

**TABLE 2—16-BIT MICROPROCESSORS**

	Company	EEMBC member	Device family	Bus interface (bits)	Instruction width (bits)	Hardware multiplication support	CPU frequency (MHz)	Operating voltage (logic/I/O)	Typical power at maximum frequency
186	<b>AMD</b> <a href="http://www.amd.com">www.amd.com</a> Enter No. 395	Yes	Am186CC, Am186CH, Am186CU	20/16	16		25, 40, 50	3.3	0.6W
			Am186EM, Am186ES, Am186ED	20/16	16		20, 25, 33, 40	3.3 (20, 25), 5V (20, 25, 33, 40)	0.6 at 3.3V, 0.9W at 5V
			Am186ER	20/16	16		25, 33, 40, 50 (commercial and industrial)	3.3	0.6W
80C251 family	<b>Atmel</b> <a href="http://www.atmel-wm.com/nt/micro/">www.atmel-wm.com/nt/micro/</a> Enter No. 396	No	T80C251 CF1	8	16	8×8-bit	0 to 24	2.7 to 5.5	0.18W
			T83C251	8	16	8×8-bit	0 to 24	2.7 to 5.5	0.1W
Hitachi H8/300H	<b>Hitachi Semiconductor</b> <a href="http://www.semiconductor.hitachi.com">www.semiconductor.hitachi.com</a> Enter No. 397	Yes	H8/3007		16		16	2.7 to 5.5	50W at 3.3V, 80W at 5V
			H8/3052		16		20	2.7 to 5.5	55W at 5V, 12W at 3V, 75W at 5V
Hitachi H8S	<b>Hitachi Semiconductor</b> <a href="http://www.semiconductor.hitachi.com">www.semiconductor.hitachi.com</a> Enter No. 398	Yes	H8S/2134A		16		20	2.7 to 5.5	75W at 5V, 45W at 3V, 100W at 5V, 60W at 3V
			H8S/2238		16		16	2.7 to 5.5	30W at 5V, 13W at 3V, 45W at 5V, 40W at 3V
			H8S/2357		16		20	2.7 to 5.5	60W at 5V, 18W at 3V, 89W at 5V, 45W at 3V
			H8S/2623		16	16×16-bit, 32 MAC	20	2.7 to 5.5	80W at 5V, 25W at 3V, 122W at 5V, 62W at 3V
Infineon	<b>Infineon Technologies</b> <a href="http://www.infineon.com/products/">www.infineon.com/products/</a> Enter No. 399	Yes		Address: 24, code/data: 16, internal code: 32	16 and 32	16×16- and 32×16-bit, 16/16- and 32/16-bit division	16 to 40	2.7 to 5.5	69 to 500 mW
NEC k4	<b>NEC Electronics</b> <a href="http://www.necel.com">www.necel.com</a> Enter No. 400	Yes		Address: 24, data: 8/16	8	8×16-bit	16	1.8 to 5.5	5 mA at 3V, 5 mA
Philips XA	<b>Philips</b> <a href="http://www.philips.com">www.philips.com</a> Enter No. 401	Yes	XA-G30	N/A	16	16×16-bit	30	2.7 to 5.5	60 mA at 5V
			XA-G49	N/A	16	16×16-bit	30	5	110 mA at 5V
			XA-S7	N/A	16	16×16-bit	30	2.7 to 5.5	80 mA at 5V
Texas Instruments MSP430	<b>Texas Instruments</b> <a href="http://www.ti.com/sc/msp430">www.ti.com/sc/msp430</a> Enter No. 402	Yes	MSP430	16/16 (no external bus)	16	8×8-, 8×16-, 16×8-, 16×8-, 16-bit multiply and MAC	1 to 8	1.8 to 5.5	8.2 mW at 8 MHz
Toshiba TLC5-900	<b>Toshiba</b> <a href="http://www.toshiba.com/taec">www.toshiba.com/taec</a> Enter No. 403	Yes	H and L1 families	Address: 24, data: 8 or 16	8, 16, 32	8×8-bit, 16×16-bit	0.032 to 25	1.8 to 5.5	0.102W at 25 MHz
			H2 family	Address: 32, data: 8 or 16	8, 16, 32	8×8-bit, 16×16-bit	0.032 to 25	1.8 to 5.5	0.6W at 20 MHz

Power-down modes	Nonvolatile memory (kbytes)	SRAM	Timers	Serial I/O	Additional features	Price (10,000)
			Three	Two to four HDLC channels (Am186CC, Am186CH only), one high-speed USB-peripheral controller, two UART, one synchronous serial interface		\$5 to \$15
1 to 128 power-save factor			Three	One synchronous serial port, one or two asynchronous serial ports	Watchdog timer, two DMA channels, six or seven external/internal interrupts, 32 PIO pins, 12 chip selects, pulse-width demodulation	\$5 to \$15
1 to 128 power-save factor		32 kbytes	Three	One synchronous serial port, one asynchronous serial ports	Watchdog timer, two DMA channels, six or seven external/internal interrupts, 32 PIO pins, 13 chip selects	\$5 to \$15
Idle: 9.5 mA, power-down 2 $\mu$ A	ROM/OTP 16-32 kbyte	1 kbyte	Four 16-bit	Full-duplex UART, SPI, I <sup>2</sup> C	PCA, keyboard interface, watchdog timer	\$3 to \$6
Power-down: 2 $\mu$ A	Flash 256 kbyte	4.5 kbytes	Four 16-bit	ISO 7816 smart-card interface, SPI	Cryptographic processor (RSA), random-numbergenerator, security features, watchdog timer	\$6 to \$10
Sleep: 20 to 27mA at 2.7V, standby: 0.01 to 5 $\mu$ A		4 kbytes	Integrated unit with five-channel $\times$ 16-bit counters, input capture/output compare, PWM, watchdog, timing-pattern controller	Two synchronous/asynchronous SCI	Eight-channel DMA; DRAM-refresh controller; eight-channel, 10-bit, 8.4- $\mu$ sec-conversion ADC	\$5.01 to \$10
Sleep: 8 to 55 mA, halt 5 to 27 mA, standby: 0.01 to 5 $\mu$ A	512 flash	16 kbytes	Integrated unit with five-channel $\times$ 16-bit counters, input capture/output compare, PWM, watchdog, timing-pattern controller	Two synchronous/asynchronous SCI	Four-channel DMA; DRAM-refresh controller; two-channel, 8-bit DAC; smart-card interface; clock-pulse generator; eight-channel, 10-bit, 6.7- $\mu$ sec-conversion ADC	\$15.01 to \$25
Sleep: 35 to 85 mA, standby: 0.01 to 5 $\mu$ A	128 flash	4 kbytes	Three 8-bit, one 16-bit, one 14-bit PWM, two watchdogs	Three synchronous/asynchronous SCI	IrDA interface; smart-card interface; two-channel, 8-bit DAC; 32-kHz operation; eight-channel, 10-bit, 6.7- $\mu$ sec-conversion ADC	\$10.01 to \$25
Sleep: 9 to 55 mA, stop: 9 to 35 mA, standby: 0.01 to 5 $\mu$ A	256 flash	16 kbytes	Integrated unit with three-channel $\times$ 16-bit counters, input capture/output compare, PWM, two watchdogs	Three synchronous/asynchronous SCI	Data-transfer unit; two-channel, 8-bit DAC; smart-card interface; clock-pulse generator; four-channel, 10-bit, 6.7- $\mu$ sec-conversion ADC	\$10.01 to \$25
Sleep: 11 to 73 mA, standby: 0.01 to 5 $\mu$ A	128 flash	8 kbytes	Pulse unit with six-channel $\times$ 16-bit pulse-I/O processing; programmable pulse generator using pulse unit provides 16-bit output; two-channel $\times$ 8-bit; watchdog; 16-bit timing-pattern controller	Three synchronous/asynchronous SCI	Four-channel DMA; two-channel, 8-bit DAC; smart-card interface; 16-channel, 10-bit, 6.7- $\mu$ sec-conversion ADC, one-channel CAN	\$10.01 to \$25
Sleep: 18 to 84 mA, standby: 0.01 to 5 $\mu$ A	128 OTP	4 kbytes	Pulse unit with six-channel $\times$ 16-bit pulse I/O processing, programmable pulse generator using pulse unit provides 16-bit output; two-channel $\times$ 8-bit, watchdog, 16-bit timing-pattern controller	Three synchronous/asynchronous SCI	Four-cycle hardware MAC unit; four-channel DMA; two-channel, 8-bit DAC; smart-card interface; high-speed, eight-channel, 10-bit, 2.3- $\mu$ sec-conversion (1 $\mu$ sec continuous) ADC	\$10.01 to \$25
Power-down: 10 $\mu$ A, wakeable: 140 $\mu$ A, idle: from 420 $\mu$ A	32 to 256k ROM, 64 OTP	1 to 11 kbytes	3 $\times$ 16- to 13 $\times$ 16-bit, plus watchdog and baud-rate generators	Two to five serial channels. One to five ASC, one SPI, as many as one I <sup>2</sup> C, as many as CAN, USB	As many as 56 interrupts, 10-bit ADC with as many as 24 channels, capture compare with as many as 36 channels, real-time clock, CAN interface, PWM timer, bootstrap loader	\$3.50 to \$15
Halt, stop, idle	Flash	2 to 12 kbytes	Three to eight 8- and 16-bit	Three to five channels	ADC, DAC, macro service	\$3 to \$15
Idle: 22 mA; power-down 5 $\mu$ A	None	512 bytes	Three 16-bit	Two UARTs	Watchdog timer	\$5.25
Idle: 40 mA, power-down 30 $\mu$ A	64 flash	2 kbytes	Three 16-bit	Two UARTs	Watchdog timer	\$7.50
Idle: 35 mA, power-down: 5 $\mu$ A	32 OTP	1 kbyte	Four 16-bit	ISO 7816 smart-card interface, SPI	8-bit ADC, watchdog timer	\$7.50
LPM0: 70 $\mu$ W, LPM2: 24 $\mu$ W, LPM3: 3 $\mu$ W, LPM4: 2 $\mu$ W	1 to 60 flash, 4 to 32 OTP, 2 to 32 ROM	128 to 2048 bytes	Two to four 16-bit, one 8-bit	One or two UARTs, SPI (software I <sup>2</sup> C, additional UART)	200k-sample/sec ADC, analog comparator, 12 16-bit user CPU registers, internal and external interrupts, 6- $\mu$ sec maximum wake-up, code compatible	99 cents to \$5.95
Run, stop, and two idles	As much as 256 ROM/flash	4 to 8 kbytes	Eight 16-bit	As many as three UARTs	LED, ADC, DAC, watchdog timer, $\mu$ DMA	\$7 to \$35
Run, stop, and two idles	No	2 kbytes	Eight 16-bit	As many as three UARTs	LED, ADC, DAC, watchdog timer, $\mu$ DMA	\$10 to \$35