V853

High-Performance AI Vision Processor

Overview

V853 is a new generation of high-performance and low-power processor SoC targeted for the field of intelligent vision. It can be widely used in intellectually upgraded industries such as intelligent door lock, intelligent attendance and access control, webcam, tachograph, and intelligent desk lamp.

V853 integrates the single Cortex-A7 core and RISC-V MCU. It is also designed with a new generation of high-performance ISP image processor and Allwinner Smart video engine with maximum 5M@25fps H.265/H.264 encoding and 5M@25fps H.264 decoding to achieve professional picture effect. It has built-in NPU with maximum 1T computing power and supports INT8/INT16 hybrid operation and typical network models such as TensorFlow/MXNet/PyTorch/Caffe. V853 has advanced 22nm technics to support product miniaturization design. It also supports various special video input and output interfaces such as 1*4-lane MIPI-CSI/DVP/MIPI-DSI/RGB to meet the needs of all AI visual products. V853 supports 16-bit DDR3/LDDR3L to meet the requirements of various products on high bandwidth. In addition, Allwinner provides the stable and easy-to-use matching reference design for Linux SDK and software and hardware to assist clients in the rapid mass production of products.

Highlight

● High Performance: V853 integrates ARM Cortex-A7@1GHz, RISC-V@600MHz, 1Tops NPU and 16-bit DDR3/DDR3L at maximum frequency of 933MHz to meet the variable requirements of computing power and bandwidth.

● Video Multimedia: Supports 5M@25fps H.264/H.265 video online real-time encoder and Allwinner new-generation display engine ISP600 and reach the mainstream level in 2/3DNR, HDR, edge enhancement and so on.

● Video Input: Parallel CSI and 4-lane MIPI CSI support maximum 4-ch AHD camera or 3-ch RAW data camera interleaved-input.

● Rich Peripheral Interfaces: 5xTWI, 4xUART, 4xSPI, 4xGPADC,USB2.0 DRD, WIEGAND and other interfaces greatly facilitate product expansion.
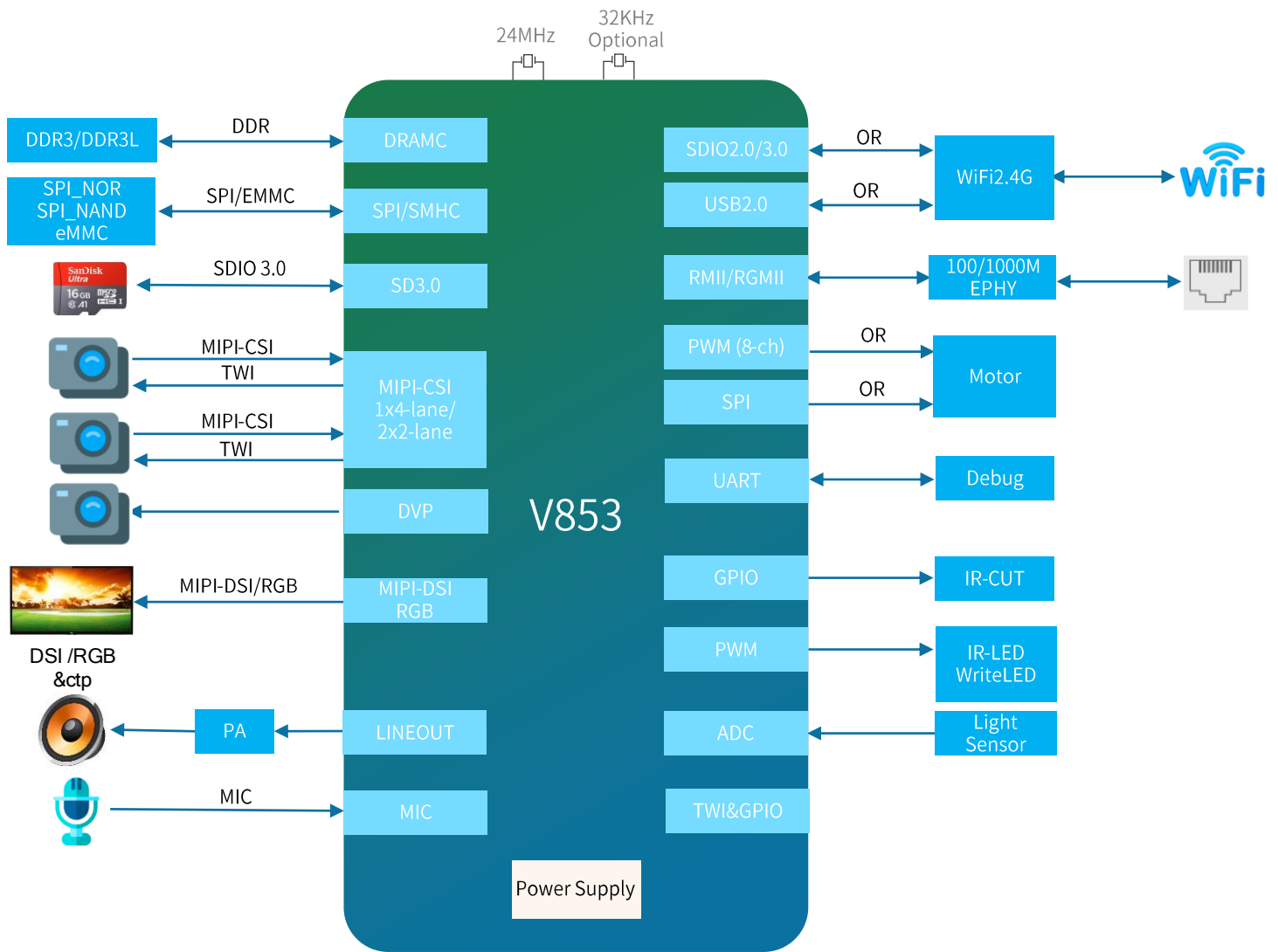
Features

CPU	• Cortex-A7@1 GHz CPU core, supporting 32 KB I-cache, 32 KB D-cache, and 128 KB L2 cache • RISC-V@600 MHz core, supporting 16 KB I-cache and 16 KB D-cache
NPU	• Maximum performance up to 1 Tops • Embedded 128KB internal buffer • Supports deep learning frameworks: TensorFlow, Caffe, Tflite, Pytorch, Onnx NN, and so on
Memory	• 16-bit DDR3/DDR3L interface, supporting maximum capacity of 1GB • SD3.0/eMMC 5.1 interface • SPI Nor/SPI Nand Flash
Video Engine	**Video encoder** • H.264/H.265 up to 4K@15fps or 5M@25fps • JPEG up to 1080p@60fps **Video decoder** • Supports H.264 BP/MP/HP, JPEG • Real-time multiple streams H.264 encoding capability: 5M@25fps • JPEG snapshot performance of 1080p@60fps independently
Display Engine	• Allwinner SmartColor post processing for an excellent display experience • Supports 2 video channels and 1 UI channel • Supports G2D hardware accelerator including rotate, mixer, scaler functions
Video Input	**ISP** • Maximum performance of 5M@30fps and maximum resolution of 3072 x 1772 • Adjustable 3A functions (AE, AWB, and AF), and 3A parameters are adjustable • Provides ISP tuning tools for the PC **VIPP** • Four VIPP YUV422 or YUV420 outputs • Maximum performance of 5M@30fps and maximum resolution of 3072 x 1772 **8-/10-/12-/16-bit parallel CSI interface** • Supports digital camera (DC), BT.601, BT.656, BT.1120 protocol • Maximum video capture resolution up to 5M@30fps **1*4-lane MIPI CSI interface** • Supports DOL WDR mode and splitting into 2*2-lane MIPI CSI • Supports 4-ch VC de-interleaver function • Maximum video capture resolution up to 5M@30fps
Video OUT	• RGB LCD output interface up to 1920 x 1080@60fps • 1*4-lane MIPI DSI interface up to 1920 x 1200@60fps
Audio	• 1 DAC and 2 ADCs • Analog audio interfaces: MICIN1P/N, MICIN2P/N, LINEOUTP/N • Digital audio interfaces: I2S/PCM x 2, DMIC
Security System	• AES, DES, 3DES encryption and decryption algorithms • RSA/ECC signature verification algorithm • MD5/SHA and HMAC tamper proofing • PRNG/TRNG hardware random number generator • Integrated 2 Kbits OTP storage space
Connectivity	• USB2.0 DRD, SDIO 3.0, SPI x 4, UART x 4, TWI x 5, WIEGAND • PWM (12-ch), GPADC (4-ch) • 10/100/1000M EMAC with RMII and RGMII interfaces
Package	• LFBGA318, 12 mm x 12 mm body size, 0.5 mm ball pitch

Block Diagram

Video Output
- 4-lane MIPI DSI 1920 x 1200@60fps
- RGB LCD 1920 x 1080@60fps

ARM Cortex-A7
- I-cache 32KB
- D-cache 32KB
- L2-cache 128KB
- FPU

RISC-V
- I-cache 16KB
- D-cache 16KB

NPU 1T

Connectivity
- USB2.0 DRD
- SMHC x3
- GPIOs x8
- SPI x4 (Supports SPI Nand/Nor Flash)
- TWI x5
- UART x4
- 10M/100M/1000M EMAC
- GPADC(4-ch)
- PWM(12-ch)
- WIEGAND IN

Video Input
- ISP 5M@30fps
- VIPP 5M@30fps
- 8-/10-/12-/16-bit Parallel CSI
- 4-lane MIPI CSI 5M@30fps

Display Engine
- DE
- G2D

Video Engine
- Video Decoding 5M@25fps H.264
- Video Encoding 5M@25fps H.265/ H.264

Internal System
- CCU
- GIC
- DMA
- Thermal Sensor
- Timer
- High Speed Timer
- IOMMU

Audio
- Audio Codec
- I2S/PCM x2
- DMIC

Memory
- 16 bits DDR3/DDR3L
- SD3.0/eMMC5.1
- SPI Nor/SPI Nand Flash

Security System
- Crypto Engine
- Security ID
- Trustzone
- Secure Boot

Application Diagram

24MHz
32KHz Optional

	V853	
DRAMC		SDIO2.0/3.0
SPI/SMHC		USB2.0
SD3.0		RMII/RGMII
MIPI-CSI 1x4-lane/ 2x2-lane		PWM (8-ch)
		SPI
DVP		UART
MIPI-DSI RGB		GPIO
		PWM
LINEOUT		ADC
MIC		TWI&GPIO

Power Supply

DDR → DDR3/DDR3L
SPI/EMMC → SPI_NOR SPI_NAND eMMC
SDIO 3.0
MIPI-CSI / TWI
MIPI-CSI / TWI
MIPI-DSI/RGB
DSI /RGB &ctp
PA
MIC

SDIO2.0/3.0 — OR — WiFi2.4G — WiFi
USB2.0 — OR
RMII/RGMII — 100/1000M EPHY
PWM (8-ch) — OR — Motor
SPI — OR
UART — Debug
GPIO — IR-CUT
PWM — IR-LED WriteLED
ADC — Light Sensor