eXtreme Low Power Solutions for Wearable Applications

Summary

Extremely small, wearable devices are popular, either as stand-alone accessories or as companions for use with a smartphone. Wearable technology is being developed for many applications including medical diagnostics, fitness monitoring and personal entertainment.

Developers of wearable devices face many unique design challenges, including long battery life, extreme space efficiency and effortless cloud connectivity, while protecting sensitive user data. Microchip focuses on enabling you to develop highly integrated, cost-effective embedded systems with an MCU portfolio that meshes perfectly with the needs of wearable designs.

Ultra-Tight Power Budgets

Wearable devices run on batteries that are expected to last for weeks or months. To extend the battery life in these power-sensitive applications, PIC® microcontrollers with eXtreme Low Power (XLP) technology offer the industry's lowest currents for Run and Sleep modes.

When sensing data and executing code, wearable devices need to process and transmit information as fast and efficiently as possible, and then go back to sleep in order to optimize battery life. PIC MCUs with XLP technology operate as low as 30 µA/MHz and with speeds up to 16 MIPS, enabling power-efficient applications.

Typically, wearable devices spend most of their time in sleep mode until they are needed to measure biometric data. PIC MCUs with XLP technology consume sleep currents as low as 9 nA with flexible wake-up sources and a variety of low-power modes, retaining state, RAM and time. Also, PIC MCUs offer supervisory circuits to protect stored data and to ensure safe operation when batteries are depleted or changed.

Small Form Factor

In wearable device design, every millimeter counts. Our PIC MCU portfolio gives you the functional "building blocks" needed to architect your system with as few external components as possible. Flexible, integrated Core Independent Peripherals are designed to take the load off the CPU and reduce the amount of code needed. PIC MCUs enable you to combine several functional tasks onto a smaller, more cost-effective MCU.

Additionally, on-chip Intelligent Analog peripherals (ADCs, Op Amps, Slope Compensation and Zero Cross Detect) on PIC MCUs can be configured to autonomously provide data to the digital peripherals from sensors, touch buttons and feedback circuits for low latency and quick system response. This creates a higher-performance system, without higher clock speed and power consumption, resulting in a smaller battery. More space savings can be achieved with our small-footprint QFN packaging, making PIC MCUs the right choice to reduce size and BOM cost for wearable applications.

Effortless Connectivity

Wireless communication, such as Bluetooth® and Wi-Fi®, are emerging as the standard communication channels for wearable devices. Microchip's wireless modules offer drop-in functionality for optimum flexibility. Modules are available for Wi-Fi, Bluetooth 2.1 and 4.2 (BLE). A space-saving module with integrated antenna and on-board software stack enables you to add wireless connectivity to any design with minimum effort. These modules have already been certified by the FCC and international agencies.

Securing Personal Data

A growing number of wearable applications include some personal data and encrypting this data on the device adds another level of privacy when using Internet-based storage.

PIC MCUs with an integrated hardware crypto engine offer data encryption without sacrificing battery life. The hardware crypto engine saves power, performing encryption 10× faster than software algorithms, with a quick return to low-power sleep modes. Also, these MCUs include a random number generator for secure key generation and dedicated memory for secure key management. We also provide extensive security software libraries for devices that do not feature an integrated hardware crypto engine.

Featured XLP Products for Wearable Applications

Device Family	Flash Memory (KB)	Pins	Sleep (nA)	WDT (nA)	RTCC (nA)	Touch Sense	Core Independent Peripherals	ADC	DAC	Highlights
PIC18F "K42"	16–128	28–48	60	720	–	✓	✓	12-bit	5-bit	Vectored Interrupts, DMA
PIC16F153xx	3.5–28	8–48	50	500	–	✓	✓	10-bit	5-bit	Device Info Area, Memory Access Partition
PIC16F188xx	7–56	28–40	50	500	–	✓	✓	10-bit	5-bit	–
PIC16F191xx	7–56	28–64	50	500	400	✓	✓	12-bit	5-bit	LCD w/ Charge Pump, VBAT
PIC18F "K40"	16–128	28–64	50	500	–	✓	✓	10-bit	5-bit	–
PIC24FJ128GB204	64–128	28–44	380	240	300	✓	✓	12-bit	–	Crypto Engine, USB, VBAT
PIC24FJ128GA310	64–128	64–100	330	270	400	✓	✓	12-bit	–	LCD, VBAT
PIC24FJ128GC010	64–128	64–100	420	270	360	✓	✓	12-,16-bit	10-bit	OpAmps, USB, LCD, VBAT
PIC24FJ256GA705	64–256	28–48	190	220	350	✓	✓	12-bit	–	Small form factor packages
PIC24FJ256GB412	64–256	64–121	70	100	170	✓	✓	12-bit	–	Crypto Engine, USB, LCD, VBAT
PIC24FJ1024GB610	128–1024	64–100	190	220	350	✓	✓	12-bit	–	Large Memory, USB
PIC32MM "GPL"	16–64	20–36	500	80	450	–	✓	12-bit	5-bit	Small form factor packages
PIC32MM "GPM"	64–256	28–64	650	220	720	–	✓	12-bit	5-bit	Small form factor packages, USB
PIC32MX 1/2	128–256	28–44	673	800	710	✓	✓	10-bit	–	Audio and Graphics interfaces, USB, Advanced Analog

XLP Development Tools

We offer a wide range of development tools to support your low-power design effort. All are supported by a unified, MPLAB® X IDE, MPLAB Xpress Cloud-based IDE, MPLAB Code Configurator and comprehensive libraries for quick and easy device development.

XLP Development Boards

Part Number	Board Name	Support
DM164137	8-bit Curiosity Development Board	8-bit PIC® MCUs
DM164136	8-bit Curiosity HPC Development Board	8-bit PIC MCUs
DM240004	PIC24F Curiosity Development Board	16-bit PIC24F MCUs
DM240016	PIC24FJ256GA7 Curiosity Development Board	16-bit PIC24F MCUs
DM320101	PIC32MM Curiosity Development Board	32-bit PIC MCUs
DM320107	PIC32MM USB Curiosity Development Board	32-bit PIC MCUs
DM240001-2	Explorer 16/32 Development Board	16-bit PIC24 MCUs, dsPIC® DSCs and 32-bit PIC32 MCUs
DM240314	LCD Explorer XLP Development Board	16-bit PIC24F MCUs
DM240015	MPLAB® Starter Kit for PIC24F Intelligent	16-bit PIC24F "GC" MCUs

XLP Battery Life Estimator

The XLP Battery Life Estimator is a free software utility that aids in developing low-power applications with Microchip's XLP PIC MCUs. The easy-to-use utility models the active current, sleep current and the time spent in each mode to provide an estimate of battery life. New device profiles and battery specifications can be added, allowing you to save profiles and compare results.

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