.10	
D1	4.70	4.75	4.80	
D2	2.95	3.10	3.25	
E	4.90	5.00	5.10	
E1	4.70	4.75	4.80	
E2	2.95	3.10	3.25	
e		0.50 BSC		
L	0.30	0.40	0.50	
P	–	–	0.60	
θ	–	–	12°	
K	0.20	–	–	

Note: JEDEC Standard MO-220, Fig. 2 (Anvil Singulation), VHHD-2.

5/25/06

	TITLE	DRAWING NO.	REV.
2325 Orchard Parkway San Jose, CA 95131	**32M1-A**, 32-pad, 5 x 5 x 1.0 mm Body, Lead Pitch 0.50 mm, 3.10 mm Exposed Pad, Micro Lead Frame Package (MLF)	32M1-A	E

10. Datasheet Revision History

Please note that the referring page numbers in this section are referred to this document. The referring revision in this section are referring to the document revision.

10.1 8209A – 08/09

1. Initial revision.

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