

# PIC<sup>®</sup> XLP and SAM Ultra-Low Power 32-bit MCUs

Reduce Power Consumption While Maintaining Performance

## Summary

Microchip's ultra-low power SAM 32-bit ARM<sup>®</sup>-based and PIC32 eXtreme Low Power (XLP) MCU portfolio extends battery life from years to decades, reducing the number of times batteries need to be changed. It combines ultra-low power with Flash and SRAM that are large enough to run both the application and wireless stacks, ideal for a number of applications including the Internet of Things (IoT), consumer, industrial, medical and other battery-powered devices. 32-bit ultra-low power MCUs integrate peripherals and design techniques used to minimize power consumption in real-world applications.

### Technology and Innovation

- PicoPower<sup>®</sup> technology - ultra-low power process and design (SAM MCUs)
- eXtreme Low Power (XLP) technology (PIC32 MCUs)
- Multiple power sources and clocking options
  - Linear, switching and battery backup
- Power and clock gating
- Low-power analog and peripherals
- Flexible sleep modes
  - Scale performance vs. power consumption
- Event system and Sleepwalking

### Ultra-Low Power

- Active mode
  - 35  $\mu$ A/MHz
- Deep sleep
  - 200 nA
- SRAM retention (40 KB)
  - $\sim$ 1  $\mu$ A
- Wake up time
  - 1.2  $\mu$ s (idle state)
- Benchmarks (SAML21, Cortex<sup>®</sup> M0+)
  - 185 EEMBC ULPBench<sup>®</sup> Score
- Fully operational down to 1.62V
  - While still maintaining all functionality, including analog functions

### Advanced Peripherals Features

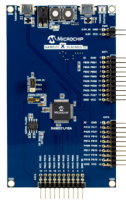
- Event system
  - CPU independent inter-peripheral communication offloading and minimizing CPU active time
- Sleepwalking with dynamic power gating
  - Allows MCU to be put into deep sleep and wake up only upon a pre-qualified event
- Low-power SERCOM and timer counters
- 2.84 x 2.84 mm WLCSP
- Peripheral touch controller
  - 4  $\mu$ A standby with multi-button, wake on touch support

## 32-bit Ultra-Low Power MCUs, Diverse Power and Performance Levels

	SAML21/22	SAMD5x	SAMD1/2x	SAM4L	SAMG5x	PIC32MX XLP
<b>Performance</b>	Cortex <sup>®</sup> M0+, 48/32 MHz	Cortex M4F, 120 MHz	Cortex M0+, 48 MHz	Cortex M4, 48 MHz	Cortex M4F, 48/96/120 MHz	MIPS32 M4K <sup>®</sup> 25 MHz
<b>Memory</b>	32–256 KB Flash, 4–32 KB SRAM	Up to 1 MB Flash, 256 KB SRAM	8–256 KB Flash, 2–32 KB SRAM	128–512 KB Flash, 32/64 KB SRAM	256–512 KB Flash, 64–176 KB SRAM	128–256 KB Flash, 32–64 KB RAM
<b>Active Current</b>	35 $\mu$ A/MHz	65 $\mu$ A/MHz	70 $\mu$ A/MHz	90 $\mu$ A/MHz	100 $\mu$ A/MHz	250 $\mu$ A/MHz
<b>Sleep Current SRAM Retention</b>	900 nA	10 $\mu$ A	3.5 $\mu$ A	1.5 $\mu$ A	7 $\mu$ A	13 $\mu$ A
<b>Wake Up Time</b>	1.2 $\mu$ s	5 $\mu$ s	4 $\mu$ s	1.5 $\mu$ s	3 $\mu$ s	–
<b>Back-up Mode</b>	200 nA	3 $\mu$ A	No back up mode	500 nA	1 $\mu$ A	673 nA
<b>Operating Voltage</b>	1.62V up to 3.6V	1.71V up to 3.6V	1.62V up to 3.6V	1.68V up to 3.6V	1.62V up to 3.6V	2.5V up to 3.6V
<b>Additional Features</b>	PicoPower <sup>®</sup> , Event System, SleepWalking	Event System, SleepWalking	Event System, SleepWalking	PicoPower, Event System, SleepWalking	PicoPower, Event System, SleepWalking	eXtreme Low Power (XLP)

## Featured Hardware and Software Development Tools

### SAML21 Xplained Pro Evaluation Kit (ATSAML21-XPRO-B)



This kit is ideal for evaluating and prototyping with the ultra-low power SAML21 ARM Cortex-M0+ based microcontrollers. Board includes embedded current measurement circuitry, with Data Visualizer support for data visualization and power measurement.

### SAME54 Xplained Pro (ATSAME54-XPRO)



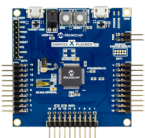
This kit is ideal for evaluating and prototyping with the ultra-low power SAMD5x and E54 ARM Cortex-M4F based microcontrollers. Board includes embedded current measurement circuitry, with Data Visualizer support for data visualization and power measurement. This is recommended when evaluating SAMD5x.

### SAMD21 Xplained Pro Evaluation Kit (ATSAMD21-XPRO)



This kit is ideal for evaluating and prototyping with the low-power, high-performance SAMD21 ARM Cortex-M0+ based Flash microcontroller.

### SAMG55 Xplained Pro Evaluation Kit (ATSAMG55-XPRO)



This kit is ideal for evaluation and prototyping with the SAMG55 Cortex-M4 processor-based microcontrollers.

### PIC32MX274 XLP Starter Kit (DM320105)



Fully integrated 32-bit development platform featuring the high performance PIC32MX274 series. Software compatible with existing PIC32MX class devices, the PIC32MX274 offers developers an increase in performance at almost half of the run current, enabling longer lasting, more feature rich battery applications.

### SAM4L Development System (ATSAM4L-EK)



This kit is ideal for evaluating and prototyping with the SAM4L Cortex-M4 processor-based microcontrollers. The board features an embedded debugger, dedicated circuitry to measure the power consumption of your application, LCD, USB, capacitive touch functionality and much more.

### Power Debugger (ATPOWERDEBUGGER)



Powerful development tool for debugging and programming AVR microcontrollers using UPDI, JTAG, PDI, debugWIRE, aWire, TPI or SPI target interfaces and ARM Cortex-M based SAM microcontrollers using JTAG or SWD target interfaces. The Power Debugger streams power measurements and application debug data to Data Visualizer for real-time analysis.

### XLP Battery Life Estimator

The XLP Battery Life Estimator is a free PC Software tool to aid in developing low-power applications with Microchip's SAM and PIC MCUs featuring PicoPower and XLP Technologies.

## Featured Reference Designs/Additional Tools

### Ultra-Low Power Connected Demonstrator, Featuring SAML21 and BTLC1000 (ULPC-DEMO)



This tool demonstrates the lowest power ARM Cortex-M0+, SAML21 for wearable applications. It includes a small size fully certified Bluetooth® module sensor tag with Android® app to display data, activity and environment monitor.

### Data Visualizer – Power Consumption Measurement and Visualization Analysis Software Tool



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