AVR® Microcontrollers Peripheral Integration

Quick Reference Guide

Product Family	Pin Count	Program Flash Memory (KB)	SRAM (KB)	Supply Voltage	Speed (MHz) Single Cycle Instruction: MHz = MIPS	Peripheral Function Focus																																		
						Intelligent Analog								Waveform Control				Timing and Measurements				Logic, Crypto and Math			Safety and Monitoring				Communications						User Interface			System Flexibility					
						ADC (# of bits)	ADC (# of channels)	Comparators	ADC Gain Stage	DAC (# of bits)	Temperature Sensor	Internal Voltage Reference	Zero Cross Detector (ZCD)	8-bit PWM	16-bit PWM	Quadrature Decoder	Waveform Extension (WeX)	Real-Time Counter	8-bit Timer/Counters	12-bit Timer Counter	16-bit Timer/Counter	CCL	MULT	Crypto (AES/DES)	CRC/SCAN	POR	BOD	WDT	USART	USB	I²C	SPI	IRCOM	Serial Number	QTouch® Technology	QTouch Technology with PTC (2)	LCD	External Bus Interface	DMA Channels	Event System	SleepWalking	Sleep Modes	picoPower® Technology
ATtiny4/5/9/10	6	0.5–1	0.032	1.8–5.5	12	10[3]	4[3]	✓							2						1					✓		✓						✓							4	
ATtiny102/104	8/14	1	0.032	1.8–5.5	12	10	5/8	✓				✓			2						2					✓		✓	1												4	
ATtiny13A	8–20	1	0.064	1.8–5.5	20	10	4	✓							2										✓	✓	✓							✓						3	✓
ATtiny20/40	12–20	2/4	0.128/0.256	1.8–5.5	12	10	8/12	✓			✓			2	2				1		1					✓	✓	✓			1	1			✓						4	
ATtiny24A/44A/84A	14–20	2–8	Up to 0.512	1.8–5.5	20	10	8	✓	✓		✓	✓		2	2				1		1					✓	✓	✓			1	1			✓						4	✓
ATtiny48/88	28–32	4/8	Up to 0.512	1.8–5.5	16	10	8	✓			✓	✓		1	1				1		1					✓	✓	✓			1	1									3	✓
ATtiny87/167	20–32	8/16	0.512	1.8–5.5	16	10	11	✓			✓	✓		1	2				1		1					✓	✓	✓	1[8]		1	2									4	
ATtiny261A/461A/861A	20–32	2–8	Up to 0.512	1.8–5.5	20	10	11	✓	✓		✓	✓							1		1					✓	✓	✓			1	1			✓						4	✓
ATtiny20x/40x/80x/160x	8–24	2–16	Up to 1	1.8–5.5	20	10	12	✓			✓	✓			2			✓			1	✓	✓		✓	✓	✓	✓	1[1]		1	1		✓				✓	✓	3	✓
ATtiny21x/41x/81x/161x/321x	8–24	2–32	Up to 2	1.8–5.5	20	10	12	✓		8	✓	✓			2			✓		1	1	✓	✓		✓	✓	✓	✓	1[1]		1	1		✓		✓[4]			✓	✓	3	✓
ATtiny441/841	14–20	4/8	Up to 0.512	1.7–5.5	16	10	12	✓	✓		✓			1	2				1		2					✓	✓	✓	2		1	1									4	✓
ATtiny2313A	20	2	0.128	1.8–5.5	20	–	–	✓				✓		2	2				1		1					✓	✓	✓	1		1	2									3	✓
ATmega8A/16A/32A	28–44	8–32	1–2	2.7–5.5	16	10	8	✓						2	1			✓	2		1		✓			✓	✓	✓	1		1	1			✓						5	
ATmega8U2/16U2/32U2	32	8–32	0.5–1	2.7–5.5	16	–	–	✓			✓	✓		4	6			✓	2		3		✓			✓	✓	✓	2	✓	2	2									6	
ATmega16U4/32U4	32	16/32	1/2	2.7–5.5	16	10	12	✓			✓	✓		5					1		1		✓			✓	✓	✓	1	✓		1									6	
ATmega48PB/88PB/168PB/328PB	32	4–32	0.5–2	1.8–5.5	20	10	8	✓			✓	✓		4	2/6[6]			✓	2		1/3[6]		✓			✓	✓	✓	1/2[6]		1/2[6]	1/2[6]			✓	✓[6]					6	
ATmega80x/160x/320x/480x	28–48	8–48	1–6	1.8–5.5	20	10	16	✓			✓	✓		4	3			✓			5	✓	✓		✓	✓	✓	✓	4		1	1		✓				✓	✓	3	✓
ATmega64A/128A	64	64–128	4	2.7–5.5	16	10	8	✓	✓			✓		2	6				2		2		✓			✓	✓	✓	2		1	1			✓						6	
ATmega164PA/324PA/644PA/1284P	44	16–128	1–16	1.8–5.5	20	10	8	✓	✓			✓		4	2/2/4			✓	2		1/1/2		✓			✓	✓	✓	2		1	1			✓						6	✓
ATmega165PA/325PA/645P	44	16–64	1–4	1.8–5.5	16	10	8	✓				✓		4	6			✓	2		3		✓			✓	✓	✓	3		2	2									6	✓
ATmega169PA/329PA/649P	64	16–64	1–4	1.8–5.5	16	10	8	✓				✓		2	2			✓	2		1		✓			✓	✓	✓	1		1	1			✓		✓				5	
ATmega324PB	44	32	2	1.8–5.5	20	10	8	✓				✓		2	2			✓	2		1		✓			✓	✓	✓	1		1	1			✓	✓					5	
ATmega640/1280/2560/1281/2561	64–100	64–256	8	1.8–5.5	16	10	8/16	✓	✓			✓		4	6/12			✓	2		4		✓			✓	✓	✓	2/4		1	1			✓			✓[5]			6	
ATmega3290PA/6490P	100	32–64	2–4	1.8–5.5	20	10	8	✓	✓			✓		2	2			✓	2		1		✓			✓	✓	✓	1		1	1			✓		✓				5	
ATmega3250PA/6450P	100	32–64	2–4	1.8–5.5	20	10	8	✓	✓			✓		2	2			✓	2		1		✓			✓	✓	✓	1		1	1			✓						5	
AVR-DA Family	28-64	32-128	4–16	1.8–5.5	24	12	12	✓		10	✓	✓	1-3	9–17	3–6			✓		1	1–5	✓	✓		✓	✓	✓	✓	3–6		1–2	2	✓	✓		✓			✓	✓	3	✓
ATxmega A1U/A3U/A4U Family	44-100	16–128	2–8	1.6–3.6	32	12	12/16	✓	✓	12	✓	✓			5-8	✓	✓	✓			5-8		✓	✓		✓	✓	✓	5-8	✓	2-4	2-4	✓		✓			✓	4	✓		5	✓
ATxmega B1/B3 Family	64–100	64–128	4–8	1.6–3.6	32	12	8	✓	✓		✓	✓			2/3	✓	✓	✓			2/3		✓	✓	✓	✓	✓	✓	1/2	✓	1	1	✓	✓	✓		✓		2	✓		5	✓
ATxmega C3/D3/C4/D4 Family	44-64	16–384	2–32	1.6–3.6	32	12	12/16	✓	✓		✓	✓			4/5	✓	✓	✓			4/5		✓	✓	✓	✓	✓	✓	2/3	✓(7)	2	2	✓	✓	✓				✓			5	✓
ATxmega32E5 Family	32	8–32	1–4	1.6–3.6	32	12	16	✓	✓	12	✓	✓			3	✓	✓	✓			3	✓	✓	✓	✓	✓	✓	✓	2		1	1	✓	✓	✓				4	✓		5	✓

1: LIN port also **2:** Peripheral Touch Controller **3:** Only on the ATtiny5/10 **4:** Not on the ATtiny212/214/412/414/416 **5:** Only on the ATmega1281/2561 **6:** Only on the ATmega328PB **7:** Only on the C3 and C4 **8:** UART only LIN Port also

Terminology

INTELLIGENT ANALOG: Sensor Interfacing and Signal Conditioning	
ADC: Analog-to-Digital Converter	General purpose 10-/12-bit ADC
ADC Gain Stage: Analog-to-Digital Converter Gain Stage	Programmable gain stage, providing amplification steps on the differential input voltage
Comp: Comparator	General purpose rail-to-rail comparator
DAC: Digital-to-Analog Converter	Programmable voltage reference with multiple internal and external connections
VREF: Voltage Reference	Stable fixed voltage reference for use with integrated analog peripherals
ZCD: Zero Cross Detect	AC high-voltage zero-crossing detection for simplifying TRIAC control, synchronised switching control and timing
WAVEFORM CONTROL: PWM Drive and Waveform Generation	
PWM: Pulse Width Modulation	General purpose 10-bit PWM control
16-bit PWM: Standalone 16-bit PWM and 16-bit Timer/Counter	1. High-resolution 16-bit PWM with edge- and center-aligned modes 2. General purpose 16-bit timer/counter
WeX: Waveform Extension	1. Module for more customised and advanced waveform generation 2. Optimised for various types of motor, ballast and power stage control
TIMING AND MEASUREMENTS: Signal Measurement with Timing and Counter Control	
8-/12-/16-bit Timer	General purpose 8-/12-/16-bit timer/counter
LOGIC, CRYPTO AND MATH: Customizable Logic and Math Functions	
CCL: Configurable Custom Logic	1. Integrated combinational and sequential logic 2. Customer interconnection and re-routing of digital peripherals
MULT: Hardware Multiplier	MULTIPLY function of two 8-bit values with 16-bit result
Crypto (AES/DES)	Data encryption and decryption can be easily performed for both internally stored data or for small external data packets
SAFETY AND MONITORING: Hardware Monitoring and Fault Detection	
CRC/SCAN: Cyclical Redundancy Check with Memory Scan	Automatically calculates CRC checksum of Program/DataEE memory for NVM integrity
POR: Power-On Reset	Keeps the device in reset until the voltage is high enough. Ensures a safe start-up of logic and memories
BOD: Brownout Detector	Prevents code execution if voltage drops below a set threshold
WDT: Watchdog Timer	Monitors correct program operation. Constantly running timer with a configurable time-out period

COMMUNICATIONS: General, Industrial, Lighting and Automotive	
UART: Universal Asynchronous Receiver Transmitter	1. General purpose serial communications 2. Support for LIN
USB: Universal Serial Bus	Support for Full-Speed USB 2.0 device profiles
I²C: Inter-Integrated Circuit	General purpose 2-wire serial communications
SPI: Serial Peripheral Interface	General purpose 4-wire serial communications
IRCOM: Infrared Communication Module	Encodes and decodes data according to the IrDA communication protocol
Serial Number	Factory programmed unique ID useful in wired and wireless communications
USER INTERFACE: Capacitive Touch Sensing and LCD Control	
LCD: Liquid Crystal Display	Highly integrated segmented LCD controller
QTouch®: Microchip Proprietary Touch Technology	Provides a simple-to-use solution to realize touch-sensitive interfaces
QTouch with PTC: QTouch with Peripheral Touch Controller	Provides a simple-to-use solution to realize touch-sensitive interfaces with a Peripheral Touch Controller
LOW POWER AND SYSTEM FLEXIBILITY: Low-Power Technology, Peripheral and Interconnects	
DMA: Direct Memory Access	Moves data between memories and peripherals without CPU overhead, improving overall system performance and efficiency
Event System	Flexible routing of peripheral events, ability to control peripheral independent from the CPU
External Bus Interface	Highly flexible module for interfacing external memories and memory-addressable peripherals
picoPower® Technology	Low-power technology
Sleep Modes	Low-power saving modes, IDLE, power-down, power-save, standby and extended standby
SleepWalking	Ability to put the CPU core to sleep until a relevant event occurs

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