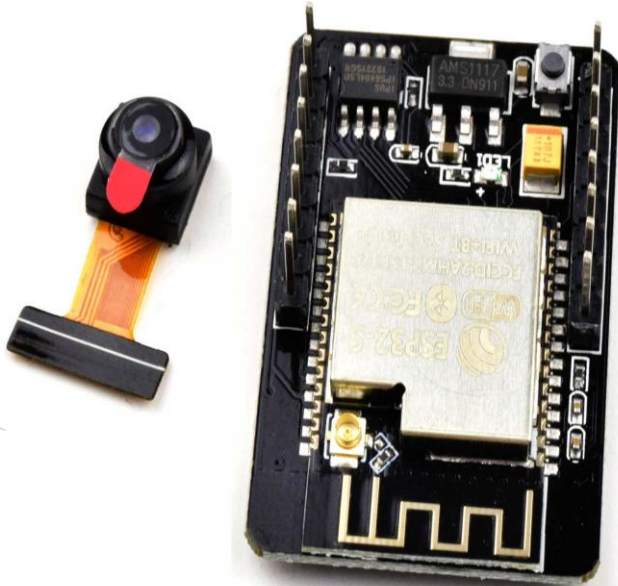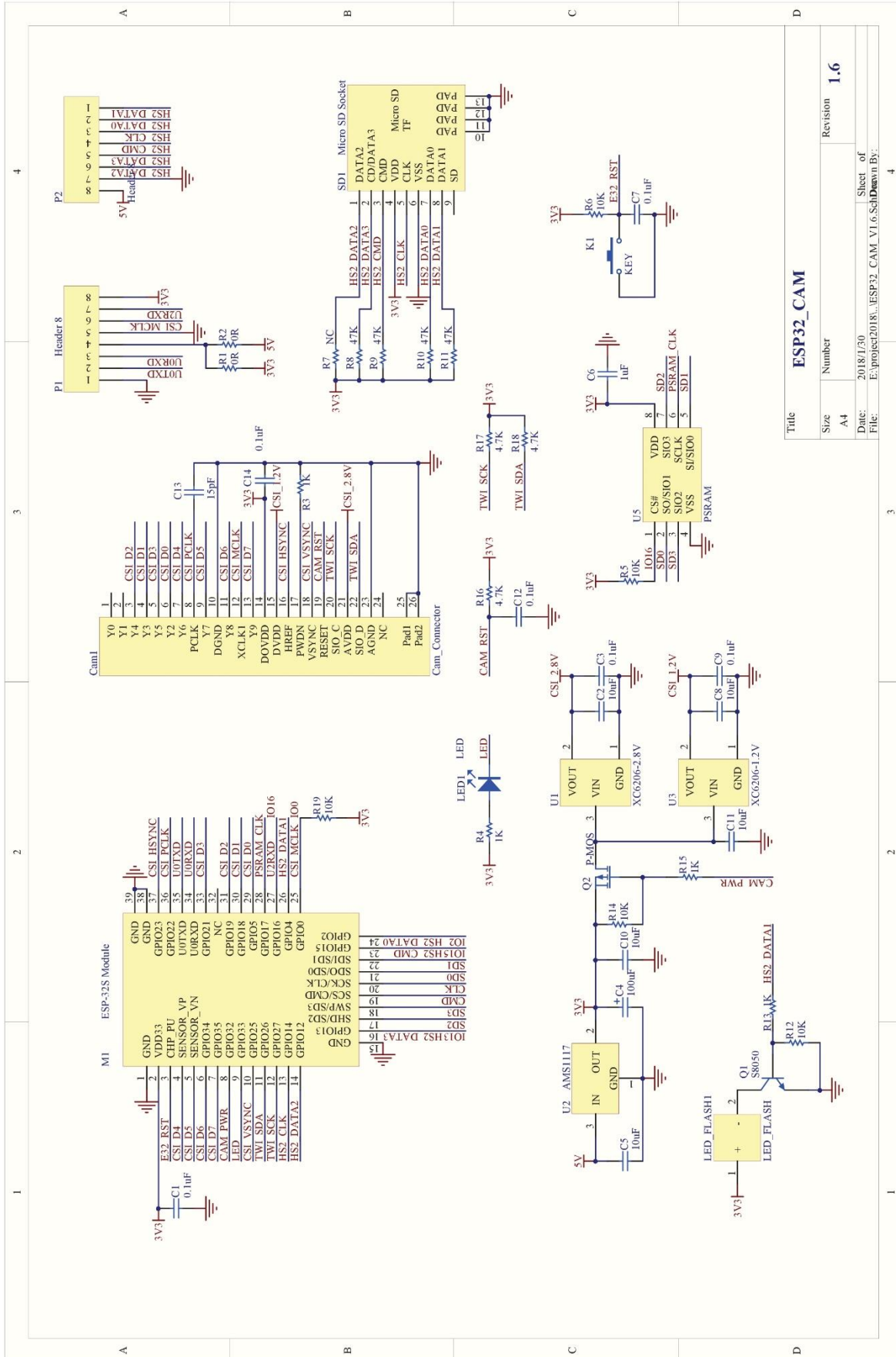# Ai-Thinker ESP32-CAM WiFi + BT + BLE SoC with 2MP Camera
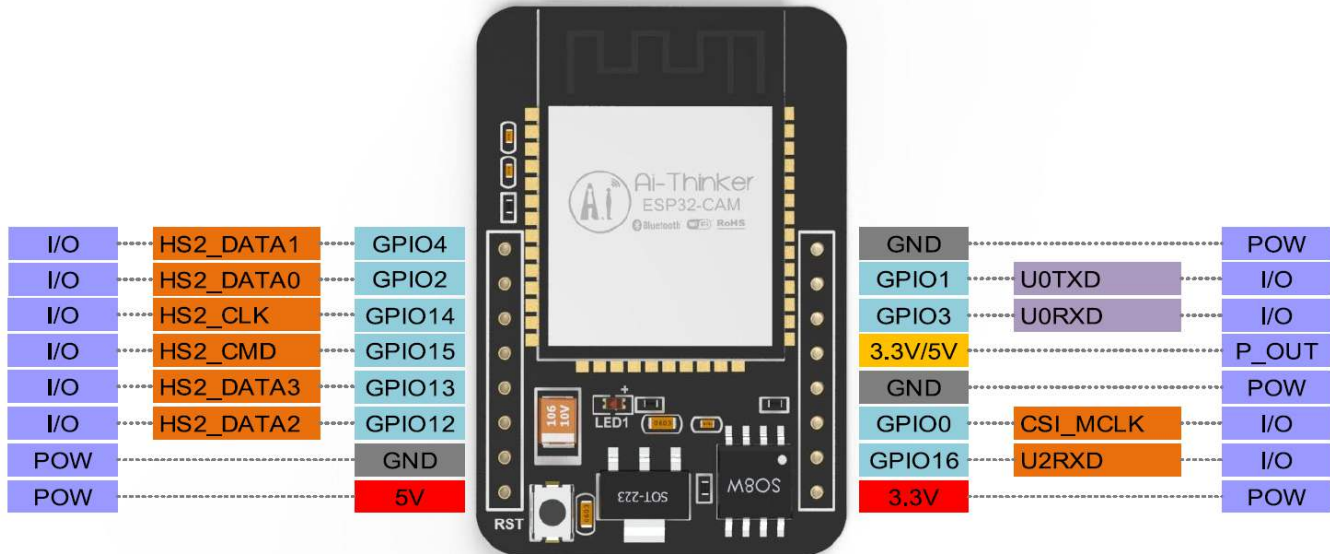
**Ai-Thinker ESP32-CAM** is a small and ultra-low power device with the original Ai-Thinker ESP32-S SoC and an OmniVision OV2640 Camera module with 1600 x 1200 pixel. The ESP32-S SoC contains two 240MHz Xtensa® 32-bit LX6 microprocessor cores, 32Mbit flash memory, and radios for Bluetooth 4.2 and WiFi 2.4GHz.

**ESP32-CAM** can be programmed, for example, using Arduino IDE. The board manager files and example code is available on GitHub and from many other sources.

- Low-power dual-core 32-bit CPU, can be used as an application processor
- Main frequency up to 240MHz, computing power up to 600 DMIPS
- Built-in 520 KB SRAM, external 8MB PSRAM
- Support UART/SPI/I2C/PWM/ADC/DAC and other interfaces
- Support OV2640 and OV7670 cameras, built-in flash
- Support picture WiFI upload
- Support TF card
- Support multiple sleep modes.
- Embedded Lwip and FreeRTOS
- Support STA/AP/STA+AP working mode
- Support Smart Config/AirKiss one-click network configuration

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Title: **ESP32_CAM**

Size A4
Number
Revision **1.6**
Date: 2018/1/30
File: E:\project2018\...\ESP32_CAM_V1.6.SchDoc
Sheet of
Drawn By:

P2 Header 8
5V
HS2 DATA1
HS2 DATA0
HS2 CLK
HS2 CMD
HS2 DATA3
HS2 DATA2

P1 Header 8
3V3
U2RXD
CSI MCLK
U0RXD
U0TXD
3V3 5V
R1 0R R2 0R

SD1 Micro SD Socket
Micro SD TF
DATA2
CD/DATA3
CMD
VDD
CLK
VSS
DATA0
DATA1
SD
PAD PAD PAD PAD
HS2 DATA2
HS2 DATA3
HS2 CMD
HS2 CLK
HS2 DATA0
HS2 DATA1
R7 NC
R8 4.7K
R9 4.7K
R10 4.7K
R11 4.7K
3V3

K1 KEY
R6 10K
E32_RST
C7 0.1uF
3V3

Cam1 Cam_Connector
Y0 Y1 Y4 Y3 Y5 Y2 Y6 PCLK Y7 DGND Y8 XCLK1 Y9 DOVDD DVDD HREF PWDN VSYNC RESET SIO_C AVDD SIO_D AGND NC Pad1 Pad2
CSI D2 CSI D1 CSI D3 CSI D0 CSI PCLK CSI D5 CSI D6 CSI MCLK CSI D7 CSI HSYNC CSI VSYNC CAM_RST TWI SCK TWI SDA
C13 15pF
3V3 C14
CSI_1.2V
R3 1K
CSI_2.8V
0.1uF

R17 TWI SCK 4.7K
R18 TWI SDA 4.7K
3V3

R16 CAM RST 4.7K
C12 0.1uF
3V3

U5 PSRAM
CS# SO/SIO1 SIO2 VSS
VDD SIO3 SCLK SI/SIO0
IO16 SD0 SD3
PSRAM_CLK
SD1 SD2
C6 1uF
3V3
R5 10K
3V3

U1 XC6206-2.8V
VOUT VIN GND
CSI_2.8V
C3 0.1uF
C2 10uF

U3 XC6206-1.2V
VOUT VIN GND
CSI_1.2V
C9 0.1uF
C8 10uF
C11 10uF

LED1 LED
R4 1K
3V3

Q2 P-MOS
R15 1K
CAM PWR
R14 10K
C10 10uF
+C4 100uF
3V3

U2 AMS1117
IN OUT GND
5V
C5 10uF

Q1 S8050
R13 1K HS2 DATA1
R12 10K
LED_FLASH1
LED_FLASH
3V3

M1 ESP-32S Module
GND GND GPIO23 GPIO22 U0TXD U0RXD GPIO21 GPIO35 GPIO32 GPIO33 GPIO25 GPIO26 GPIO16 GPIO14 GPIO12
GND VDD33 CHIP_PU SENSOR_VP SENSOR_VN GPIO34 GPIO35 GPIO32 GPIO25 GPIO26 GPIO27 GPIO14 GPIO12
E32_RST CSI D4 CSI D5 CSI D6 CSI D7 CAM PWR LED CSI VSYNC TWI SDA TWI SCK HS2 CLK HS2 DATA2
CSI HSYNC CSI PCLK U0TXD U0RXD CSI D3 CSI D2 CSI D1 CSI D0 PSRAM_CLK U2RXD HS2 DATA1 IO16 MCLK IO0
NC GPIO19 GPIO18 GPIO5 GPIO17 GPIO16 GPIO4 GPIO0
GPIO2 GPIO15 IO2 HS2 DATA0 24 IO15 HS2 CMD 23 SDI/SD1 SDO/SD0 SCK/CLK SCS/CMD SWP/SD3 SHD/SD2 IO13 HS2 DATA1 GND GPIO13
SD2 SD1 SD0 CLK CMD SD3
R19 10K
3V3
C1 0.1uF
3V3

| I/O | HS2_DATA1 | GPIO4 | | | GND | | POW |
| I/O | HS2_DATA0 | GPIO2 | | | GPIO1 | U0TXD | I/O |
| I/O | HS2_CLK | GPIO14 | | | GPIO3 | U0RXD | I/O |
| I/O | HS2_CMD | GPIO15 | | | 3.3V/5V | | P_OUT |
| I/O | HS2_DATA3 | GPIO13 | | | GND | | POW |
| I/O | HS2_DATA2 | GPIO12 | | | GPIO0 | CSI_MCLK | I/O |
| POW | | GND | | | GPIO16 | U2RXD | I/O |
| POW | | 5V | | | 3.3V | | POW |

## Specifications:

SPI Flash default 32Mbit

RAM internal520kb + external 8MB PSRAM

Bluetooth Bluetoo4th.2 BR / EDR and BLE standard

Wi-Fi 802.11 b/g/n/e/i

Supported interfaces UART、SPI、I2C、PWM

Serial port rate default 115200 bps

Image output format JPEG (OV2640 support only), BMP, Grayscale

Antenna on board (PCB antenna), gain 2dbi

Transmit power:

802.11b: 17±2 dBm (@11Mbps)

802.11g: 14±2 dBm (@54Mbps)

802.11n: 13±2 dBm (@MCS7)

Receive sensitivity:

CCK, 1 Mbps : -90dBm

CCK, 11 Mbps: -85dBm

6 Mbps (1/2 BPSK): -88dBm

54 Mbps (3/4 64-Qam): -70DBM

MCS7 (65 Mbps, 72.2 Mbps): -67dBm

Power consumption:

w/o Flash: 180mA @ 5V

with Flash (full brightness): 310mA @ 5V

Deep-Sleep: 6mA @ 5V

Security: WPA/WPA2/WPA2-Enterprise/WPS

Power supply range 4.75-5.25V

Operating temperature -20°C ~ 70°C

Storage environment -40°C ~ 125°C

Size 27*40.5*4.5（±0.2）mm

UNIVERSAL-SOLDER offers 3 different models of ESP32-CAM modules:

| Model | SKU | EAN |
|---|---|---|
| Ai-Thinker® ESP32-CAM<br>with genuine Ai-Thinker® SoC | 26573 | 4260474035731 |
| CANADUINO® ESP32-CAM<br>with 3rd party ESP32-S SoC | 26387 | 4260474033874 |
| CANADUINO® ESP32-CAM-MB<br>with 3rd party SoC and USB adapter | 26570 | 4260474035700 |

For more information, please visit Ai-Thinker website and GitHub repository:

https://docs.ai-thinker.com/en/esp32-cam

https://github.com/espressif/esp32-camera