# PIC® XLP and SAM picoPower® Technology 32-bit MCUs

Reduce Power Consumption While Maintaining Performance

## Summary

Microchip’s picoPower® Technology SAM and eXtreme Low Power (XLP) PIC32 MCU portfolio provides best-in-class power consumption numbers and fast wake-up times. They offer flexible power-saving techniques that significantly improve the battery life, reducing the number of times batteries need to be changed. They combine 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. They utilize low-leakage processes and libraries to deliver industry-leading low power consumption in active and all sleep modes.

## Technology and Innovation

- **picoPower 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
    - 25 µA/MHz
  - Deep sleep
    - 100 nA
  - SRAM retention
    - 500 nA
  - Wake-up time
    - 1.2 µs (idle state)
  - Benchmarks (SAML11, Cortex® M23)
    - EEMBC Certified ULPMark: 410
  - Fully operational down to 1.62V
  - While still maintaining all functionality, including analog functions

## Advanced Features

- Chip-level security and Arm® TrustZone®
- Enhanced peripheral touch controller, water tolerant
  - 4 µA standby, wake on touch support
- 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
- 1.93 mm × 2.43 mm WLCSP

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

<table>
<thead>
<tr>
<th>32-bit Ultra-Low Power MCUs, Diverse Power and Performance Levels</th>
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<tbody>
<tr>
<td><strong>Performance</strong></td>
<td><strong>Memory</strong></td>
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<tr>
<td>SAML10/11 Cortex® M23, 32 MHz</td>
<td>16–64 KB Flash 4–16 KB SRAM</td>
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<tr>
<td>SAML11-KPH Cortex M23, 32 MHz</td>
<td>32–64 KB Flash 8–16 KB SRAM</td>
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<tr>
<td>SAML21/22 Cortex M0+, 48/32 MHz</td>
<td>32–256 KB Flash, 4–32 KB SRAM</td>
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<tr>
<td>SAMD5x Cortex M4F, 120 MHz</td>
<td>Up to 1 MB Flash, 256 KB SRAM</td>
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<tr>
<td>SAMD1/2x Cortex M0+, 48 MHz</td>
<td>8–256 KB Flash, 2–32 KB SRAM</td>
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<tr>
<td>SAM4L Cortex M4, 48 MHz</td>
<td>128–512 KB Flash, 32/64 KB SRAM</td>
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<tr>
<td>SAMG5x Cortex M4F, 48/96/120 MHz</td>
<td>256–512 KB Flash, 64–176 KB SRAM</td>
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<tr>
<td>PIC32MX XLP MIPS32 M4K® 25 MHz</td>
<td>128–256 KB Flash 32–64 KB RAM</td>
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SAML11 features chip-level security, Arm TrustZone and come with secure provisioning options supported by Secure Thingz Secure Deploy. SAML11-KPH devices are supported by Kinibi-M SDK and are pre-provisioned with Trustonic’s Root of Trust key.

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www.microchip.com/32bit
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.

SAM L22 Xplained Pro Evaluation Kit
This kit is ideal for evaluating and prototyping with the ultra-low power SAML22 Arm Cortex-M0+ based microcontrollers. The kit includes TSLCD1 Xplained Pro extension board for touch and segment LCD application development.

SAME54 Xplained Pro (ATSAME54-XPRO)
This kit is ideal for evaluating and prototyping with the low power SAMD5x and E54 Arm Cortex-M4F based microcontrollers.

SAME54 Curiosity Ultra (DM320210)
This kit is ideal for evaluating and prototyping with the low power SAMD5x and E54 Arm Cortex-M4F based microcontrollers and comes with graphics card interface, Ethernet PHY and mikroBUS socket.

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.

SAML10 Xplained Pro Evaluation Kit (DM320204)
This kit is ideal for evaluating and prototyping with the ultra-low power SAM L10 Arm Cortex-M23 based microcontrollers.

PIC32MX274 XLP Starter Kit (DM320105)
Fully integrated 32-bit development platform featuring the high performance and eXtreme Low Power (XLP) PIC32MX274 series. The PIC32MX XLP offers developers an increase in performance at almost half of the current, enabling longer lasting, more feature rich battery applications.

SAML11 Xplained Pro Evaluation Kit (DM320205)
This kit is ideal for evaluating and prototyping with the ultra-low power and advanced security SAM L11 and SAM L11-KPH Arm Cortex-M23 based microcontrollers.

SAM4L Development System (ATSAM4L-EK)
This kit is ideal for evaluating and prototyping with the SAM4L Cortex-M4 processor-based microcontrollers. The board features LCD, USB, capacitive touch functionality and much more.

Power Debugger (ATPOWERDEBBUGGER)
The Power Debugger streams power measurements and application debug data to Data Visualizer for real-time monitoring and 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.

SAML22 Wearable Electrocardiogram (WECG) Reference Design
SAML22 is at the heart of this ECG reference design, driving the display, controlling and sensing the touch screen, interfacing with the BLE Radio (BTLC1000), and processing the NeuroSky BMD101 CardioChip and Bosch BHA250 Smart-Hub sensors to provide readings that include heart rate, heart age, heart rate variability and step count. In addition to acting as a standalone device, it can connect to Neurosky’s smartphone app via BLE, to provide remote connectivity. Please contact your local Microchip sales office for availability.

Data Visualizer – Power Consumption Measurement and Visualization Analysis Software Tool