

SF32LB56x

big.LITTLE Arm Cortex-M33 STAR-MC1@240MHz/96MHz, 1378 CoreMark
2D/2.5D GPUs, 960KB SRAM, BT/BLE 5.3, TinyML

Product Brief

Key Features

- Bluetooth MCU with dual-core Arm Cortex-M33 STAR-MC1 up to 240MHz/96MHz, 1378 CoreMark, 517 DMIPS, suitable for both feature-rich graphical HMI and ultra-low power sensor hub operation
- ePicasso™2.0 2D/2.5D GPUs, support rotation and scaling, 4-layer blending
- eZip™2.0 lossless graphics decompression, support native animation
- Dual-mode BT5.3, EDR2 sensitivity of -95.5dBm, BLE 1Mbps sensitivity of -100dBm and Rx power of 2.2mA@3.3V
- On-chip HiFi audio ADC/DAC, support audio playback and Bluetooth call
- 960KB on-chip SRAM, 512KB/1MB QSPI-NOR, support OPI-PSRAM, interfaces for NOR, SPI-NAND, SD-NAND and eMMC
- BGA175 and QFN68L, up to 120 GPIOs

Applications

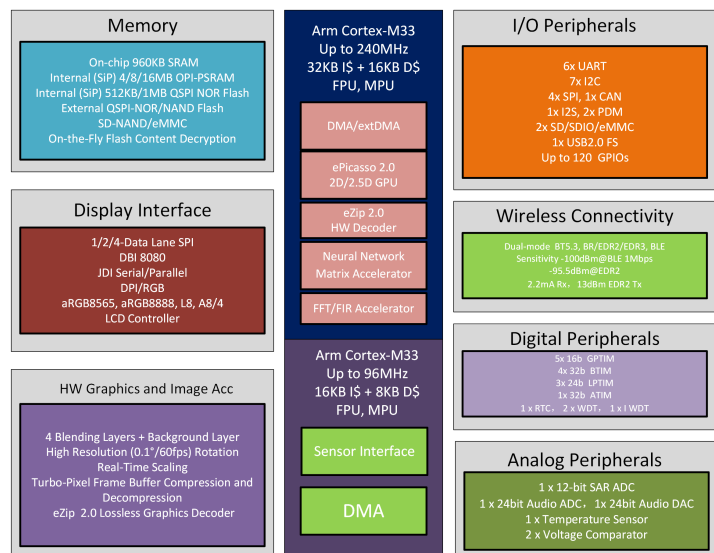
- Smart watch
- Activity and fitness monitor
- Graphical HMI device
- Industrial sensor control
- Smart home appliance
- Smart door lock
- Low-power sensor hub

SF32LB56x is a family of highly integrated high-performance MCUs for ultra-low power AIoT scenarios. It adopts the big.LITTLE architecture with Arm Cortex-M33 STAR-MC1 processors, and is embedded with 2D/2.5D GPU, neural network matrix accelerator, dual-mode BT5.3, and audio codec. SF32LB56x can be used for a wide variety of applications such as smart wearables, smart HMI devices, and smart homes.

The high-performance processor ("big core") of SF32LB56x can operate at up to 240MHz for 984 CoreMark. The low-power processor can operate at up to 96MHz for 394 CoreMark and serves as both sensor hub and Bluetooth controller at high energy efficiency of 3.3uA/CoreMark. This architecture delivers no-compromise user experience of both high computational performance required for feature-rich graphical HMI and always-on ultra-low power sensor control and wireless connectivity.

The 2D/2.5D GPU, at up to 240MHz, support 4-layer alpha blending, hardware accelerated rotation and scaling, and conversion of various common graphic formats. eZip™2.0 supports lossless compressed graphics file, saving memory bandwidth and storage capacity. The LCD controller can support interfaces of 8080/QSPI/JDI at a full-screen refresh frame rate up to 60fps.

The world-class dual-mode BT5.3 transceiver has a maximum Tx power of 13dBm at EDR2 mode and Rx power of 2.2mA@3.3V, and the sensitivity reaches -100dBm (1Mbps) for BLE and -95.5dBm for EDR2.



CPU and Memory

- High Performance Application Processor (HCPU)
 - Arm Cortex-M33 STAR-MC1
 - Clock up to 240MHz, adjustable
 - Up to 370DMIPS, 984 EEMBC CoreMark
 - I/D-Cache: 32KB(2-way)+16KB(4-way)
 - SRAM: 800KB (128KB Retention SRAM)
 - CoreMark power: <34uA/MHz @3.3V
 - Floating Point Unit (FPU)
 - Memory Protection Unit (MPU)
- Ultra Low-Power Processor (LCPU)
 - Arm Cortex-M33 STAR-MC1
 - Clock up to 96MHz, adjustable
 - Up to 148DMIPS, 394 EEMBC CoreMark
 - I/D-Cache: 16KB (2-way)+8KB (4-way)
 - SRAM: 160KB (all Retention SRAM)
 - CoreMark power: <13.5uA/MHz @3.3V
 - Floating Point Unit (FPU)
 - Memory Protection Unit (MPU)

Graphics and Display

- 2D/2.5D GPUs—ePicasso™2.0
 - 4-layer alpha blending + 1 background layer
 - Hardware-accelerated rotation, scaling, mirroring
 - Maximum resolution: 1024×1024
 - Support aRGB8565, aRGB8888, L8, A8/4, YUV, support alpha blending
- Lossless Decompression Accelerator – eZip™2.0
 - Lossless graphics decompression, support native animation eZip-A
 - Support aRGB8565, aRGB8888, L8, A8/4
 - Concatenated operation with ePicasso™2.0
- LCD Controller
 - Support 8080, SPI, Dual-SPI, Quad-SPI, DPI/RGB, JDI
 - 2-layer alpha blending + 1 background layer
 - TurboPixel™ Frame Buffer compression and decompression

Wireless Connectivity

- Dual-mode BT5.3, with BLE Audio support
- Sensitivity: -100dBm (BLE/1Mbps) , -96.3dBm (BR) , -95.5dBm (EDR2), -88.5dBm (EDR3)
- Max. Tx power: 13dBm (EDR2/3) , 19dBm (BR/BLE)
- Rx peak current (BR): 2.2mA@3.3V

Audio

- 1×HiFi 24-bit Audio DAC, 108dB SNR
- 1×HiFi 24-bit Audio ADC, 99dB SNR
- 2×PDM, 1×I²S

Neural Network Matrix Accelerator

- Matrix convolution acceleration for TinyML scenarios
- Processing power up to 1.92GOPS
- Energy efficiency higher than 10TOPS/W

Memory Interface

- 4×MPI, support QSPI-NOR, SPI-NAND, QPI/OPI-PSRAM
- 2×SD/SDIO/eMMC, one 4-bit and one 8-bit, support SD3.0, SDIO3.0 and eMMC4.51

Others

- DMA
 - General DMA: high efficiency data transfer between internal memory and peripherals
 - extDMA: high efficiency data transfer between internal memory and external memory
- Security
 - AES, HASH and CRC hardware accelerator
 - True random number generator (TRNG)
 - PSA Certified Level 1
- Timers
 - 5×16b GPTIM, 1×32b ATIM, 4×32b BTIM, 3×24b LPTIM
 - 1×RTC
 - 2×24b WDT, 1×IWDWT
- Analog Peripherals
 - 1×12-bit general purpose SAR ADC, 8 channels
 - 1×Temperature sensor
 - 2×Low power voltage comparator
- I/O Peripherals
 - 6×UART, 7×I²C, 4×SPI, 1×ISO7816
 - 1×USB2.0 FS
 - Peripheral Task Controller (PTC)
- Power Management
 - Power supply: 1.7 to 3.6V, -40 to 85°C
 - High-efficiency buck and low-power LDO
 - Sleep current with RTC wake-up: 600nA
 - Sleep current with pin wake-up: 300nA

Package

- WBBGA175, 120 GPIOs, 6.5×6.1×0.94mm
- QFN68L, 44 GPIOs, 7×7×0.75mm