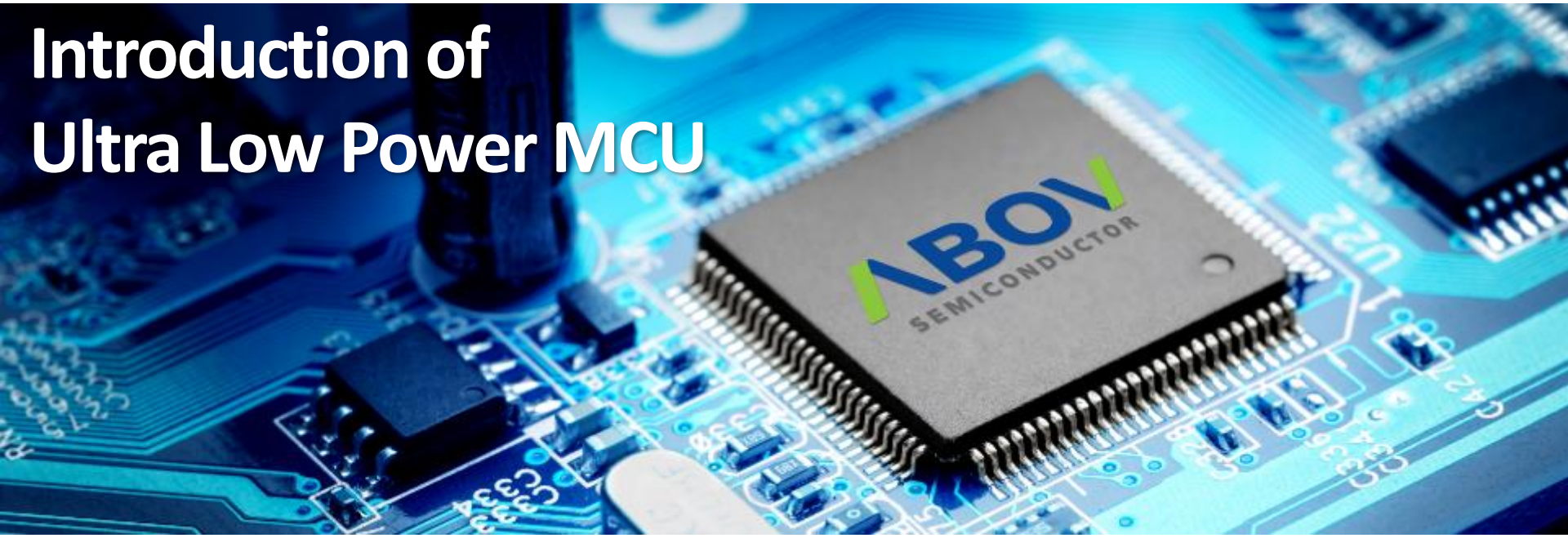
Introduction of Ultra Low Power MCU



2024

ABOV SEMICONDUCTOR

Confidential

L Series Ultra-low Power Family

A31L Series Ultra-low power MCUs 32-bit Arm Cortex-M0+

A31L22x

- Flash : 16/32KB
  SRAM 4KB
- < 1uA @ Deep Sleep w/RTCC
- 36nA Shut Down Mode

A31L21x

- Flash : 64/128KB
  Data Flash 4KB
- SRAM 20KB
- <1uA @ STOP with RTC
- 45nA Shunt Down Mode

A31L12x

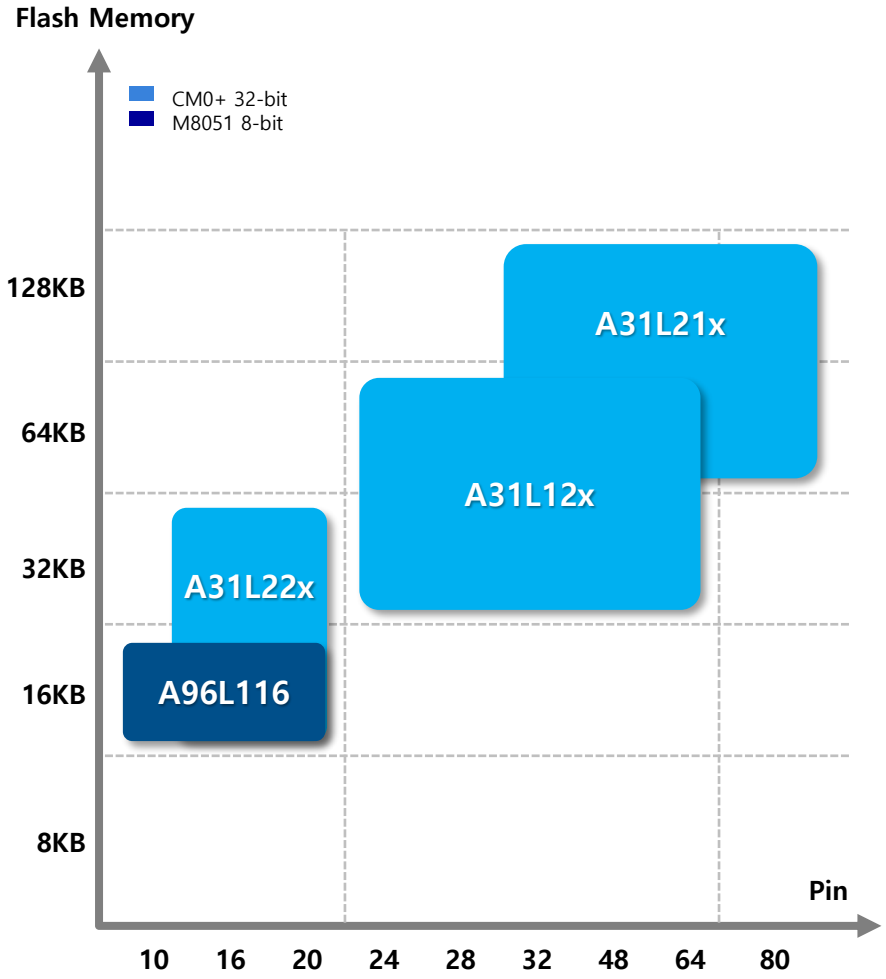
- Flash : 32/64KB
- SRAM : 8KB
  1.3uA @ STOP with RTC
  LCD Control

A96L Series Ultra-low power MCUs 8-bit Arm M8051

A96L116

- M8051 16KB
- TYP 0.35uA @ Stop mode
- 94uA/MHz @ Run mode

Cost Effective



L Series Ultra-low Power Mode

	A96L116	A31L12x	A31L21x	A31L22x
IDD1: Main Run	94uA/MHz @ 32MHz	78uA/MHz @ 32MHz	90uA/MHz @ 32MHz	78uA/MHz @ 32MHz
IDD2: Main Sleep		40uA/MHz @ 32MHz	43uA/MHz @ 32MHz	43uA/MHz @ 32MHz
IDD3: Sub Run		12uA @25℃	13uA @25℃	12uA @25℃
IDD4: Sub Sleep		2uA @25℃	2.3uA @25℃	2uA @25℃
IDD5: Deep Sleep w/ RTC	0.9uA @3v 25℃	1.3uA @3v 25℃	0.99uA @3v 25℃	0.95uA @3v 25℃
IDD5: Deep Sleep w/o RTC		0.60uA @3v 25℃	0.43uA @3v 25℃	0.39uA @3v 25℃
IDD6 Deep Sleep			0.35uA @3V 25℃	
IDD7 Deep Sleep			0.35uA @3V 25℃	0.30uA @3V 25℃
IDD8 Shut Down			45nA @3V 25℃	36nA @3V 25℃
Wake-up Time		8us (from deep sleep)	5us (from deep sleep) 8.5ms (from shutdown)	5us (from deep sleep)

L Series Ultra-low Power Feature

Items	A31L123	A31L214	A31L222	A96L116
CPU Core	Cortex-M0+	Cortex-M0+	Cortex-M0+	M8051
Clock Speed	32MHz	32MHz	32MHz	16MHz
Code Flash (Data)	64KB	128KB(4KB)	32KB	16KB(256B)
SRAM	8KB	20KB	4KB	1KB
UART/USART/I2C/SPI	2 (+LP 1) / 1 / 2 / 2	1 (+LP 2) / 2 / 3 / 4	1 (+LP 1) / 1 / 1 / 1	LP x 1/ - / 1 / 1
Timer/PWM	16-bit Timer x 4 (Each timer w/ 2-ch PWM) 16-bit LP Timer	16-bit x 8 (Each timer w/ 2-ch PWM) 16-bit LP Timer x 1 Simple Timer x 1 for Wakeup Shut Down Mode	16-bit Timer x 4 (Each timer w/ 2-ch PWM) 16-bit LP Timer	16-bit Timer x 3 WDT x 1
I/O	Max. 52 @ 64LQFP (28 @ 32QFN)	Max. 74 @ 80LQFP	Max. 17 @ 20TSSOP (13 @ 16TSSOP)	Max. 18 @ 20TSSOP/QFN
LCD Driver	29-SEG 8-COM(R-bias)	39-SEG 8-COM(Cap-bias)	--	-
ADC	12-bit 1Msps	12-bit 1Msps	12-bit 0.5Msps	12-bit ADC 125ksps
Comparator (PGA)	2	2	2	-
Power Consumption	Typ. 78uA/MHz @ Run mode Typ. 1.3uA @STOP with RTC	Typ. 90uA/MHz @ Run mode Typ. 0.99uA @STOP with RTC Typ. 45nA@shutdown	Typ. 78uA/MHz @ Run Typ. 0.99uA @STOP w/ RTC Typ. 36nA@shutdown	Typ. 94uA/MHz @ Run Typ. 0.9uA @STOP w/ RTC
Useful Functions	128-bit Unique ID / DMA, RTC, WDT ISO-7816-3, CRC,etc.	AES 128, TRNG, CRC, DMA, RTC, WDT, etc.	24-bit WWDT RTC, CRC,128-bit UID, etc.	CRC, LPUART, RTCC POR, LVR/LVI, WDT
Oscillator	Ext. 2~16MHz / 32.768KHz Int. High Speed 32MHz (Max. ±1.5%@0~50℃ ±4.5%@-40~105℃) Int. Low Speed 40kHz	Ext. 2~16MHz / 32.768KHz Int. High Speed 32MHz (Max. ±2.0%@-40~85℃ ±3.0%@-40~105℃) Int. Low Speed 40kHz	Ext. 2~16MHz / 32.768KHz Int. High Speed 32MHz (Max. ±2.0%@-40~85℃ ±3.0%@-40~105℃) Int. Low Speed 40kHz	**Ext. 0.4~12MHz / 32.768KHz** HFIRC 16MHz (Max. ±1.5%@0~50℃ ±2.0%@-40~85℃) Int. Low Speed 40kHz
Op. Voltage	1.65 ~ 3.6V	1.71V ~ 3.6V	1.71 ~ 3.6V	1.71 ~ 3.6V
Op. Temp.	-40 ~ 85/105℃	-40 ~ 85/105℃	-40 ~ 85/105℃	-40 ~ 85
Package	64-LQFP10 / 48-LQFP / 32-LQFP, 32-QFN	32/48/64/80-LQFP, 32-QFN	TSSOP-16/20 QFN-20	20-TSSOP/QFN, 16-SOPN, 10-SSOP

Introduction of Ultra Low Power 32-bit MCU

- A31L12x
- A31L21x
- A31L22x

32-bit General Purpose Microcontroller Road map

G7 Series

Cortex-M4F
High Speed
Low Power

- High Speed Core Speed up to 170MHz
- Advanced Efficient Computing & Enhanced Performance

A34G7361

L1 Series

Cortex-M0+
Max. 32MHz
Ultra Low Power

A31L123
- Flash : 64KB
- SRAM : 8KB
  1.3uA @ STOP with RTC
  LCD Control

A31L214
- Code Flash 128KB
  Data Flash 4KB
- SRAM 20KB
- <1uA @ STOP with RTC
- 45nA Shunt Down Mode

A31L222
- Flash 32KB
  SRAM 4KB
- < 1uA @ Deep Sleep w/RTCC
- 36nA Shut Down Mode

M4 Series

Cortex-M4F
Max. 120MHz
High Performance

A34M418
- A34M41x
  512KB~128KB (64KB~32KB)
  EEPROM : 32KB
  AES-128
- 3-phase PWMx2/ADC 1.5Mspsx3/PGAx3/COMPx4/QEIx2

G5 Series

Cortex-M3
Max. 75MHz
UL60730

A33G527
A33G526
A33G524
- A33G52x
  384KB~128KB (24KB)
- EEPROM : 32KB
  UL60730

G3 Series

Cortex-M0+
Max. 48MHz
Plentiful Peri. and HMI

A31G316
A31G314
A31G313
- A31G31x
  64KB~256KB (16KB)
  Touch Control

A31G324
- A31G324
  128KB (16KB)
  USB 2.0 FS

G2 Series

Cortex-M0+
Max. 48MHz / 1% IRC
LED Control

A31G21x
- A31G21x
  32KB~64KB (6KB)
  Touch Control

A31G226
- A31G226
  256KB (20KB)
  EEPROM 32KB
  FOTA (Firmware Over-The-Air)
  LCD Control

G1 Series

Cortex-M0+
Max. 40MHz
LCD/LED Control

A31G12x
- A31G12x
  32KB~64KB (6KB)

A31G11x
- A31G11x
  16KB~32KB (4KB)

Existing → 2023

A31L12x Ultra Low Power Microcontroller

A31L1xx Low Power Microcontroller arm® Cortex®-M0+

A31L1xx series are the 32-bit **ultra low power microcontroller for various battery operated applications**. They equipped with Arm Cortex-M0+ core and also support high performance analog features, 12-bit ADC, comparators, and they also provide external communication through a variety of interfaces such as UART, SPI, I2C. To reduce system power consumption, the A31L1xx devices also include various power modes and ultra-low-power functions such as LPUART and LP timer.

Ultra low Power Microcontroller

Cortex-M0+, 32-bit Core

- Max. operating frequency **32MHz**
- A31L123 : **64KB(Flash), 8KB(SRAM)**
- A31L122 : **32KB(Flash), 8KB(SRAM)**
- **Run mode : 78uA/MHz @ 32MHz**
- **Deep sleep mode : 1.3uA with RTC**
  600nA without RTC ***(+ 200nA@LVR On)***
- **Wake-up time : 8us (from deep sleep)**

Wide Range Clock & System

High-speed Clock

- Internal **32MHz, 40kHz, /** External **2MHz ~ 16MHz**
- Sub external **32.768kHz**

System

- Clock monitoring / POR / LVR / CRC (8/16/32-bit)
- **DMA Controller 5-ch**
- ISP and read protection capabilities

High Performance Functions and Rich Peripherals

High Performance Analog Functions & Peripherals

- **12-bit ADC (1Msps, up to 16-ch)**
- **Comparator 2-ch**
- 16-bit TIMER / **16-bit LP Timer**
- **LPUART** / UART / USART
- **I2C (up to 1Mbps) / SPI (up to 16Mbps)**
- **LCD Driver : 29-SEG/8-COM**
- **ISO-7816-3** compliant (smartcard I/F)

Characteristics & Package

Voltage and Temperature

- 1.65 ~ 3.6V
- -40 ~ 85/105℃

Package and I/O

- 64-LQFP10 / 48-LQFP / 32-LQFP, 32-QFN
- Max. 52 (I/O Ports) , 28 I/O@32-QFN

A31L12x Key Benefits & Block Diagram

Key Benefits & Block Diagram

Ultra Low Power & High Performance

- Cortex-M0+, 32-bit core (Max. 32MHz)
- 64KB / 32KB flash memory
  (A31L123: 64KB / A31L122:32KB)
- 8KB SRAM
- 5 channels of DMA
- **Ultra low power consumption**
  - **78uA/MHz at run mode**
  - **1.3uA at deep sleep mode (with RTC)**
  - ***+200nA @ LVR on***

Design for System Perspective & Reduced System Cost

- Built-in 12-bit ADC(1Msps, up to 16-ch), Comparator
- RTC calendar & LCD function
- Various type of memory and package options

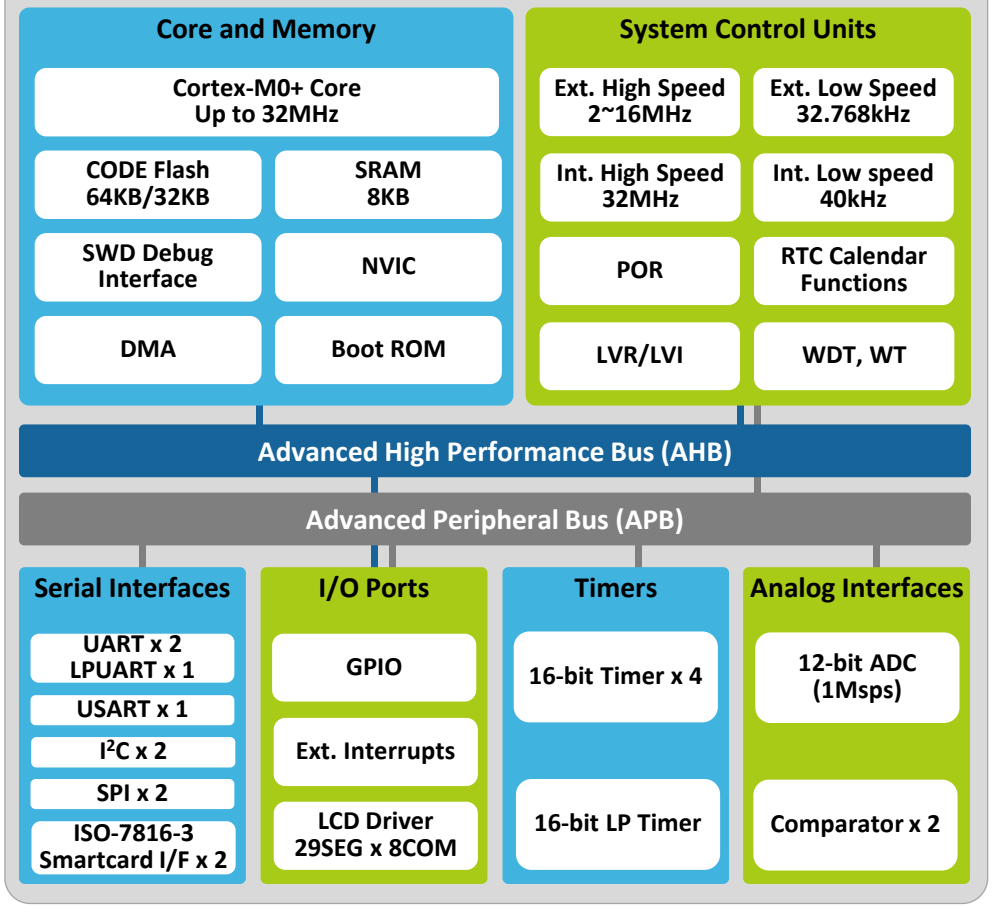
Reliable Safety Functions

- Error detection
- Memory protection unit

Rich connectivity Peripheral

- 2 x UART and 1 x LPUART
- 1 x USART
- 2 x I2C (up to 1Mbps)
- 2 x SPI (up to 16Mbps)
- 2 x ISO-7816-3, Smartcard I/F

A31L12x Block Diagram



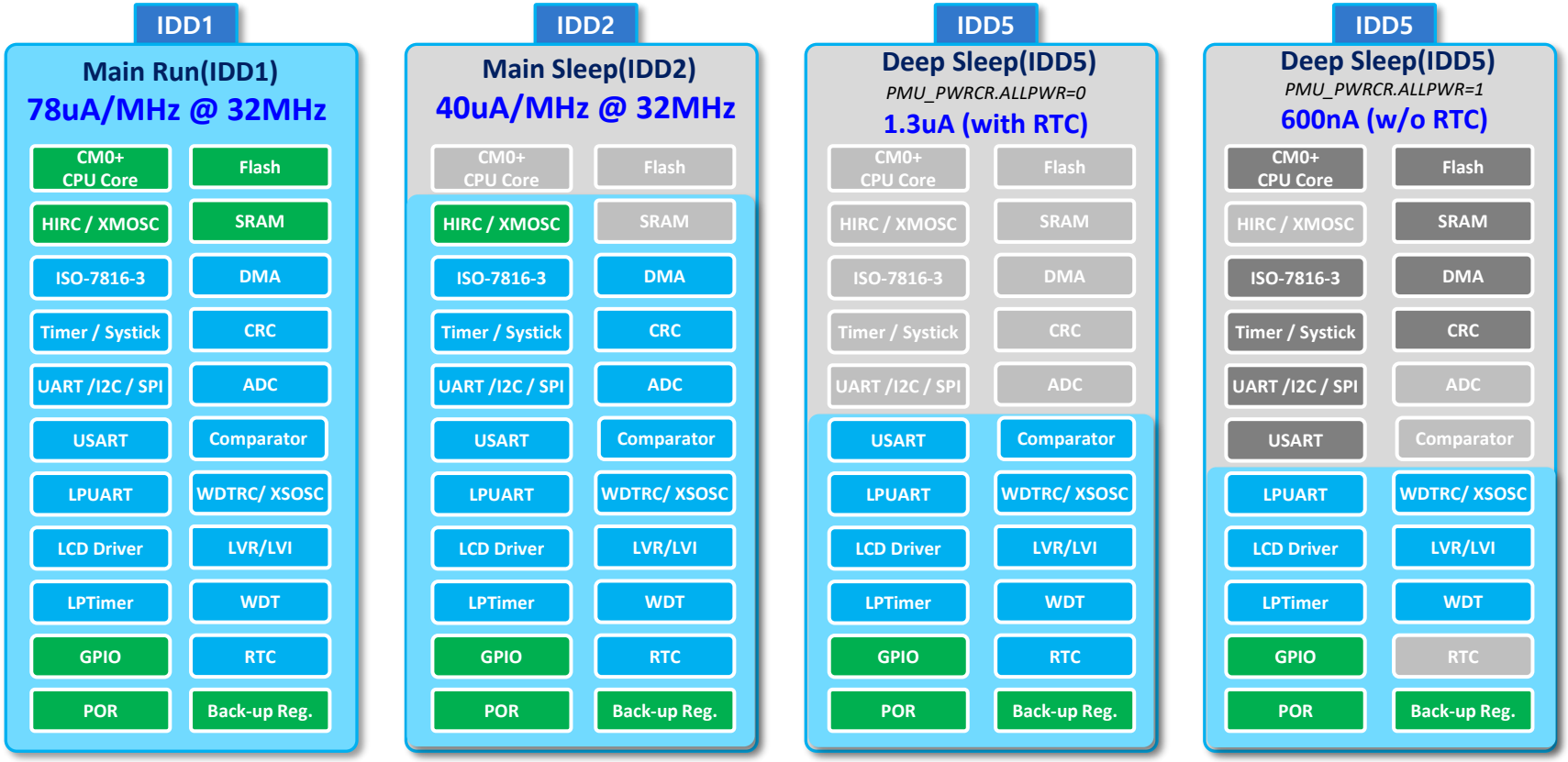
A31L12x ABOV's Creative Power Management System

Only 78uA/MHz in run mode and 600nA*(W/O RTC)* in deep sleep mode !!!

A31L123 has a built-in power management block which manages internal system power supply, peri. blocks and a wake-up time from sleep and deep sleep modes

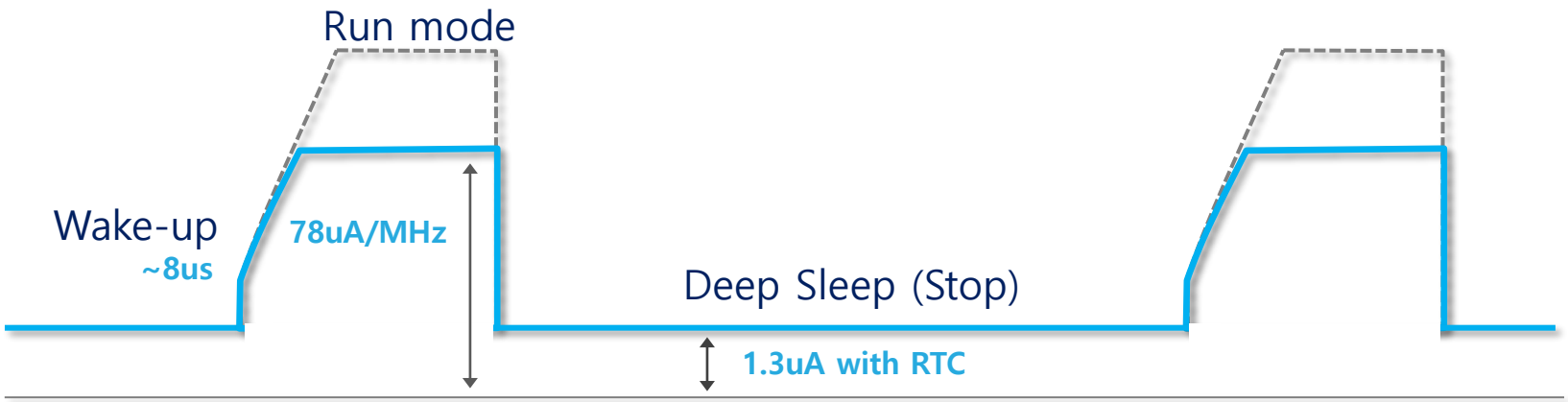
A31L123 can **wake up from deep sleep in just 8us !!!**

- : *Enable*
- : *Optional*
- : *Disable*
- : *Power off*



A31L12x Application Examples for Current Consumption Performance

Low power performance of A31L123
will deliver system power savings that result in longer battery life.



78uA/MHz in run mode and 1.3uA(with RTC) in deep sleep mode !!!

A31L123 can **wake up from deep sleep in just 8us !!!**

Case Study

- **Scenario 1**
  : Smoke detector *(On-time 1.14ms / Off-time 5sec)* ➔ **12.2 years** *@ 200mAh Coin Batt.*
  (cf. A company : 9.4 years)
- **Scenario 2**
  : Door Lock *(On-time 7 sec / Off-time 1 hour)* ➔ **3.7 years** *@ 200mAh Coin Batt.*
  (cf. A company : 1.7 years)

A31L12x Feature Comparison

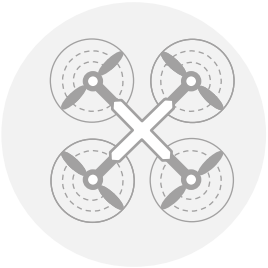
Items	A31L12x	A Company	B Company
CPU/Tech(um)	Cortex M0+	Cortex M0+	Cortex M0
Flash	64KB / 32KB	64KB / 32KB (2KB EEPROM)	32KB
SRAM	8KB	8KB	8KB
PKG	32/48/64-LQFP, 32-QFN	32~64pin	64-LQFP
I/O	up to 52 IO	up to 51 IO	up to 58 IO
Timer	16-bit x 4 / 16-bit LP Timer	16-bit x 3, 16-bit LP Timer	32-bit x 4
PWM	16-bit x 8	16-bit x 10	16-bit x 4
Main Clock	Ext. 2~16MHz 32MHz HIRC 40kHz WDTRC	Ext. 1~25MHz IRC 37kHz/8MHz Up to 32MHz w/ PLL	Ext. 4~24MHz IRC 10kHz/12MHz Up to 32MHz w/ PLL
USART (UART/SPI)	1 (SPI: 16Mbps)	2 (SPI: 16Mbps)	-
UART	2	-	4
LPUART	1 (9600bps)	1 (9600bps)	2 (9600bps)
I2C / SPI	2 / 2 (16Mbps)	2 / 4 (I2S,16Mbps)	2 / 2 (32Mbps)
ISO-7816-3	2	2	2
12-bit ADC	1Msps	1.14Msps	1.5Msps
Voltage	1.65V ~ 3.6V	1.65V ~ 3.6V	1.8V ~ 3.6V
Temperature	-40 ~ **105 °C**	-40 ~ 125 °C	-40 ~ 85 °C
CRC	CRC, WDT	CRC, WDT	CRC, WDT
CMP	2-ch	2-ch	2-ch
Other Useful Functions	DMA 5ch, POR, LVR/LVI, RTC, ISO-7816-3 Smartcard I/F, **128-bit unique ID**, **LCD** (29seg x 8com)	DMA 7ch, POR, BOD, RTC 96-bit unique ID, I2S, RS485	DMA 4ch, POR, BOD, RTC 96-bit unique ID, LCD

A31L12x Competitive Comparison of Current Consumption

Mode	A31L12x	A Company	B Company
Run (IDD1)	**78uA/MHz (Flash)** @32MHz **72uA/MHz (SRAM)** @32MHz	195uA/MHz (Flash)@HSI 32MHz 162uA/MHz (Flash) @16MHz 131uA/MHz (SRAM) @16MHz	137uA/MHz (Flash) @12MHz
Sleep (IDD2)	**40uA/MHz** @32MHz	54uA/MHz (Flash) @32MHz 41uA/MHz (SRAM) @16MHz	46uA/MHz @12MHz
Sub-Run (IDD3)	**12uA (Flash)** @32kHz 9uA (SRAM) @32kHz	22uA (Flash) @32kHz 8.5uA (SRAM) @32kHz	-
Sub-Sleep (IDD4)	**2.0uA** @32kHz	4.7uA @32kHz	-
Deep Sleep (IDD5) *PMU_PWRCR_ALLPWR=0* (without RTC)	**0.65uA**	0.41uA	0.65uA
Deep-Sleep (IDD5) *PMU_PWRCR_ALLPWR=0* (with RTC)	**1.3uA@3.0V**	0.8uA@1.8V 1.0uA@3.0V	1.5uA
Deep-Sleep (IDD5) *PMU_PWRCR_ALLPWR=1* (without RTC)	**0.6uA**	0.29uA (Standby mode)	-
Wakeup time (Deep-Sleep)	**8us**	5us	6us

A31L12x Application & Package

Target Application



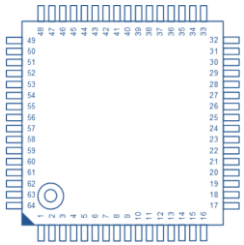
Battery Operated Application

Small Consumer Appliances

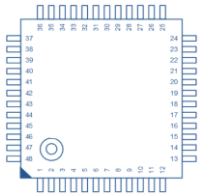
IoT & Wearable Devices

- Portable Healthcare
- Door Lock
- Building & Home Control
- Smart Meter / Smart Sensing
- Portable Consumers
- Other Battery Operated Devices

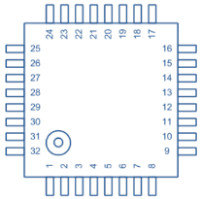
Package



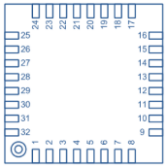
64-Pin
LQFP_10



48-Pin
LQFP_07



32-Pin
LQFP_07



32-Pin
QFN_05

A31L214 Ultra Low Power Microcontroller

A31L214 Low Power Microcontroller arm® Cortex®-M0+

The A31L21x series is an ultra-low power microcontroller based on the high-performance ARM CortexM0+ core. It has a Flash memory of up to 128KB, a Data Flash of 4KB, and an SRAM of 20KB. Operation voltage of the device is from 1.71V to 3.6V. It provides a highly flexible and cost-effective solution for many embedded control applications. This device offers 16-bit timers, Real timer and calendar, 12-bit ADC, Comparator, CRC generator, UART, USART, LPUART, I2C, SPI, Smart card interface, LCD driver/controller, AES 128, True random number generator, DMA, etc. The A31L21x series also has a POR, LVR, LVI, and an internal RC oscillator. The A31L21x series supports SLEEP mode and DEEP SLEEP mode to reduce power consumption, and these power saving modes allow the design of low power applications.

Ultra low Power Microcontroller

Cortex-M0+, 32-bit Core

- Max. operating frequency **32MHz**
- **128KB(Flash), 4KB(Data Flash), 20KB (SRAM)**
- **Run mode : 90uA/MHz @ 32MHz**
- **Deep Sleep w/ RTC : 0.99uA @25˚C**
- **Deep Sleep w/o RTC : 0.39uA @25˚C**
  2.24uA @85˚C
  5.0uA @105˚C
- **Shut Down Mode : 45nA @25˚C**
- **Wake-up time : 5us (from deep sleep) / 8.5ms (from shutdown)**

Wide Range Clock & System

High-speed Clock

- Internal **32MHz, 40kHz, /** External **Up to 16MHz**
- Sub external **32.768kHz**

System

- Clock monitoring / POR / LVR / CRC (8/16/32-bit)
- **DMA Controller 7-ch**
- ISP and read protection capabilities

High Performance Functions and Rich Peripherals

High Performance Analog Functions & Peripherals

- **12-bit ADC (1Msps, up to 16-ch)**
- **Comparator 2-ch**
- 16-bit Timer / **16-bit LP Timer**
- **LPUART** / UART / USART
- **I2C (up to 1Mbps) / SPI (up to 16Mbps)**
- **LCD Driver : 39 x 8 / 43 x 4 with C-Bias & R-Bias**
- **ISO-7816-3** compliant (smartcard I/F)

Characteristics & Package

Voltage and Temperature

- 1.71 ~ 3.6V
- -40 ~ 105℃

Package and I/O

- 80-LQFP / 64-LQFP10 / 48-LQFP / 32-LQFP, 32-QFN

A31L21x Key Benefits & Block Diagram

Key Benefits & Block Diagram

Ultra Low Power & High Performance

- Cortex-M0+, 32-bit core (Max. 32MHz)
- 128KB / 64KB flash memory
- 20KB SRAM / 7 channels of DMA
- **Ultra low power consumption**
  - **Run mode : 90uA/MHz @ 32MHz**
  - **Deep Sleep w/ RTC : 0.99uA [1.6uA] @25°C**
  - **Deep Sleep w/o RTC : 0.39uA [0.99uA] @25°C**
    2.24uA [7.9 uA] @85°C
    5.0uA [18.9uA] @105°C

Design for System Perspective & Reduced System Cost

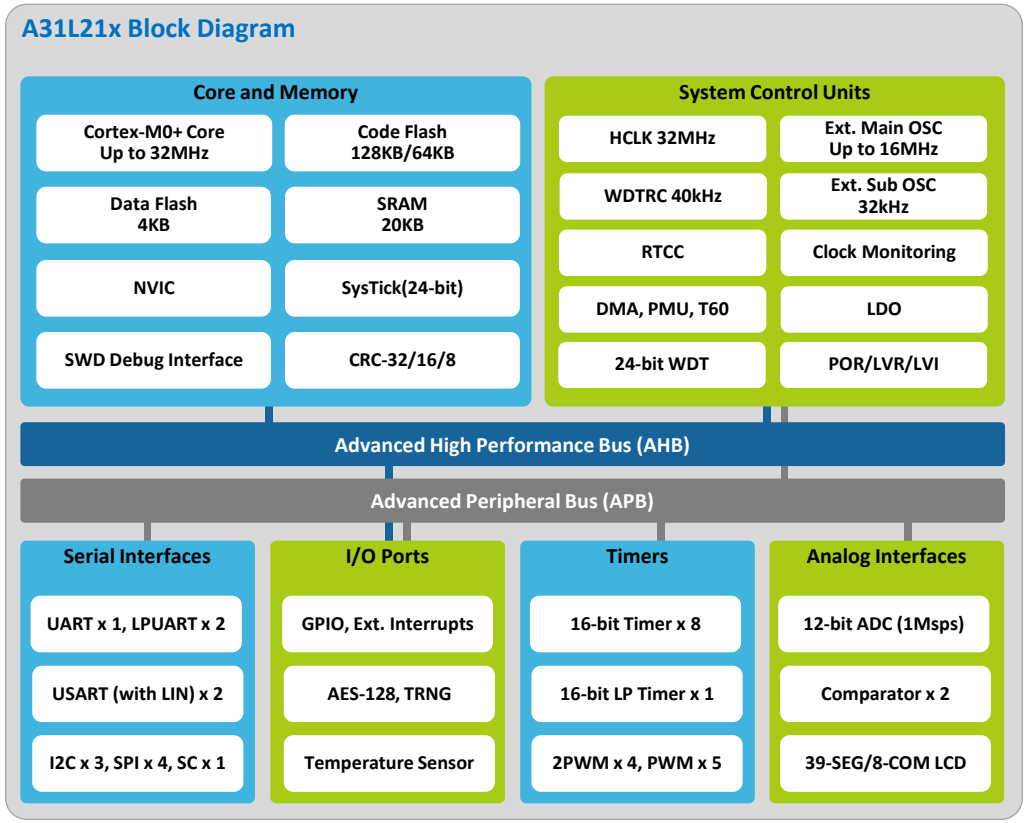
- Built-in 12-bit ADC(1Msps, up to 16-ch), Comparator
- RTC calendar & LCD function
- Various type of memory and package options

Reliable Safety Functions

- Error detection
- Memory protection unit

Rich connectivity Peripheral

- 1 x UART and 2 x LPUART / 2 x USART
- 3 x I2C /4 x SPI

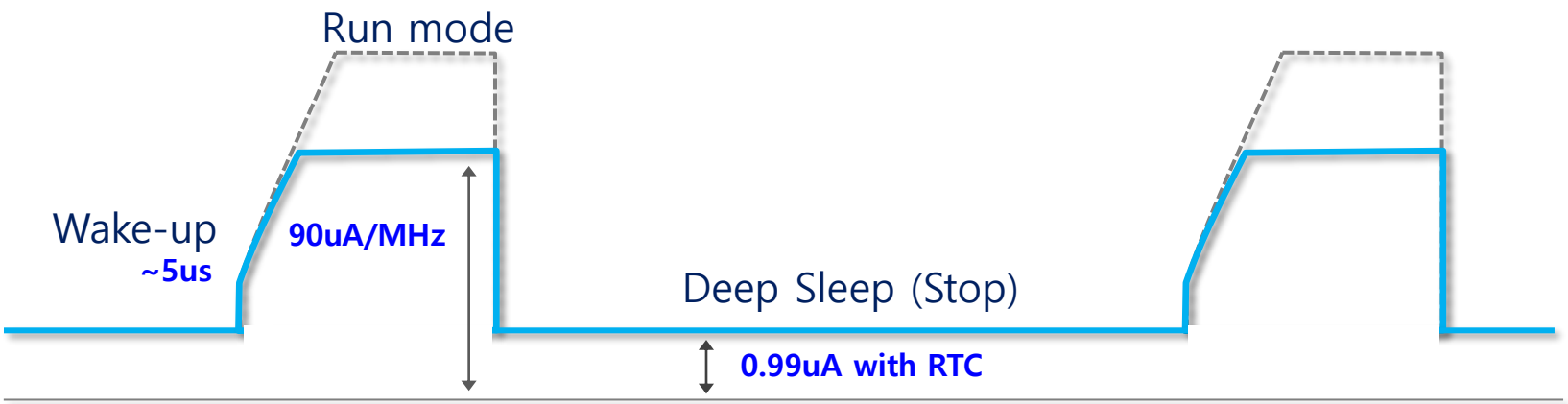


32-bit Microcontroller Low Power MCU

Items	A31L123	A31L214	A31L222
CPU Core	Cortex-M0+	Cortex-M0+	Cortex-M0+
Clock Speed	32MHz	32MHz	32MHz
Code Flash (Data)	64KB	128KB(4KB)	32KB
SRAM	8KB	20KB	4KB
UART/USART/I2C/SPI	2 (+LP 1) / 1 / 2 / 2	1 (+LP 2) / 2 / 3 / 4	1 (+LP 1) / 1 / 1 / 1
Timer/PWM	16-bit Timer x 4 (Each timer w/ 2-ch PWM) 16-bit LP Timer	16-bit x 8 (Each timer w/ 2-ch PWM) 16-bit LP Timer x 1 Simple Timer x 1 for Wakeup Shut Down Mode	16-bit Timer x 4 (Each timer w/ 2-ch PWM) 16-bit LP Timer
I/O	Max. 52 @ 64LQFP (28 @ 32QFN)	Max. 74 @ 80LQFP	Max. 17 @ 20TSSOP (13 @ 16TSSOP)
LCD Driver	29-SEG 8-COM(R-bias)	39-SEG 8-COM(Cap-bias)	--
ADC	12-bit 1Msps	12-bit 1Msps	12-bit 0.5Msps
Comparator (PGA)	2	2	2
Power Consumption	Typ. 78uA/MHz @ Run mode Typ. 1.3uA @STOP with RTC	Typ. 90uA/MHz @ Run mode Typ. 0.99uA @STOP with RTC Typ. 45nA@shutdown	Typ. 78uA/MHz @ Run Typ. 0.99uA @STOP w/ RTC Typ. 36nA@shutdown
Useful Functions	128-bit Unique ID / DMA, RTC, WDT ISO-7816-3, CRC,etc.	AES 128, TRNG, CRC, DMA, RTC, WDT, etc.	24-bit WWDT RTC, CRC,128-bit UID, etc.
Oscillator	Ext. 2~16MHz / 32.768KHz Int. High Speed 32MHz (Max. ±1.5%@0~50℃ ±4.5%@-40~105℃) Int. Low Speed 40kHz	Ext. 2~16MHz / 32.768KHz Int. High Speed 32MHz (Max. ±2.0%@-40~85℃ ±3.0%@-40~105℃) Int. Low Speed 40kHz	Ext. 2~16MHz / 32.768KHz Int. High Speed 32MHz ((Max. ±2.0%@-40~85℃ ±3.0%@-40~105℃) Int. Low Speed 40kHz
Op. Voltage	1.65 ~ 3.6V	1.71V ~ 3.6V	1.71 ~ 3.6V
Op. Temp.	-40 ~ 85/105℃	-40 ~ 85/105℃	-40 ~ 85/105℃
Package	64-LQFP10 / 48-LQFP / 32-LQFP, 32-QFN	32/48/64/80-LQFP, 32-QFN	TSSOP-16/20 QFN-20

A31L21x Application Examples for Current Consumption Performance

Low power performance of A31L21x
will deliver system power savings that result in longer battery life.



90uA/MHz in run mode and 0.99uA(with RTC) in deep sleep mode !!!

***A31L214* can wake up from deep sleep in just 5us !!!**

A31L21x ABOV's Creative Power Management System

Only 90uA/MHz in run mode and 0.39uA*(W/O RTC)* in deep sleep mode !!!

- : *Enable*
- : *Optional*
- : *Disable*
- : *Power off*
- : *MB off*

	IDD1	IDD2	IDD3	IDD4	IDD5	IDD6	IDD7	IDD8
	Main Run(IDD1)	Main Sleep(IDD2)	Sub Run(IDD3)	Sub Sleep(IDD4)	Deep Sleep(IDD5)	Deep Sleep(IDD6)	Deep Sleep(IDD7)	Deep Sleep(IDD8)
CPU Core	Enable	Disable	Enable	Disable	Disable	Disable	Power off	Power off
Flash	Enable	Disable	Enable	Disable	Disable	Disable	Power off	Power off
SCU	Enable	Enable	Enable	Enable	Enable	Enable	Enable	Enable
FMC/DFMC	Optional	Disable	Optional	Disable	Disable	Disable	Power off	Power off
HIRC	Enable	Enable	Optional	Disable	Disable	Disable	Disable	Disable
XMOSC	Optional	Optional	Optional	Optional	Disable	Disable	Disable	Power off
ISO-7816-3	Optional	Optional	Optional	Optional	Disable	Disable	Power off	Power off
SRAM	Enable	Disable	Enable	Disable	Disable	Disable	Power off	Power off
Timer	Optional	Optional	Optional	Optional	Disable	Disable	Power off	Power off
DMA	Optional	Optional	Optional	Optional	Disable	Disable	Power off	Power off
Systick	Optional	Optional	Optional	Optional	Disable	Disable	Power off	Power off
CRC	Optional	Disable	Optional	Disable	Disable	Disable	Power off	Power off
UART/I2C/SPI	Optional	Optional	Optional	Optional	Disable	Disable	Power off	Power off
ADC	Optional	Disable	Optional	Disable	Disable	Disable	Power off	Power off
USART	Optional	Optional	Optional	Optional	Optional	Disable	Power off	Power off
Comparator	Optional	Optional	Optional	Optional	Optional	MB off	Power off	Power off
LPUART	Optional	Optional	Optional	Optional	Optional	MB off	Power off	Power off
WDTRC XSOSC	Optional	Optional	Optional	Optional	Optional	Optional	Power off	Power off
LCD Driver	Optional	Optional	Optional	Optional	Optional	MB off	Power off	Power off
LVR/LVI	Optional	Optional	Optional	Optional	Optional	Optional	Power off	Power off
LP Timer	Optional	Optional	Optional	Optional	Optional	MB off	Power off	Power off
WDT	Optional	Optional	Optional	Optional	Optional	Optional	Power off	Power off
GPIO	Enable	Enable	Enable	Enable	Enable	Disable	Disable	Power off
RTC	Optional	Optional	Optional	Optional	Optional	Optional	Optional	Power off
POR	Enable	Enable	Enable	Enable	Enable	Enable	Enable	Enable
Back-up Reg.	Enable	Disable	Enable	Disable	Disable	Disable	Disable	Disable
PMU	Enable	Enable	Enable	Enable	Enable	Enable	Enable	Enable
Wakeup Pin	Disable	Disable	Disable	Disable	Disable	Optional	Optional	Optional
AES128	Enable	Enable	Enable	Enable	Disable	Disable	Power off	Power off
RNG	Optional	Optional	Disable	Disable	Disable	Disable	Power off	Power off

A31L222 Ultra Low Power Microcontroller

A31L222 Low Power Microcontroller arm® Cortex®-M0+

The A31L22x series is an ultra-low power microcontroller based on the high-performance ARM Cortex-M0+ core. It has a Flash memory of up to 32KB, and an SRAM of 4KB. Operation voltage of the device is from 1.71V to 3.6V. It provides a highly flexible and cost-effective solution for many embedded control applications. This device offers 16-bit timers, Real timer and calendar, 12-bit ADC, Comparator, CRC generator, UART, USART, LPUART, I2C, SPI, etc. The A31L22x series also has a POR, LVR, LVI, and an internal RC oscillator. The A31L22x series supports SLEEP mode and DEEP SLEEP mode to reduce power consumption, and these power saving modes allow the design of low power applications.

Ultra low Power Microcontroller

Cortex-M0+, 32-bit Core

- Max. operating frequency **32MHz**
- **32KB(Flash), 4KB (SRAM)**
- **Run mode : 78uA/MHz @ 32MHz**
- **Deep Sleep w/ RTCC : 0.99uA @25˚C**
- **Deep Sleep w/o RTCC : 0.39uA @25˚C**
  1.7uA @85˚C
  3.5uA @105˚C
- **Shut Down Mode : 36nA @25˚C**
- **Wake-up time : 5us (from deep sleep)**

Wide Range Clock & System

High-speed Clock

- Internal **32MHz, 40kHz, /** External **Up to 16MHz**
- Sub external **32.768kHz**

System

- Clock monitoring / POR / LVR / CRC (8/16/32-bit)
- Temp. Sensor
- ISP and read protection capabilities

High Performance Functions and Rich Peripherals

High Performance Analog Functions & Peripherals

- **12-bit ADC (0.5Msps, up to 8-ch)**
- **Comparator 2-ch**
- 16-bit Timer / **16-bit LP Timer**
- **LPUART** / UART / USART
- **I2C (up to 1Mbps) x 1**
- **SPI (up to 16Mbps) x 1**

Characteristics & Package

Voltage and Temperature

- 1.71 ~ 3.6V
- -40 ~ 105℃

Package and I/O

- 20-TSSOP / 20-QFN, 16-TSSOP

A31L222 Key Benefits & Block Diagram

Key Benefits & Block Diagram

Ultra Low Power & High Performance

- Cortex-M0+, 32-bit core (Max. 32MHz)
- 32KB / 16KB flash memory
- 4KB SRAM
- **Ultra low power consumption**
  - **Run mode : 78uA/MHz @ 32MHz**
  - **Deep Sleep w/ RTC : 0.99uA [1.6uA] @25°C**
  - **Deep Sleep w/o RTC : 0.39uA [0.99uA] @25°C**
    1.7uA [6.0 uA] @85°C
    3.5uA [13.2uA] @105°C

Design for System Perspective & Reduced System Cost

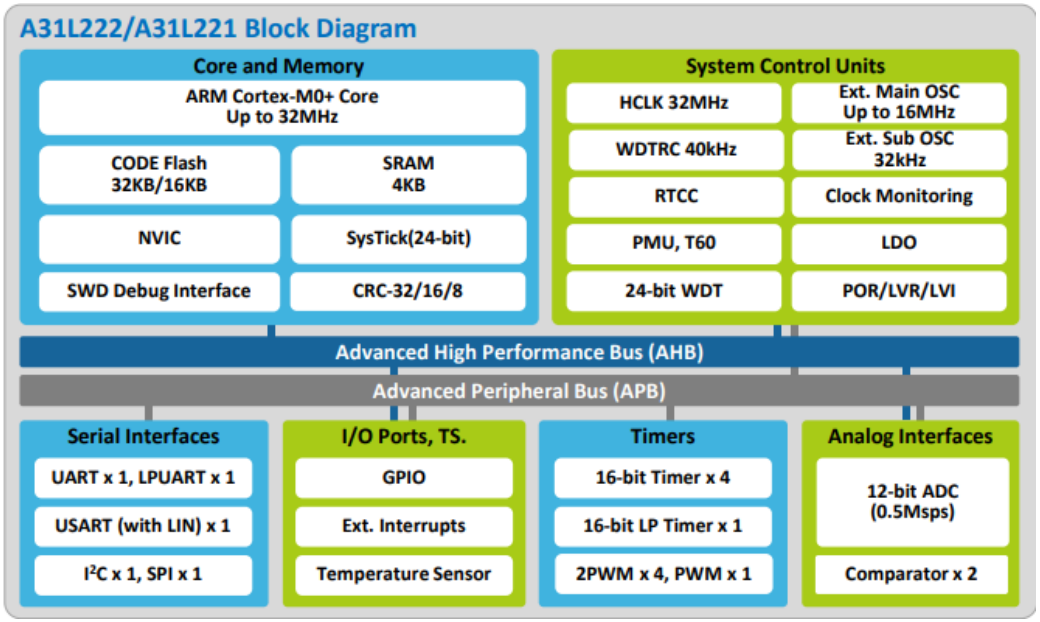
- Built-in 12-bit ADC(0.5Msps, up to 8-ch), Comparator
- RTC calendar
- Various type of memory and package options

Reliable Safety Functions

- Error detection
- Memory protection unit

Rich connectivity Peripheral

- 1 x UART and 1 x LPUART / 1 x USART
- 1 x I2C /1 x SPI



32-bit General Purpose MCU - Cortex-M0+ Product Line-up Features

Items	A31L222/L221	A31L123/L122	A31L214	A31G112	A31G123	A31G226
CPU Core	Cortex-M0+	Cortex-M0+	Cortex-M0+	Cortex-M0+	Cortex-M0+	Cortex-M0+
Clock Speed	32MHz	32MHz	32MHz	40MHz	40MHz	48MHz
Code Flash (Data)	32KB/16KB	64KB / 32KB	128KB	32KB	64KB	256KB (32KB)
SRAM	**4KB**	8KB	20KB	4KB	6KB	20KB
UART/USART/I2C/SPI	1 (LP 1)/ 1 / 1 / 1	2 (LP 1) / 1 / 2 / 2	1 (LP 2) / 2 / 3 / 4	2 / 2(SPI) / 2 / -	2 / 4(SPI) / 3 / -	2 / 4 / 3 / 2
Timer/PWM	16-bit PWM x 8 16-bit Timer x 4 16-bit LP Timer	16-bit PWM x 8 16-bit Timer x 4 16-bit LP Timer	16-bit x 8 16-bit LP Timer x 1 Simple Timer x 1 for WKUP S.D	3-Phase PWM 32-bit Timer x 2 16-bit Timer x 3	3-Phase PWM 32-bit Timer x 2 16-bit Timer x 7	3-Phase PWM 32-bit Timer x 2 16-bit Timer x 7
I/O	Max. 17 @ 20TSSOP (13 @ 16TSSOP)	Max. 52 @ 64LQFP (28 @ 32QFN)	Max. 73 @ 80LQFP	Max. 45 @ 64LQFP (29 @ 32QFN)	Max. 77	Max. 75
LCD Driver	--	**29-SEG 8-COM(R-bias)**	**39-SEG 8-COM(Cap-bias)**	23-SEG 8-COM (R-bias)	39-SEG 8-COM (R-bias)	39-SEG 8-COM (R-bias)
ADC	**12-bit 0.5Msps**	**12-bit 1Msps**	**12-bit 1Msps**	12-bit 50ksps	12-bit 50ksps	12-bit 1Msps
Comparator	**2**	**2**	**2**	-	-	2
DAC	-	-	-	-	-	1 (12-bit)
Useful Functions	**24-bit WWDT RTC, WWDT, CRC, 128-bit Unique ID, etc. [Ultra Low Power] 78uA/MHz @ Run 0.99uA @STOP w/ RTC 36nA@Shut Down**	**128-bit Unique ID / DMA, RTC, WDT ISO-7816-3, CRC,etc. [Ultra Low Power] 78uA/MHz @ Run mode 1.3uA @STOP with RTC**	**AES 128, TRNG,** CRC, DMA, RTC, WDT, etc. **[Ultra Low Power] 90uA/MHz @ Run mode 1.0uA @STOP with RTC 45nA@Standby**	6-pin High Current ports (LED), LVD, 32-bit WDT POR, etc.	8-pin High Current ports (LED), LVD, 32-bit WDT POR, etc.	10-pin High Current ports (LED), LVD, 32-bit WDT POR, etc.
Oscillator	Int. High Speed 32MHz (Max. ±2%@-40~85℃ ±3.0%@-40~105℃) Int. Low Speed 40kHz	Int. High Speed 32MHz (Max. ±1.5%@0~50℃) Int. Low Speed 40kHz	Ext. 2~16MHz IRC 32MHz ±2.0 @-40~85C ±3.0 @-40~105C 40kHz WDTRC	Int. High Speed 40MHz (Max. ±3.5%@85℃) Int. Low Speed 40kHz	Int. High Speed 40MHz (Max. ±3.5%@85℃) Int. Low Speed 40kHz	Int. High Speed 48MHz (Max. ±1%@85℃) Int. Low Speed 500kHz Max. PLL 48MHz
Op. Voltage	**1.71 ~ 3.6V**	**1.65 ~ 3.6V**	1.71V ~ 3.6V	1.8 V ~ 5.5 V	1.8 V ~ 5.5 V	1.8 V ~ 5.5 V
Op. Temp.	**-40 ~ 85/105℃**	**-40 ~ 85/105℃**	**-40 ~ 85/105℃**	-40°C ~ 85/105°C	-40°C ~85/105°C	-40°C ~ 105°C
Package	TSSOP-16/20 QFN-20	64-LQFP10 / 48-LQFP / 32-LQFP, 32-QFN	32/48/64/80-LQFP, 32-QFN	LQFP-48/32 MQFP-44 / TSSOP-28 QFN-32/24	LQFP-80/64/48 MQFP-44	LQFP-80/64/48
Status	Planning	MP		MP	MP	Under development

A31L222 주요 사양 : Target current consumption

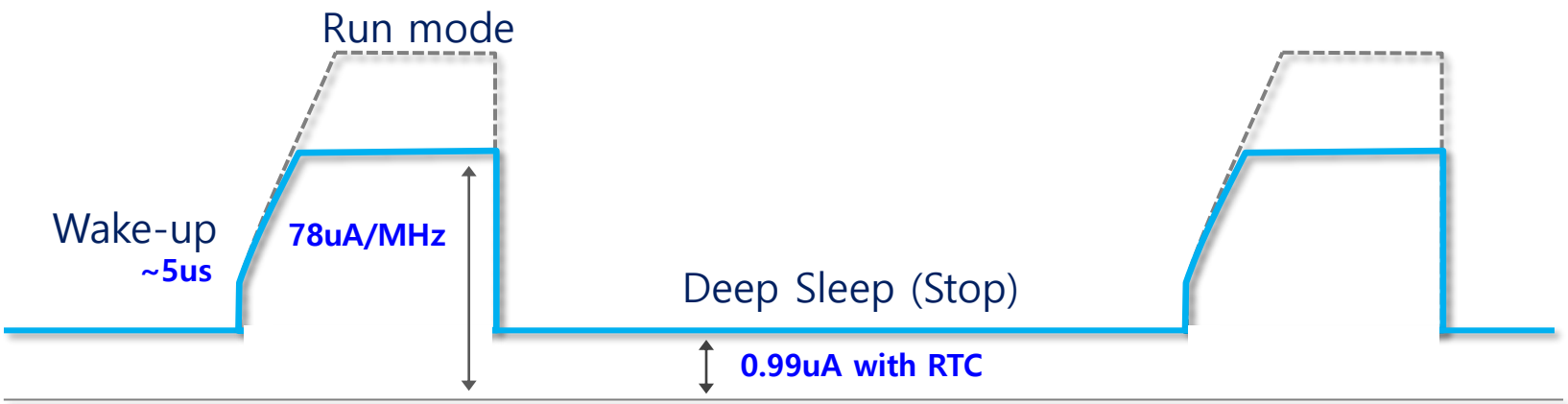
ABOV SEMICONDUCTOR

Mode		A31L222 (ABOV)	A31L123 (ABOV)	A31L214 (ABOV)	STM32L051 (STM)	STM32L011 (STM)	HC32L110 (HDSC)
Run	• CPU on • FLASH on • SRAM on • Any Clock	78 uA/MHz @32MHz Vcore=1.35	78 uA/MHz @32MHz Vcore=1.35	90 uA/MHz @32MHz Vcore=1.35	162uA/MHz @32MHz	165uA/MHz @32MHz	120uA/MHz @ 16MHz
IDD5 Deep Sleep (RAM Reten. w/o RTC)	• CPU stop • FLASH dis • SRAM on • Clock disable • IO on/ LPUART WDT Opt	0.39uA @25°C 1.7uA @85°C 3.5uA @105°C	0.65 uA @25°C 4.5 uA @85°C 11.0 uA @105°C	0.39uA @25°C 2.24uA @85°C 5.0uA @105°C	0.41uA@-40~25℃ 1.7uA@85℃ 4uA105℃	0.34uA@25℃ 0.94uA@85℃	0.42uA@25℃ 2.2uA@85℃ N.A. uA105℃
IDD6 Deep Sleep w/ RTC (Stop)	• CPU stop • FLASH dis • SRAM on(Retention) • Clock : RTC on • IO on • LPUART / WDT Opt.	0.99uA @25°C	1.3 uA @25°C	≤ 0.99uA @25°C	1.0uA@25℃	0.44uA@25℃	1.0 uA@25℃
IDD7 Deep Sleep w/o RTC : RAM Irreten. (Standby)	• CPU off • FLASH off • SRAM off • Clock : RTC Opt. HSI/HSE off, LSI/LSE Opt • IO on	0.29uA @25°C 0.70uA @85°C 1.3uA @105°C	0.6 uA @25°C 2 uA @85°C 4.5 uA @105°C	0.32uA @25°C 0.80uA @85°C 1.7uA @105°C	0.29uA25℃ 0.5uA@85℃ 0.94uA@105℃	0.23uA @25°C 0.36uA @85°C 0.62uA @105°C	Undefined
IDD8 Shut Down	• Wakeup GPIO 4pins, Reset, POR, etc.	36nA @25°C 0.20uA @85°C 0.70uA @105°C	-	45nA @25°C 0.35uA @85°C 0.95uA @105°C			
Wakeup time	From Deep sleep	From Deep Sleep : 5 us	8 us	From Deep Sleep : 5 us From shutdown : 8.5ms	From Stop : 5 us	From Stop : 5 us From Stnadby : 2.2ms	4us, form Deep Sleep

Confidential

A31L222 Application Examples for Current Consumption Performance

Low power performance of A31L222
will deliver system power savings that result in longer battery life.



78uA/MHz in run mode and 0.99uA(with RTC) in deep sleep mode !!!

***A31L222* can wake up from deep sleep in just 5us !!!**

A31L222 ABOV's Creative Power Management System

Only 78uA/MHz in run mode and 0.39uA*(W/O RTC)* in deep sleep mode !!!

- : *Enable*
- : *Optional*
- : *Disable*
- : *Power off*

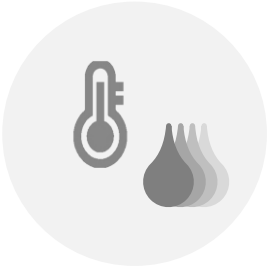
IDD1	IDD2	IDD3	IDD4	IDD5	IDD7	IDD8
Main Run(IDD1)	Main Sleep(IDD2)	Sub Run(IDD3)	Sub Sleep(IDD4)	Deep Sleep(IDD5)	Deep Sleep(IDD7)	Deep Sleep(IDD8)
CPU Core	CPU Core	CPU Core	CPU Core	CPU Core	CPU Core	CPU Core
Flash	Flash	Flash	Flash	Flash	Flash	Flash
HIRC	HIRC	HIRC	HIRC	HIRC	HIRC	HIRC
FMC	FMC	FMC	FMC	FMC	FMC	FMC
PMU	PMU	PMU	PMU	PMU	PMU	PMU
CRC	CRC	CRC	CRC	CRC	CRC	CRC
Timer	Timer	Timer	Timer	Timer	Timer	Timer
ADC	ADC	ADC	ADC	ADC	ADC	ADC
Systick	Systick	Systick	Systick	Systick	Systick	Systick
XMOSC	XMOSC	XMOSC	XMOSC	XMOSC	XMOSC	XMOSC
UART/I2C/SPI	UART/I2C/SPI	UART/I2C/SPI	UART/I2C/SPI	UART/I2C/SPI	UART/I2C/SPI	UART/I2C/SPI
XSOSC	XSOSC	XSOSC	XSOSC	XSOSC	XSOSC	XSOSC
USART	USART	USART	USART	USART	USART	USART
SCU	SCU	SCU	SCU	SCU	SCU	SCU
LPUART	LPUART	LPUART	LPUART	LPUART	LPUART	LPUART
Comparator	Comparator	Comparator	Comparator	Comparator	Comparator	Comparator
Wakeup pins	Wakeup pins	Wakeup pins	Wakeup pins	Wakeup pins	Wakeup pins	Wakeup pins
WDTRC XSOSC	WDTRC XSOSC	WDTRC XSOSC	WDTRC XSOSC	WDTRC XSOSC	WDTRC XSOSC	WDTRC XSOSC
LP Timer	LP Timer	LP Timer	LP Timer	LP Timer	LP Timer	LP Timer
LVR/LVI	LVR/LVI	LVR/LVI	LVR/LVI	LVR/LVI	LVR/LVI	LVR/LVI
GPIO	GPIO	GPIO	GPIO	GPIO	GPIO	GPIO
WDT	WDT	WDT	WDT	WDT	WDT	WDT
POR	POR	POR	POR	POR	POR	POR
RTC	RTC	RTC	RTC	RTC	RTC	RTC
WUT	WUT	WUT	WUT	WUT	WUT	WUT
Back-up Reg.	Back-up Reg.	Back-up Reg.	Back-up Reg.	Back-up Reg.	Back-up Reg.	Back-up Reg.
WDTRC	WDTRC	WDTRC	WDTRC	WDTRC	WDTRC	WDTRC
TS	TS	TS	TS	TS	TS	TS

A31L222 Application & Package

Target Application

IoT & RF Module Applications

- RF Module Applications (LoRa, Sub-GHz, FM Receiver)
- Smart Sensor / Detector
- Portable Healthcare
- Building & Home Control

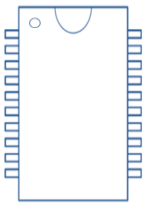


Battery Operated Sensor Applications

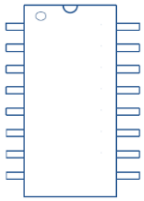
Small Consumer Appliances

- Portable Consumers
- Alarm system
- Other Battery Operated Devices

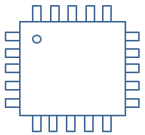
Package



20-Pin TSSOP



16-Pin TSSOP



20-Pin QFN_03

A96L116 Ultra Low Power Microcontroller

A96L116 Low Power Microcontroller with 8-bit CISC core M8051

A96L116 is an advanced CMOS Ultra-Low Power 8-bit microcontroller. It has 16Kbytes of FLASH, 256bytes data flash, 256 bytes of IRAM, 768 bytes of XRAM, general purpose I/O, basic interval timer, watchdog timer, 16-bit timer/counter, 16-bit PPG output, real time clock/calendar, LPUART, SPI, I2C, 12-bit A/D converter, on-chip POR, LVR, LVI, on-chip oscillator and clock circuitry. A96L116 supports power down modes reducing power consumption.

Ultra low Power Microcontroller

M8051, 8-bit CISC Core

- Max. operating frequency **16MHz**
- **16KB(Flash), 256B(Data Flash), 1KB (SRAM)**
- **Main Run : 93uA/MHz @ 16MHz**
- **Main Sleep : 37uA /MHz @ 16MHz**
- **Sub Run : 12uA @25˚C**
- **Sub Sleep : 1.8uA @25˚C**
- **Stop Mode : 0.35uA @25˚C (w/o RTCC)**
  0.9uA @25˚C (w/ RTCC)
- **Wake-up time : Typ. 5us (from stop mode)**

Wide Range Clock & System

High-speed Clock

- **Internal HFIRC 16MHz, LFIRC 40kHz,**
- **External Main Up to 12MHz**
- **Sub external 32.768kHz**

System

- POR / LVR / 16-bit CRC
- ISP and read protection capabilities

High Performance Functions and Rich Peripherals

High Performance Analog Functions & Peripherals

- **12-bit ADC (111ksps, up to 8-ch)**
- 8-bit Timer / 16-bit Timer **/ WDT / RTCC**
- **LPUART** / I2C / SPI
- 128-bit Unique ID

Characteristics & Package

Voltage and Temperature

- 1.71 ~ 3.6V
- -40 ~ 85℃

Package and I/O

- **10-SSOP, 16SOPN, 20-TSSOP/QFN**

A96L116 Key Benefits & Block Diagram

Key Benefits & Block Diagram

Ultra Low Power & High Performance

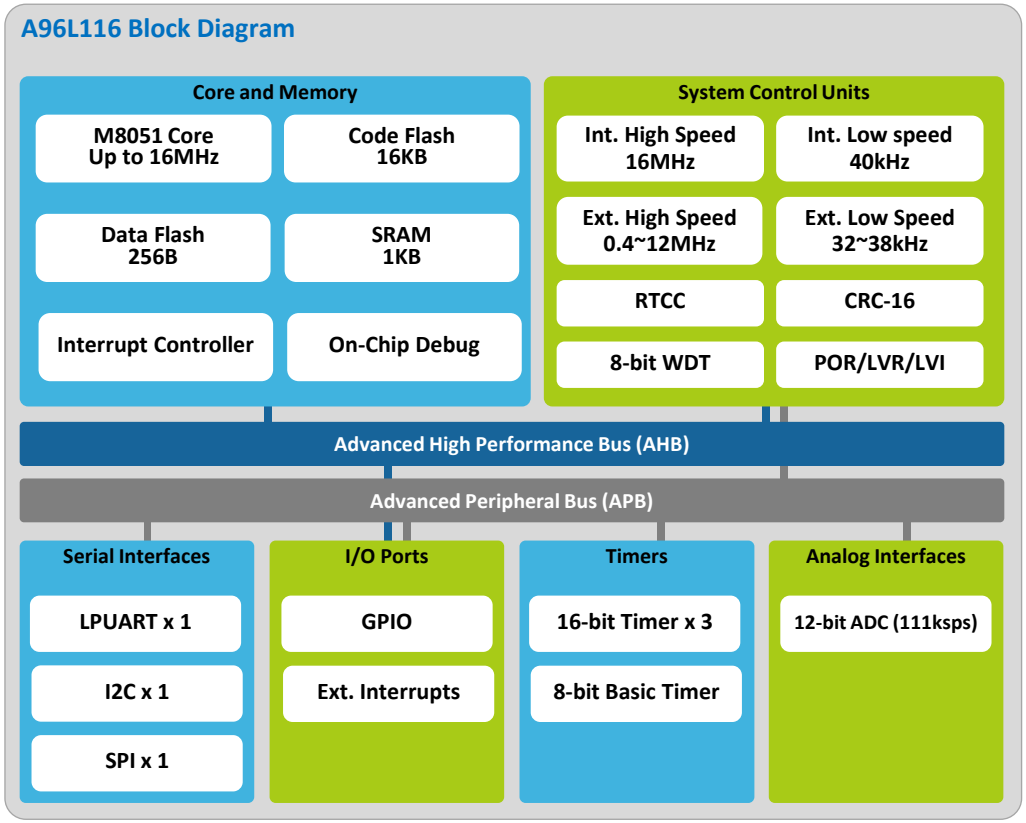
- M8051, 8-bit CISC Core (Max. 16MHz)
- 16KB flash memory / 1KB SRAM / 256B Data Flash
- **Ultra low power consumption**
  - **Main Run : 93uA/MHz @ 16MHz**
  - **Main Sleep : 37uA /MHz @ 16MHz**
  - **Sub Run : 12uA @25°C**
  - **Sub Sleep : 1.8uA @25°C**
  - **Stop Mode : 0.35uA @25°C (w/o RTCC)**
    0.9uA @25°C (w/ RTCC)
  - **Wake-up time : Typ. 5us (from stop mode)**

Design for System Perspective & Reduced System Cost

- Built-in 12-bit ADC(111ksps, up to 8-ch)
- Internal OSC, External OSC, Sub External OSC
- RTC calendar & 128-bit UID
- Various Small package options

Rich connectivity Peripheral

- LPUART x 1 / I2C x 1 / SPI x 1

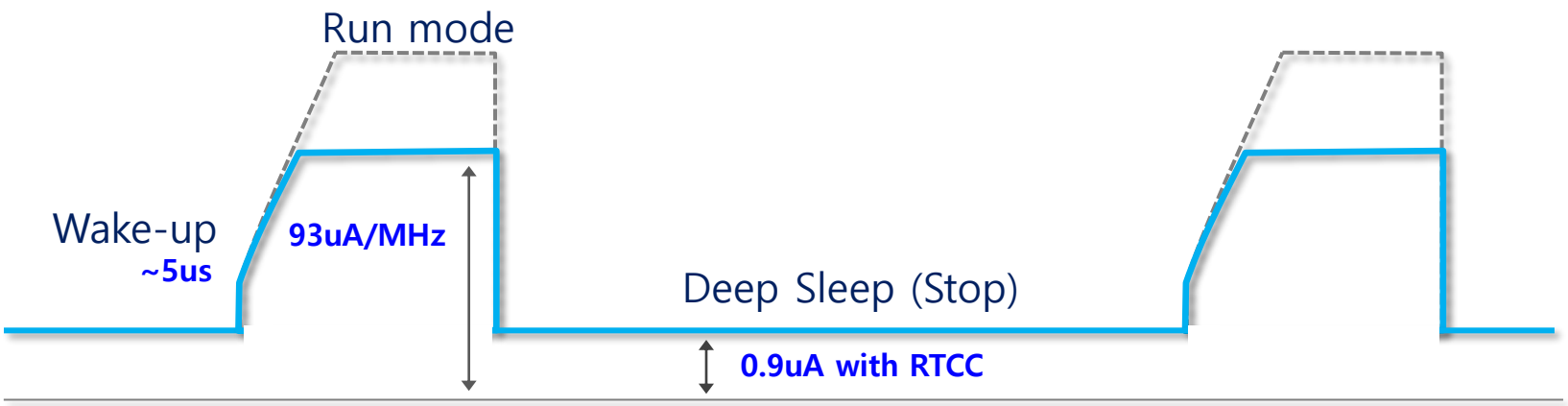


L Series Ultra-low Power Feature

Items	A31L123	A31L214	A31L222	* A96L116
CPU Core	Cortex-M0+	Cortex-M0+	Cortex-M0+	M8051
Clock Speed	32MHz	32MHz	32MHz	16MHz
Code Flash (Data)	64KB	128KB(4KB)	32KB	16KB**(256B)**
SRAM	8KB	20KB	4KB	1KB
UART/USART/I2C/SPI	2 (+LP 1) / 1 / 2 / 2	1 (+LP 2) / 2 / 3 / 4	1 (+LP 1) / 1 / 1 / 1	**LP x 1**/ - / 1 / 1
Timer/PWM	16-bit Timer x 4 (Each timer w/ 2-ch PWM) 16-bit LP Timer	16-bit x 8 (Each timer w/ 2-ch PWM) 16-bit LP Timer x 1 Simple Timer x 1 for Wakeup Shut Down Mode	16-bit Timer x 4 (Each timer w/ 2-ch PWM) 16-bit LP Timer	16-bit Timer x 3 8-bit Basic Timer WDT x 1
I/O	Max. 52 @ 64LQFP (28 @ 32QFN)	Max. 74 @ 80LQFP	Max. 17 @ 20TSSOP (13 @ 16TSSOP)	Max. 18 @ 20TSSOP/QFN
LCD Driver	29-SEG 8-COM(R-bias)	39-SEG 8-COM(Cap-bias)	--	-
ADC	12-bit 1Msps	12-bit 1Msps	12-bit 0.5Msps	12-bit ADC 111ksps
Comparator (PGA)	2	2	2	-
Power Consumption	Typ. 78uA/MHz @ Run mode Typ. 1.3uA @STOP with RTC	Typ. 90uA/MHz @ Run mode Typ. 0.99uA @STOP with RTC Typ. 45nA@shutdown	Typ. 78uA/MHz @ Run Typ. 0.99uA @STOP w/ RTC Typ. 36nA@shutdown	**Typ. 93uA/MHz @ Run** **Typ. 0.9uA @STOP w/ RTC**
Useful Functions	128-bit Unique ID / DMA, RTC, WDT ISO-7816-3, CRC,etc.	AES 128, TRNG, CRC, DMA, RTC, WDT, etc.	24-bit WWDT RTC, CRC,128-bit UID, etc.	CRC, LPUART, **RTCC** POR, LVR/LVI, WDT
Oscillator	Ext. 2~16MHz / 32.768KHz Int. High Speed 32MHz (Max. ±1.5%@0~50℃ ±4.5%@-40~105℃) Int. Low Speed 40kHz	Ext. 2~16MHz / 32.768KHz Int. High Speed 32MHz (Max. ±2.0%@-40~85℃ ±3.0%@-40~105℃) Int. Low Speed 40kHz	Ext. 2~16MHz / 32.768KHz Int. High Speed 32MHz ((Max. ±2.0%@-40~85℃ ±3.0%@-40~105℃) Int. Low Speed 40kHz	**Ext. 0.4~12MHz / 32.768KHz** HFIRC 16MHz (Max. ±1.5%@0~50℃) Int. Low Speed 40kHz
Op. Voltage	1.65 ~ 3.6V	1.71V ~ 3.6V	1.71 ~ 3.6V	1.71 ~ 3.6V
Op. Temp.	-40 ~ 85/105℃	-40 ~ 85/105℃	-40 ~ 85/105℃	-40 ~ 85
Package	64-LQFP10 / 48-LQFP / 32-LQFP, 32-QFN	32/48/64/80-LQFP, 32-QFN	TSSOP-16/20 QFN-20	**20-TSSOP/QFN, 16-SOPN, 10-SSOP**

A96L116 Application Examples for Current Consumption Performance

Low power performance of A96L116
will deliver system power savings that result in longer battery life.



93uA/MHz in run mode and 0.9uA(with RTCC) in deep sleep mode !!!

***A96L116* can wake up from Stop Mode in just 5us !!!**

8-bit Low Pin Product Feature

Item	MC94F1202A MC94F1102A	MC96F8204 MC96F8104	MC96F1206	A96G181	A96G174	A96G166	A96G140	A96L116
CPU Core	CM8051	M8051	M8051	M8051	M8051	M8051	M8051	M8051
Code Flash	2KB	4KB	6KB	2KB	8KB	16KB	64KB/32KB	16KB **(256B)**
SRAM	256B	256B	256B	256B	512B	768B	2.5KB	**1KB**
I/O	Up to 14	Up to 18	Up to 18	Up to 8	Up to 18	Up to 30	Up to 46	Up to 18
Serial Interface	-	USART x1, I^2C x1	-	-	USART x1, I^2C x1	USART x2, I^2C x1	USI x2, USART x1	**LPUART x 1**, I2C x 1, SPI x 1
Timer	8-bit x1, 16-bit x2	8-bit x1, 16-bit x2	16-bit x2	8-bit x1, 16-bit x2	8-bit x1, 16-bit x2	8-bit x1, 16-bit x2	8-bit x1, 16-bit x5	8-bit x 1,16-bit x 3
LED	-	-	-	-	-	8-COM 160mA	8-COM 160mA	-
ADC (AVDD)	12-bit 30Ksps (2.7V ~ 5.5V) Int. Vref. 1.295V (±7%@-40 ~ 85℃)	12-bit 30Ksps (2.7V ~ 5.5V)	12-bit 30Ksps (2.7V ~ 5.5V) Int. LDO 2.5V for AVDD	12-bit 133Ksps (2.2V ~ 5.5V) Int. Vref. 1.2V (±3%@-40~ 85℃)	12-bit 133Ksps (2.2V ~ 5.5V) Int. Vref. 1.2V (±3%@-40 ~ 85℃)	12-bit 133Ksps (2.2V ~ 5.5V) Int. Vref. 1.55V	12-bit 133Ksps (2.5V ~ 5.5V) With ext. AVREF port	12-bit ADC 111ksps
Useful Function	LVI/LVR, WDT	LVI/LVR, WDT	LVI/LVR, WDT	Window WDT	Window WDT	Window WDT, CRC, SW Password, LVI/LVR	CRC LVI/LVR , WDT	CRC, **LPUART, RTCC** POR, LVR/LVI, WDT
Power Consumption	Typ. 375uA/MHz @ Run Typ. 5uA @STOP w/ WDTRC	Typ. 250uA/MHz @ Run Typ. 0.5uA @STOP	Typ. 375uA/MHz @ Run Typ. 2uA @STOP w/ WDT	Typ. 125uA/MHz @ Run Typ. 3uA @STOP w/ WDT	Typ. 125uA/MHz @ Run Typ. 3uA @STOP w/ WDT	Typ. 208uA/MHz @ Run Max. 22uA @STOP w/ WDT	Typ. 208uA/MHz @ Run Max. 22uA @STOP w/ WDT	**Typ. 93uA/MHz @ Run Typ. 0.9uA @STOP w/ RTC**
Oscillator	32MHz±3%	8MHz±4%	32MHz±5%	32MHz±3%, (@ -40°C~85°C)	32MHz±3%, (@ -40°C~85°C)	32MHz±3%, (@ -40°C~85°C)	32MHz±3%, (@ -40°C~85°C)	**Ext. 0.4~12MHz / 32~38KHz** 16MHz (Max. ±1.5%@0~50℃)
Op. Voltage	2.2V ~ 5.5V	1.8V ~ 5.5V	2.2V ~ 5.5V	1.8V ~ 5.5V	1.8V ~ 5.5V	1.8V ~ 5.5V	1.8V ~ 5.5V	1.71 ~ 3.6V
Op. Temp.	-40°C ~ 85°C	-40°C ~ 85°C	-40°C ~ 85°C	-40°C ~ 85°C/105°C	-40°C ~ 85°C/105°C	-40°C ~ 85°C/105°C	-40°C ~ 85°C/105°C	-40°C ~ 85°C
Package	16-SOP/QFN 10-SSOP, 8-SOP	20-TSSOP/SOP 16-SOP/QFN 10-SSOP, 8-SOP	20-TSSOP/QFN 16-SOPN	10-SSOP, 8-SOP	20-TSSOP/QFN/SOP 16-SOPN	32-LQFP / 28-SOP 20-TSSOP/QFN/SOP 16-SOPN	48-LQFP / 44-MQFP 32-LQFP / 32-SOP 28-TSSOP/SOP	**20-TSSOP/QFN, 16-SOPN, 10-SSOP**

Ecosystem

Low Power Evaluation Demo Board

Starter Kits

32-bit

A-Link

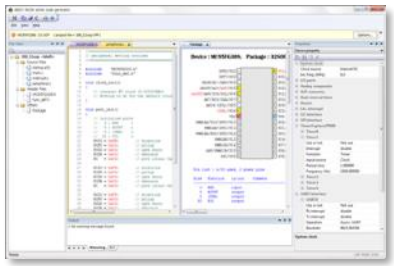
A-LinkPro

E-PGM+

E-PGM Serial

E-Gang4

E-Gang6



Code Generator

3rd Party Programmers

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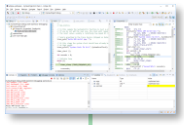
HI-LO SYSTEMS 河洛半導體股份有限公司

ee Tools

XELTEK 100.000+ DEVICES SUPPORTED

SYSTEM GENERAL



Open Source IDE

Commercial IDE

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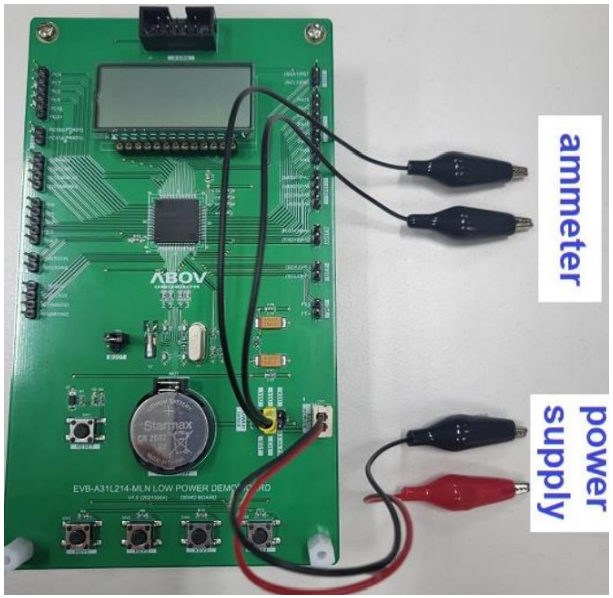
Development Environment

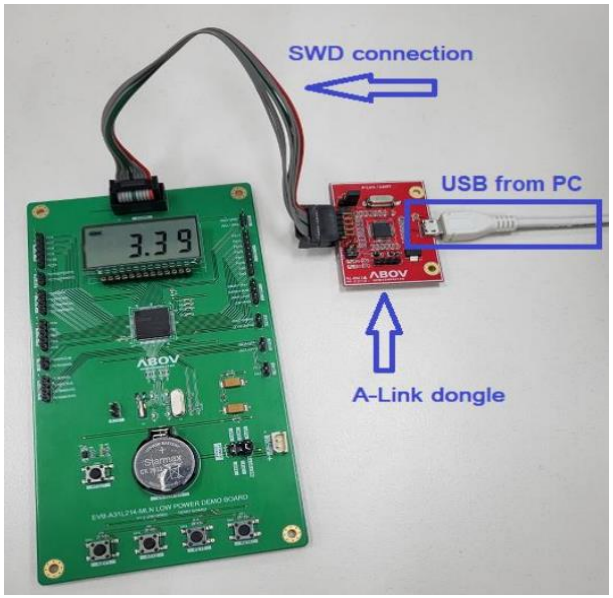
Development Environment

- A31L21x Datasheet
- A31L21x User Manual
- Application Note : Configuration Option User Guide / IAR Project Setting Guide / Low Power App Guide / Wakeup Guide_by_LPUART / KEIL Project Setting Guide / Low Power Demo Board Manual
- Example Code for Demo & STK Board
- Low Power Evaluation Demo Board / Starter-Kit

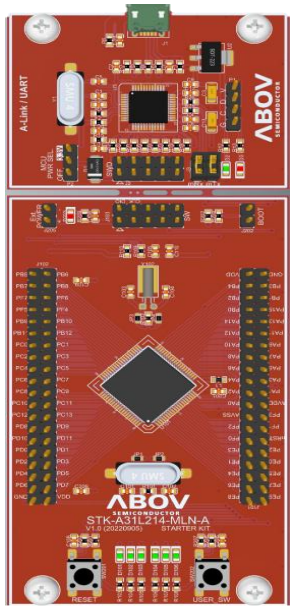
Demo Board_ Connect an ammeter



Demo Board_ Connect A-Link dongle



Starter-Kit_ A31L214

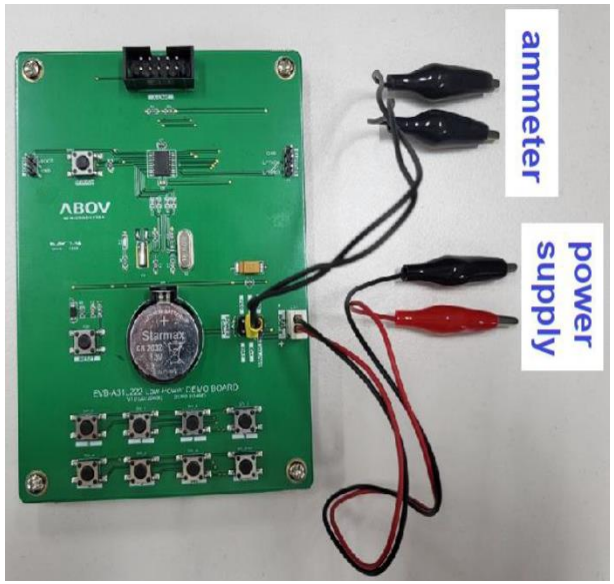


Development Environment

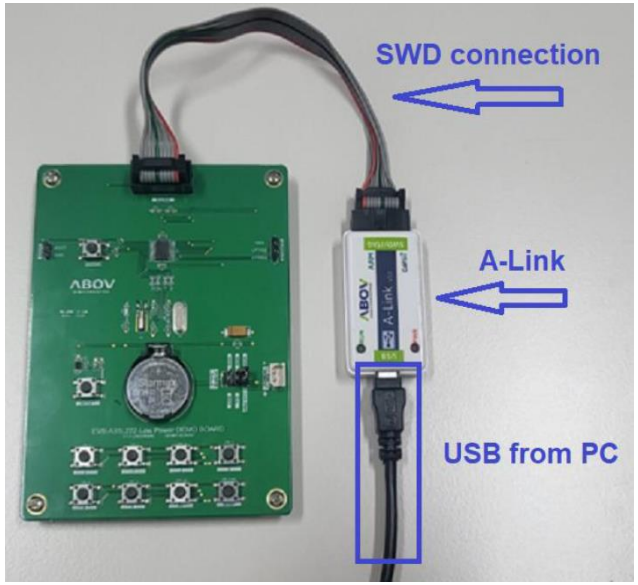
Development Environment

- A31L22x Datasheet
- A31L22x User Manual
- Application Note : Configuration Option User Guide / IAR Project Setting Guide / Low Power App Guide / Wakeup Guide_by_LPUART / KEIL Project Setting Guide / Low Power Demo Board Manual
- Example Code for Demo & STK Board
- Low Power Evaluation Demo Board / Starter-Kit

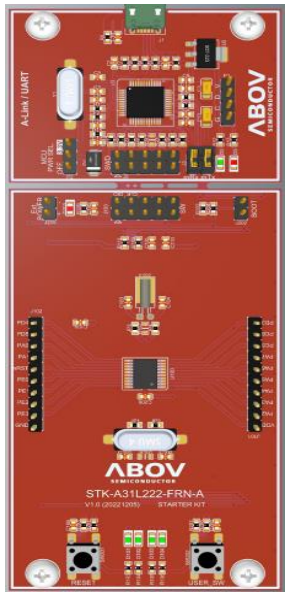
Demo Board_ Connect an ammeter



Demo Board_ Connect A-Link dongle



Starter-Kit_ A31L222

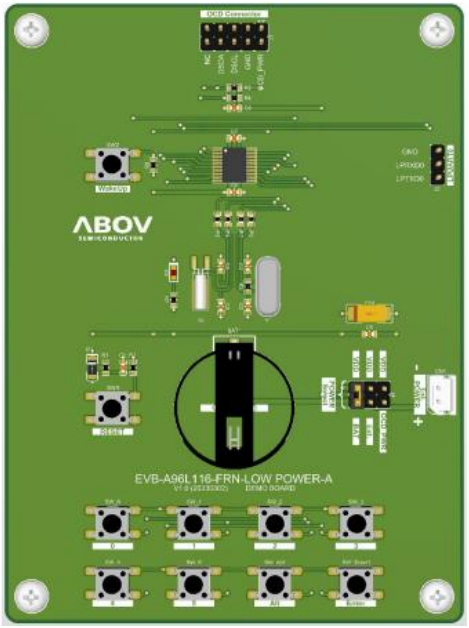


Development Environment

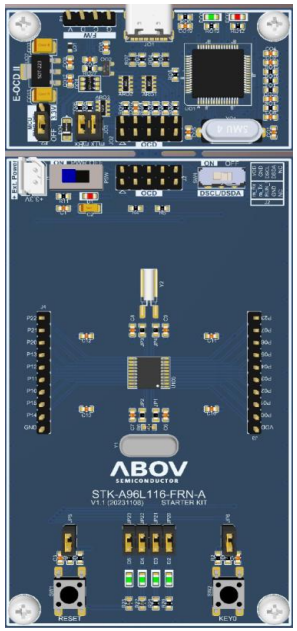
Development Environment

- A96L116 Datasheet
- A96L116 User Manual
- Application Note : Low Power App Guide/ Low Power Demo Board Manual
- Example Code for Demo & STK Board
- Low Power Evaluation Demo Board / Starter Kit

Demo Board (EVB)



Starter-Kit_ A96L116



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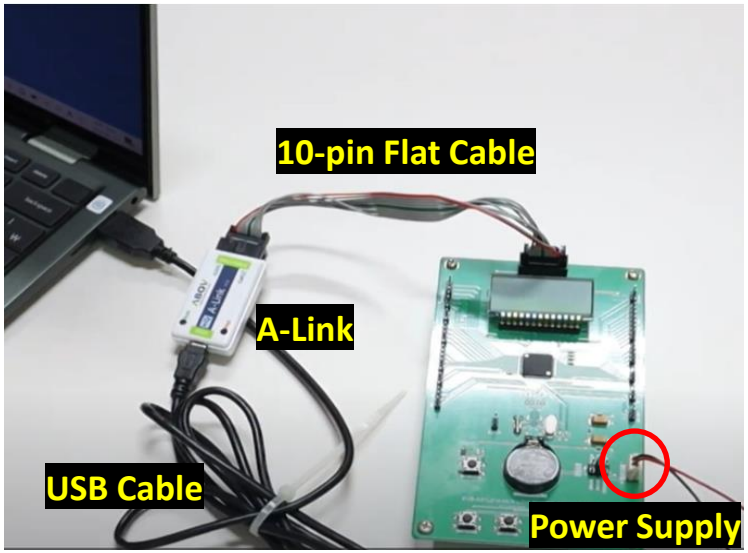
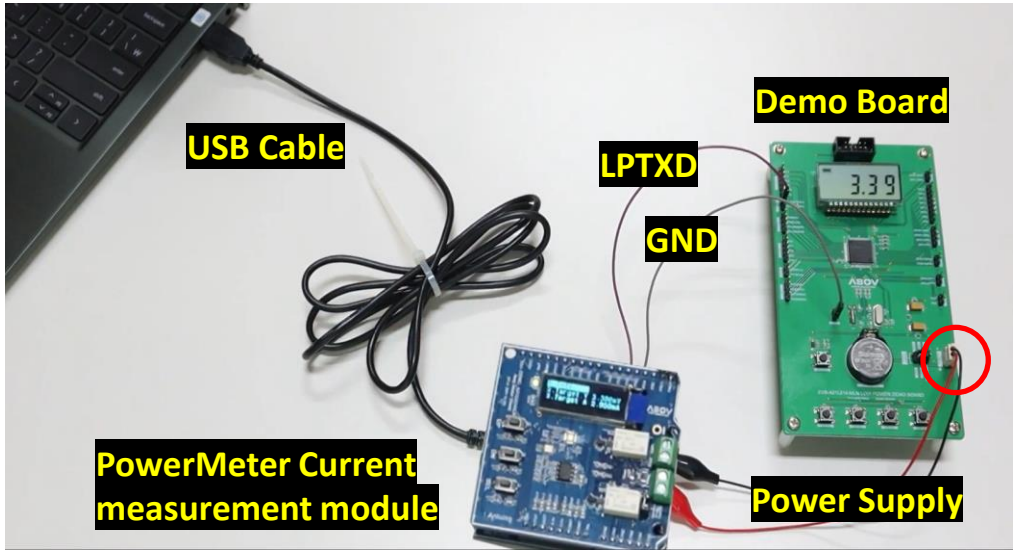
Current Measurement_Demo Board

Example Code Download

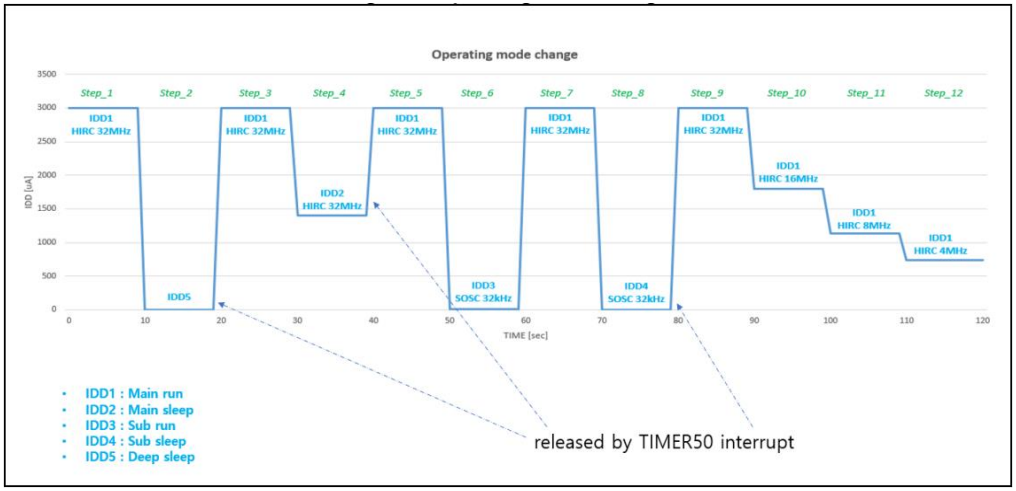


Current Measurement Environment



Power Gauge Current Measure program

Operating Current Scenario



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