SF32LB58x

Tri-core Arm Cortex-M33 STAR-MC1@240MHz/96MHz, 2362 CoreMark

2D/2.5D GPUs, 3744KB SRAM, Dual-mode BT5.3, TinyML

Product Brief

Key Features

- Bluetooth MCU with tri-core Arm Cortex-M33 STAR-MC1 up to 240MHz/96MHz, 2362 Core-Mark, 887 DMIPS, suitable for both feature-rich graphical HMI and ultra-low power sensor hub operation
- Dual 2D/2.5D GPU, 240MHz, 4-layer blending, vector graphics and fonts, rotation and scaling
- eZip™2.0 lossless graphics de-compression, saving memory bandwidth and capacity as well as data transfer power
- Dual-mode BT5.3, BR sensitiv-ity at -96.3dBm and Rx power of 2.2mA@3.3V
- On-chip HiFi audio codec and PDM interface that support up to 4 digital microphones, 2 ana-log microphones and 2 analog speakers
- 3744KB on-chip SRAM, inter-faces for NOR, NAND, eMMC, （SiP）HPI-PSRAM and QSPI-NOR
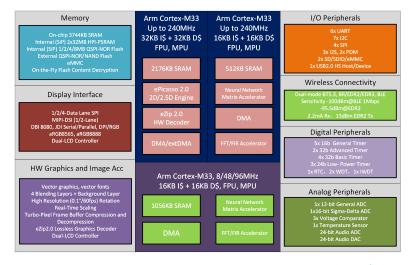- BGA256, 6.5×8.5×0.94mm, up to 154 GPIOs

Applications

- Smart watch
- Activity and fitness monitor
- Location and motion tracker
- Cost-effective display solution
- Graphical HMI device
- Smart home appliance
- Low-power sensor hub

SF32LB58x is a family of highly integrated high-performance SoC MCUs for ultra-low power AIoT scenarios. It adopts a big.LITTLE architecture based on Arm Cortex-M33 STAR-MC1 processor, and is embedded with dual 2D/2.5D GPUs, two neural network matrix accelerators, dual-mode BT5.3, and audio codec. SF32LB58x can be used for a wide variety of applications such as smart wearables, smart HMI devices, and smart home appliances, etc.

The dual-big core high performance application processor can operate at up to 240MHz, delivering up to 984 CoreMark per core. 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 3.88uA/CoreMark. This architecture delivers no-compromise user experience of both high performance computing required for rich HMI and always-on ultra-low power sensor control and wireless connectivity.

The dual 2D/2.5D GPUs, at up to 240MHz, support vector graphics and fonts, 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 dual-LCD controller can support interfaces of 8080/QSPI/MIPI-DSI/JDI at a full-screen refresh frame rate up to 60fps.

The dual-mode BT5.3 transceiver has a maximum Tx power of 13dBm at EDR2 mode, and 19dBm at BLE mode. The receiver consumes peak current of 2.2mA@3.3V at BR mode, and has a sensitivity of -100dBm (1Mbps) for BLE and -96.3dBm for BR.

Memory	Arm Cortex-M33 Up to 240MHz 32KB I$ + 32KB D$ FPU, MPU	Arm Cortex-M33 Up to 240MHz 16KB I$ + 16KB D$ FPU, MPU	I/O Peripherals
On-chip 3744KB SRAM Internal (SiP) 2x32MB HPI-PSRAM Internal (SIP) 1/2/4/8MB QSPI-NOR Flash External QSPI-NOR/NAND Flash eMMC On-the-Fly Flash Content Decryption	2176KB SRAM	512KB SRAM	6x UART 7x I2C 4x SPI 3x I2S, 2x PDM 2x SD/SDIO/eMMC 1x USB2.0 HS Host/Device
Display Interface	ePicasso 2.0 2D/2.5D Engine	Neural Network Matrix Accelerator	**Wireless Connectivity**
1/2/4-Data Lane SPI MIPI-DSI (1/2-Lane) DBI 8080, JDI Serial/Parallel, DPI/RGB aRGB8565, aRGB8888 Dual-LCD Controller	eZip 2.0 HW Decoder	DMA	Dual-mode BT5.3, BR/EDR2/EDR3, BLE Sensitivity -100dBm@BLE 1Mbps -95.5dBm@EDR2 2.2mA Rx，13dBm EDR2 Tx
	DMA/extDMA	FFT/FIR Accelerator	**Digital Peripherals**
HW Graphics and Image Acc	Arm Cortex-M33, 8/48/96MHz 16KB I$ + 16KB D$, FPU, MPU		5x 16b General Timer 2x 32b Advanced Timer 4x 32b Basic Timer 3x 24b Low- Power Timer 1x RTC，2x WDT，1x IWDT
Vector graphics, vector fonts 4 Blending Layers + Background Layer High Resolution (0.1°/60fps) Rotation Real-Time Scaling Turbo-Pixel Frame Buffer Compression and Decompression eZip2.0 Lossless Graphics Decoder Dual-LCD Controller	1056KB SRAM	Neural Network Matrix Accelerator	**Analog Peripherals**
	DMA	FFT/FIR Accelerator	1x 12-bit General ADC 1x16-bit Sigma-Delta ADC 3x Voltage Comparator 1x Temperature Sensor 24-bit Audio ADC 24-bit Audio DAC

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CPU and Memory

- High Performance Application Processor (HCPU/ACPU)
    - Arm Cortex-M33 STAR-MC1, FPU/MPU
    - Clock up to 240MHz, adjustable
    - Up to 360DMIPS, 965 EEMBC CoreMark per core
    - I-Cache + D-Cache
        — HCPU: 32KB(2-way)+32KB(4-way)
        — ACPU: 16KB(2-way)+16KB(4-way)
    - SRAM: 2176KB(HCPU)+512KB(ACPU)
    - CoreMark power: 34μA/MHz @3.3V, 240MHz
- Ultra Low-Power Processor (LCPU)
    - Arm Cortex-M33 STAR-MC1, FPU/MPU
    - Clock up to 96MHz, adjustable
    - Up to 144DMIPS, 386 EEMBC CoreMark
    - I/D-Cache: 16KB (2-way)+16KB (4-way)
    - SRAM: 1056KB (all retention SRAM)
    - CoreMark power: 15.9μA/MHz @3.3V, 48MHz

Wireless Connectivity

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

Graphics and Display

- 2D/2.5D GPUs
    - 1×2D/2.5D GPU—ePicasso™2.0
    - 1×2D/2.5D GPU—Vivante GCNanoUltraV
    - Vector graphics and fonts
    - Hardware-accelerated rotation, scaling, mirroring
    - Maximum resolution: 1024×1024
    - Support aRGB8565, aRGB8888, L8, alpha blending
- Lossless Decompression Accelerator – eZip™2.0
    - Lossless graphics decompression, support native animation, concatenated operation with ePicasso™2.0
- JPEG Hardware Accelerator
    - JPEG/MJPEG image encoding and decoding
    - JPEG image cropping and scaling
- LCD Controller
    - Support 8080, SPI, Dual-SPI, Quad-SPI, MIPI-DSI, JDI
    - TurboPixel™ FB compression and decompression
    - Dual-LCD controller, support low power always-on display based on little core

Neural Network Matrix Accelerator

- Matrix convolution acceleration for TinyML scenarios
- Processing power up to 1.92GOPS

Hardware-Accelerated Digital Signal Processing

- Two FFT accelerators, Two FIR filter accelerators
- Three CORDIC co-processors for trignometric functions

Memory Interface

- 5×QSPI (MPI), support NOR, NAND, QPI-PSRAM
- 2×OPI/HPI-PSRAM, up to 144MHz
- 2×SD/SDIO/eMMC, one 4-bit and one 8-bit,support SD3.0, SDIO3.0 and eMMC4.51

Others

- DMA
    - General DMA: data transfer for peripherals
    - extDMA: data transfer for external memory
- Security
    - AES, HASH and CRC hardware accelerator
    - True random number generator (TRNG)
    - PSA Certified Level 1
- Audio
    - Audio sample rate conversion accelerator
    - Audio EQ accelerator
- Timers
    - 5×16b GPTIM, 2×32b ATIM, 4×32b BTIM, 3×24b LPTIM
    - 1×RTC, 2×24b WDT, 1×IWDT
- Analog Peripherals
    - 1×12-bit general purpose SAR ADC, 8 channels
    - 1×16-bit Sigma-Delta ADC, 5 channels
    - 3×Low power voltage comparator
    - 2×24-bit audio ADC, 2×24-bit audio DAC
- I/O Peripherals
    - 6×UART, 7× I^2C, 4×SPI
    - 3× I^2S, 2× PDM
    - 1×USB2.0 HS Host/Device
    - SIM card controller
    - Peripheral Task Controller (PTC)
- Power Management
    - Power supply: 1.7 to 3.6V, -40 to 85°C
    - Two high-efficiency bucks and low-power LDO
    - Sleep current with RTC wake-up: <1μA

Package

- BGA256, 154(HP94+LP60) GPIOs, 6.5×8.5×0.94mm