**ESP32 Introduction**

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# ESP 32 Data sheet ( 65 Pg )

* Single 2.4 GHz Wi-Fi and Bluetooth combo chip.
* Low duty cycle is used to minimize the amount of energy that the chip expends.
* Output of the power amplifier is adjustable
  + Optimal trade off between communication range, data and power consumption
* 20 external components
* **Wi-fi Key Features**
  + **802.11 B/G/N** : IEEE 802.11 is a set of media access control (MAC) and physical layer (PHY) specifications for implementing wireless local area network (WLAN) computer communication in the 900 MHz and 2.4, 3.6, 5, and 60 GHz frequency bands.
  + **UP to 150 Mbps**
  + **WMM :** WMM is a subset of the IEEE 802.11e standard
  + **TX/RX A-MPDU, RX A-MSDU**
  + **Immediate Block ACK :**The Block Ack mechanism improves channel efficiency by aggregating several acknowledgments into one frame.
  + **Defragmentation :**  Help for smoother communication
  + **Automatic Beacon Monitoring** : I am assuming something like watch dog
  + **4 x Virtual Wi-Fi interfaces** : Can connect to four separate Wi-Fi interfaces
  + **Simultaneous support for infrastructure station, SoftAP, and Promiscuous modes**
  + **Antenna Diversity**
* **Bluetooth Key features**
  + +9dBm transmitting power
  + Adaptive frequency Hopping
  + Synchronous Connection-Oriented/Extended
* **MCU and advanced Features** 
  + 1 Core at 240 MHz: 504.85 Coremark; 2.10 Coremark/MHz
  + 2 cores at 240 MHz: 994.26 CoreMark; 4.14 CoreMark/Mhz
  + Internal 8 MHz oscillator with calibration
  + External 2 Mhz ~ 60 MHz crystal Oscillator ( 40 MHz only got Wi-Fi/ Bluetooth functionality)
  + Two timer groups , including 2x 64 bit timers and 1 x main watchdog in each group
  + 34 programmable GPIOs
  + 12 bit SAR ADC up to 18 channels
  + 2 X 8 – bit DAC
  + 3 UART
  + LED PWM up to 16 Channels
  + Chart, diagram

    Description automatically generated
  + The operating voltage of ESP32 ranges from 2.3 V to 3.6 V.
    - When using a single power supply , the recommended voltage of the power supply is 3.3V and it’s recommended output current is 500 mA or more
    - If VDD\_SDIO 1.8V is used , add a 2 K ohm grounding resistor .
* **RADIO**
  + 2.4 GHz receiver
  + 2.4 GHz transmitter
  + Bias and regulators
  + Balun and transmit receive switch
  + Clock Generator
* **WI-FI** 
  + TCP/IP and full 802.11 b/g/n Wi-Fi Mac protocol
  + Provides UART HCI interface, up to 4 Mbps
  + Provides SDIO/SPI HCI interface
  + Provides PCM/I2S audio interface
* **RTC and Low Power Management** 
  + Power modes
    - Active – Chip radio is on, the chip can receive, transmit, or listen
    - Modem sleep mode – CPU is operational, and the clock is configurable. Radio and exterior boards are not
    - Light sleep mode – CPU is paused, any wake-up events will wake up the chip
    - Deep sleep mode – Only the RTC memory and RTC peripherals are powered on.
    - Hibernation mode – Only one RTC timer on the slow clock and certain RTC GPIOs are active
  + For the most part the power consumption of the chip depends on the mode, with most of the modes being around 80 mA
* SAR ADC
  + Successive Approximation Registers
* **Electrical Characteristics ( Page 42 )**