ST STM32F4DISCOVERY 超低成本开发应用方案

ST 公司的 STM32F40x 系列是高性能的数字信号控制器（DSC），采用 ARM Cortex™-M4F 32 位 RISC 内核，工作频率高达 168 MHz，具有 210DMIPS 性能，工作电压 1.7V-3.6V，RTC 的超低功耗小于 1uA，具有优异的接口，集成了 1MB 闪存，192KB SRAM，主要用在 POS/投资管理，工业自动化和太阳能电池板，交通运输，医疗设备，建筑物，测试仪表，消费类电子和通信等设备。本文介绍了 STM32F40x 系列主要特性，方框图，STM32F4DISCOVERY 板主要特性，硬件框图和电路图，元件布局图，以及采用 STM32F4xx 和 STM32F4-DISCOVERY 板的音频播放和录音模块框图。

The STM32F405xx and STM32F407xx family is based on the high-performance ARM®Cortex™-M4F 32-bit RISC core operating at a frequency of up to 168 MHz. The Cortex-M4F core features a Floating point unit (FPU) single precision which supports all ARM single-precision data-processing instructions and data types. It also implements a full set of DSP instructions and a memory protection unit (MPU) which enhances application security.

The STM32F405xx and STM32F407xx family incorporates high-speed embedded memories (Flash memory up to 1 Mbyte, up to 192 Kbytes of SRAM), up to 4 Kbytes of backup SRAM, and an extensive range of enhanced I/Os and peripherals connected to two APB buses, two AHB buses and a 32-bit multi-AHB bus matrix.

All devices offer three 12-bit ADCs, two DACs, a low-power RTC, twelve general-purpose 16-bit timers including two PWM timers for motor control, two general-purpose 32-bit timers. a true number random generator (RNG). They also feature standard and advanced communication interfaces.

STM32F40x 系列主要特性：

Core: ARM 32-bit Cortex™-M4F CPU with FPU, Adaptive real-time accelerator (ART Accelerator™) allowing 0-wait state execution from Flash memory, frequency up to 168 MHz, memory protection unit, 210 DMIPS/1.25 DMIPS/MHz (Dhrystone 2.1), and DSP instructions

Memories

Up to 1 Mbyte of Flash memory

Up to 192+4 Kbytes of SRAM including 64-Kbyte of CCM (core coupled memory) data RAM

Flexible static memory controller supporting Compact Flash, SRAM, PSRAM, NOR and NAND memories

LCD parallel interface, 8080/6800 modes

Clock, reset and supply management

1.8 V to 3.6 V application supply and I/Os

POR, PDR, PVD and BOR

4-to-26 MHz crystal oscillator

Internal 16 MHz factory-trimmed RC (1% accuracy)

32 kHz oscillator for RTC with calibration

Internal 32 kHz RC with calibration

Sleep, Stop and Standby modes

V_{BAT}supply for RTC, 20×32 bit backup registers + optional 4 KB backup SRAM

3×12-bit, 2.4 MSPS A/D converters: up to 24 channels and 7.2 MSPS in triple interleaved mode

2×12-bit D/A converters

General-purpose DMA: 16-stream DMA controller with FIFOs and burst support

Up to 17 timers: up to twelve 16-bit and two 32-bit timers up to 168 MHz, each with up to 4 IC/OC/PWM or pulse counter and quadrature (incremental) encoder input

Debug mode

Serial wire debug (SWD) & JTAG interfaces

Cortex-M4F Embedded Trace Macrocell™

Up to 140 I/O ports with interrupt capability

Up to 136 fast I/Os up to 84 MHz

Up to 138 5 V-tolerant I/Os

Up to 15 communication interfaces

Up to 3 × I^2C interfaces (SMBus/PMBus)

Up to 4 USARTs/2 UARTs (10.5 Mbit/s, ISO 7816 interface, LIN, IrDA, modem control)

Up to 3 SPIs (37.5 Mbits/s), 2 with muxed full-duplex I^2S to achieve audio class accuracy via internal audio PLL or external clock

2 × CAN interfaces (2.0B Active)

SDIO interface

Advanced connectivity

USB 2.0 full-speed device/host/OTG controller with on-chip PHY

USB 2.0 high-speed/full-speed device/host/OTG controller with dedicated DMA, on-chip full-speed PHY and ULPI

10/100 Ethernet MAC with dedicated DMA: supports IEEE 1588v2 hardware, MII/RMII

8- to 14-bit parallel camera interface up to 54 Mbytes/s

Analog random number generator

CRC calculation unit, 96-bit unique ID

RTC: subsecond accuracy, hardware calendar

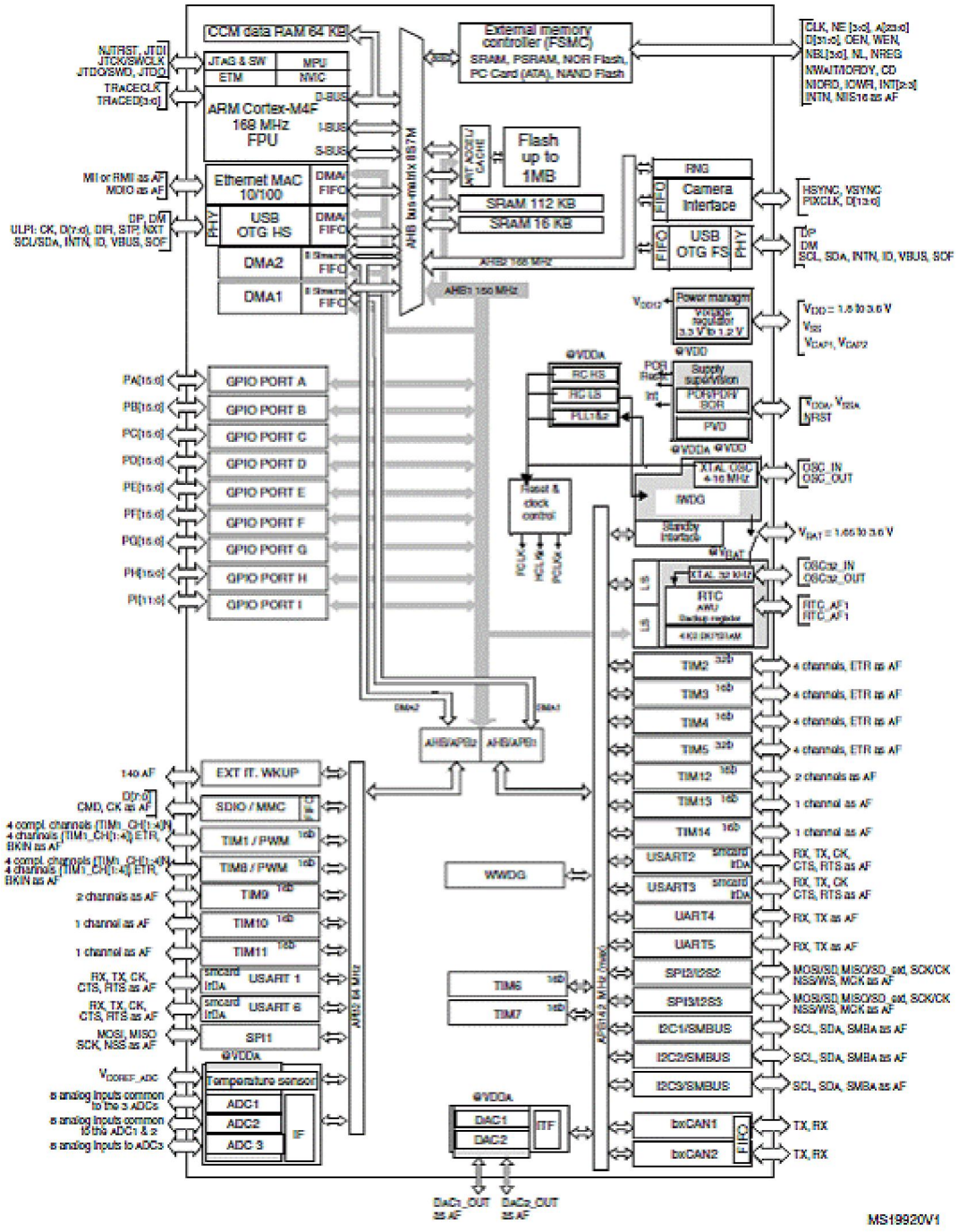

图 1。STM32F40x 系列方框图

STM32F4DISCOVERY 板

STM32F4 high-performance discovery board

The STM32F4DISCOVERY helps you to discover the STM32F4 high-performance features and to develop your applications. It is based on an STM32F407VGT6 and includes an STLINK/V2 embedded debug tool interface, ST MEMS digital accelerometer, ST MEMS digital microphone, audio DAC with integrated

class D speaker driver, LEDs, pushbuttons and an USB OTG micro-AB connector.

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STM32F4DISCOVERY 板主要特性：

The STM32F4DISCOVERY offers the following features:

● STM32F407VGT6 microcontroller featuring 1 MB of Flash memory, 192 KB of RAM in an LQFP100 package

● On-board ST-LINK/V2 with selection mode switch to use the kit as a standalone ST-LINK/V2 (with SWD connector for programming and debugging)

● Board power supply: through USB bus or from an external 5V supply voltage

● External application power supply: 3V and 5V

● LIS302DL, ST MEMS motion sensor, 3-axis digital output accelerometer

● MP45DT02, ST MEMS audio sensor, omnidirectional digital microphone

● CS43L22, audio DAC with integrated class D speaker driver

● Eight LEDs:

- LD1 (red/green) for USB communication

- LD2 (red) for 3.3V power on Four user LEDs, LD3 (orange), LD4 (green), LD5 (red) and LD6 (blue)

- 2 USB OTG LEDs LD7 (green) VBus and LD8 (red) over-current

● Two pushbuttons (user and reset)

● USB OTG with micro-AB connector

● Extension header for LQFP100 I/Os for quick connection to prototyping board and easy probing

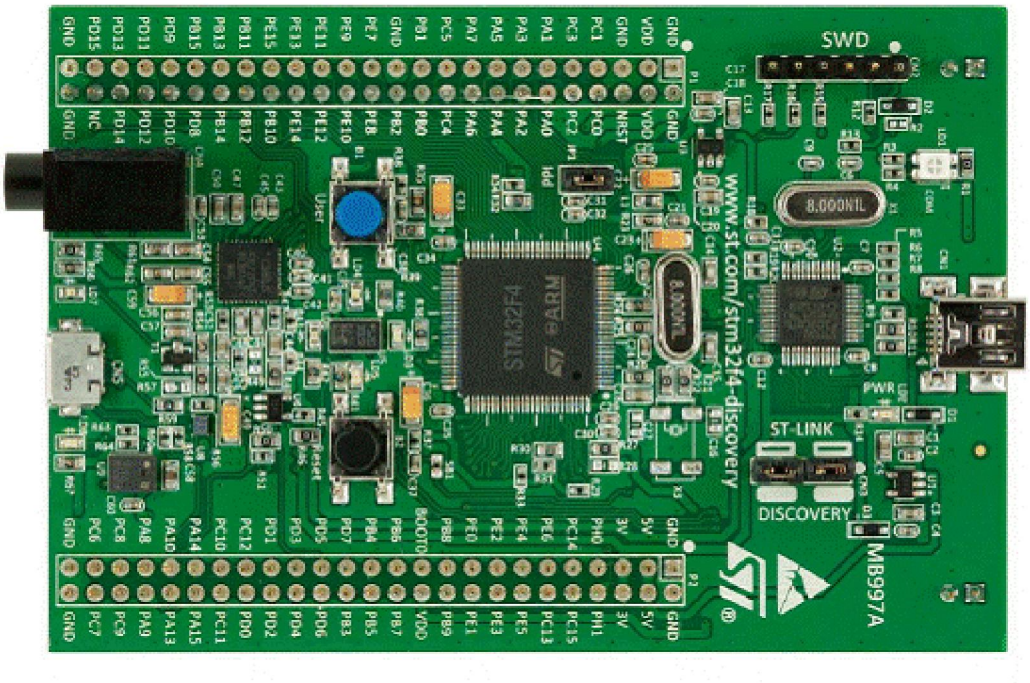

图 2。STM32F4DISCOVERY 板外形图

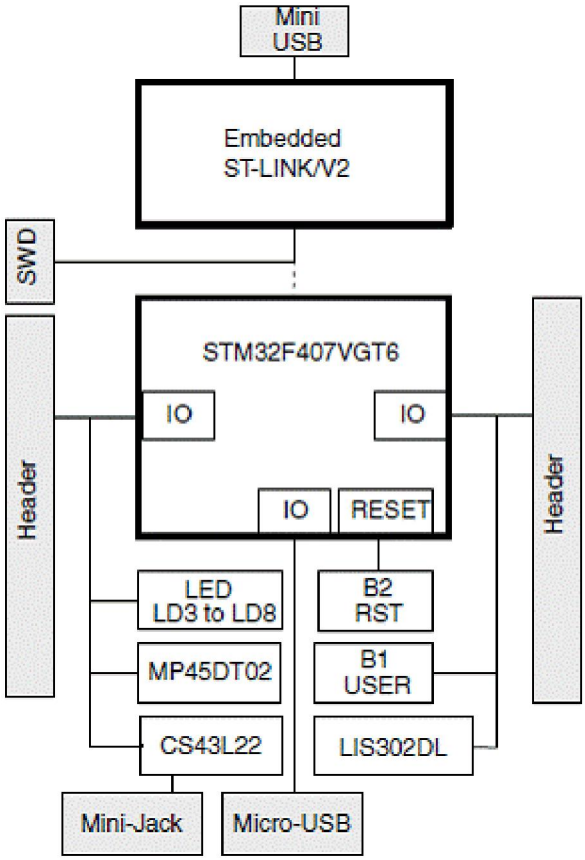

图 3。STM32F4DISCOVERY 板硬件框图

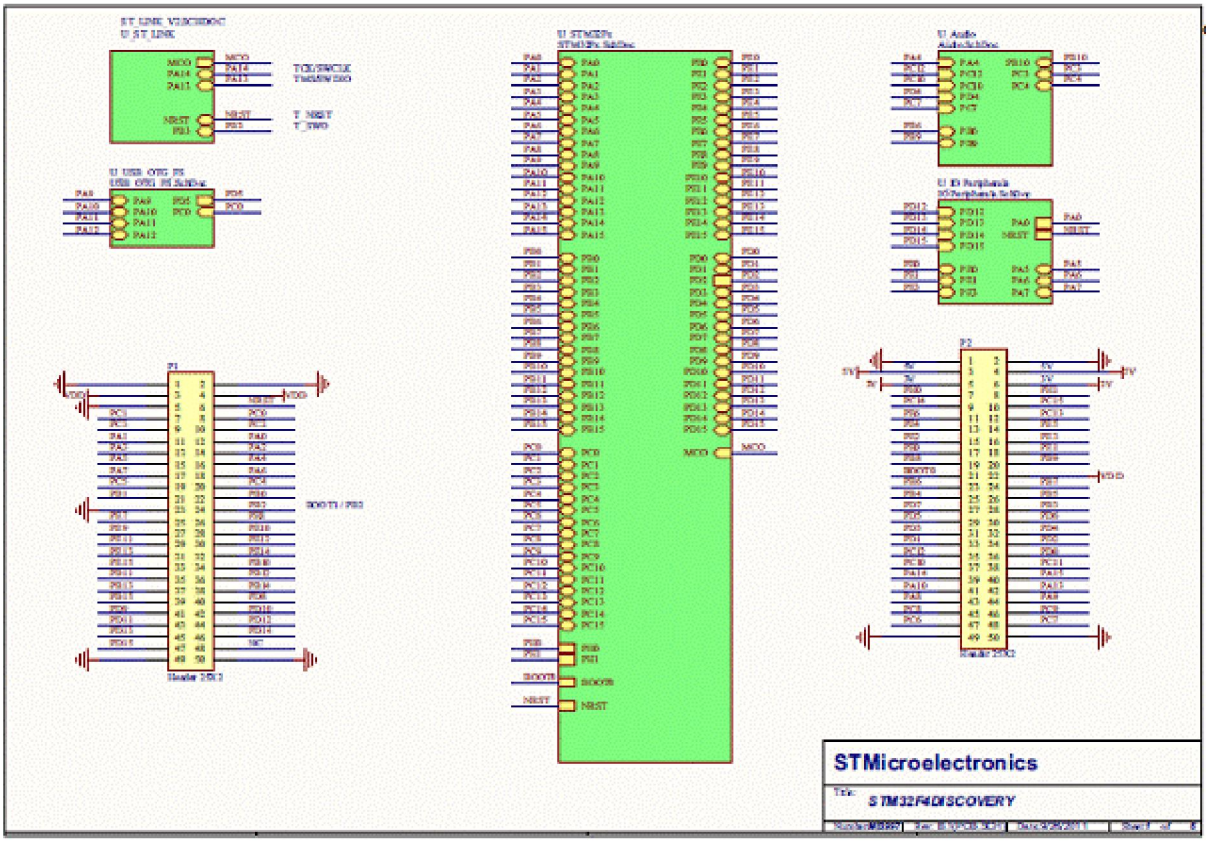

图 4。STM32F4DISCOVERY 板电路图（1）

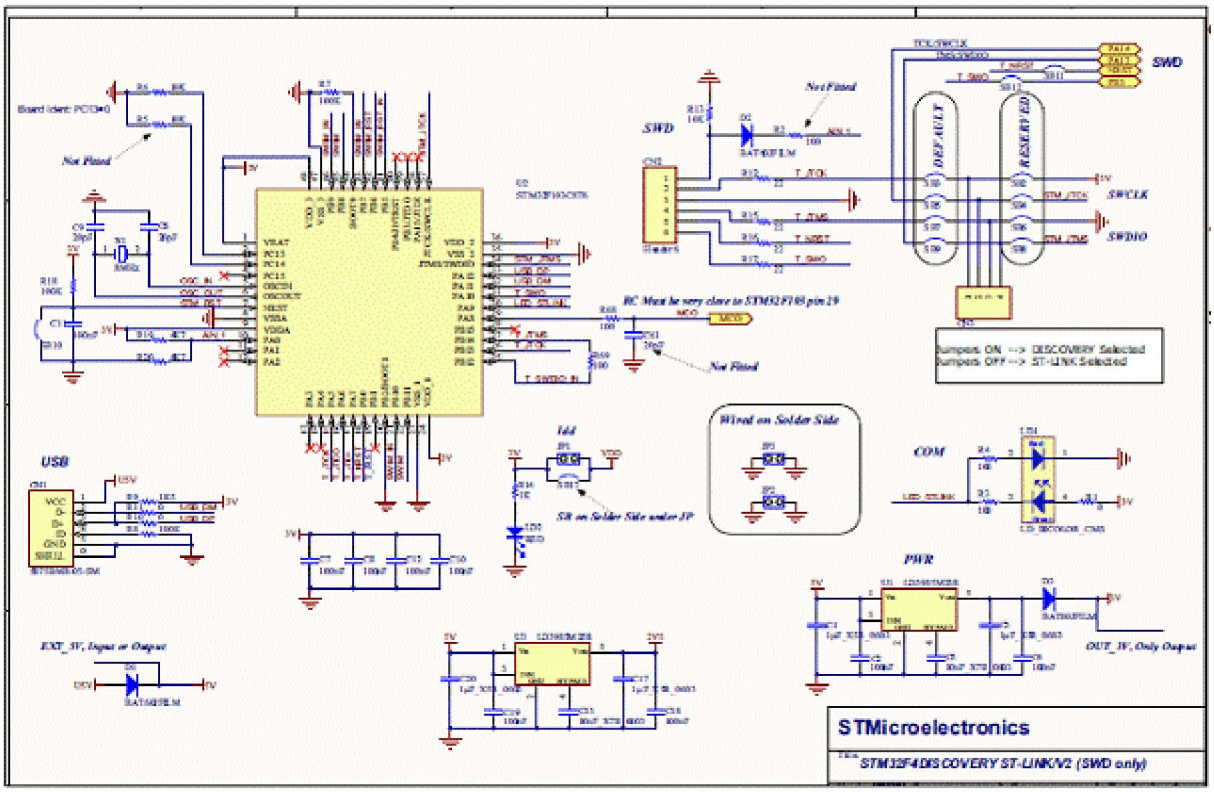

图 5。STM32F4DISCOVERY 板电路图（2）

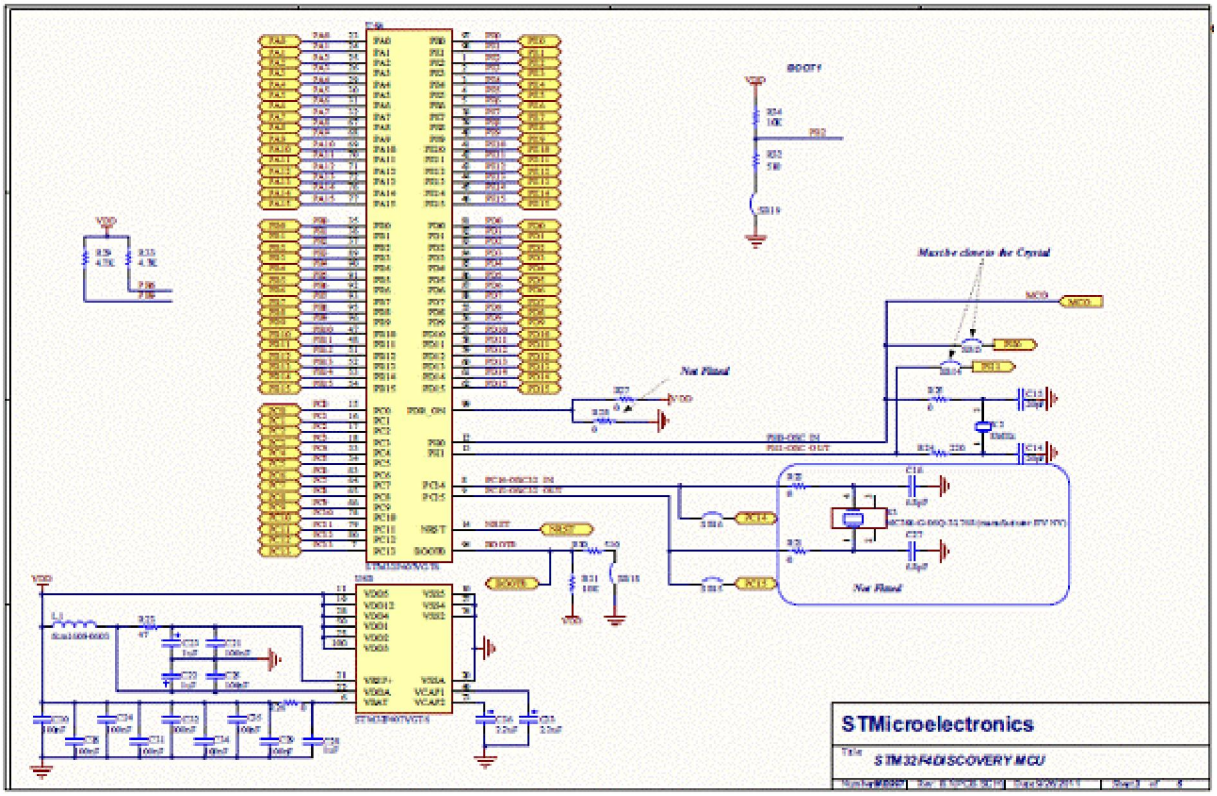

图 6。STM32F4DISCOVERY 板电路图（3）

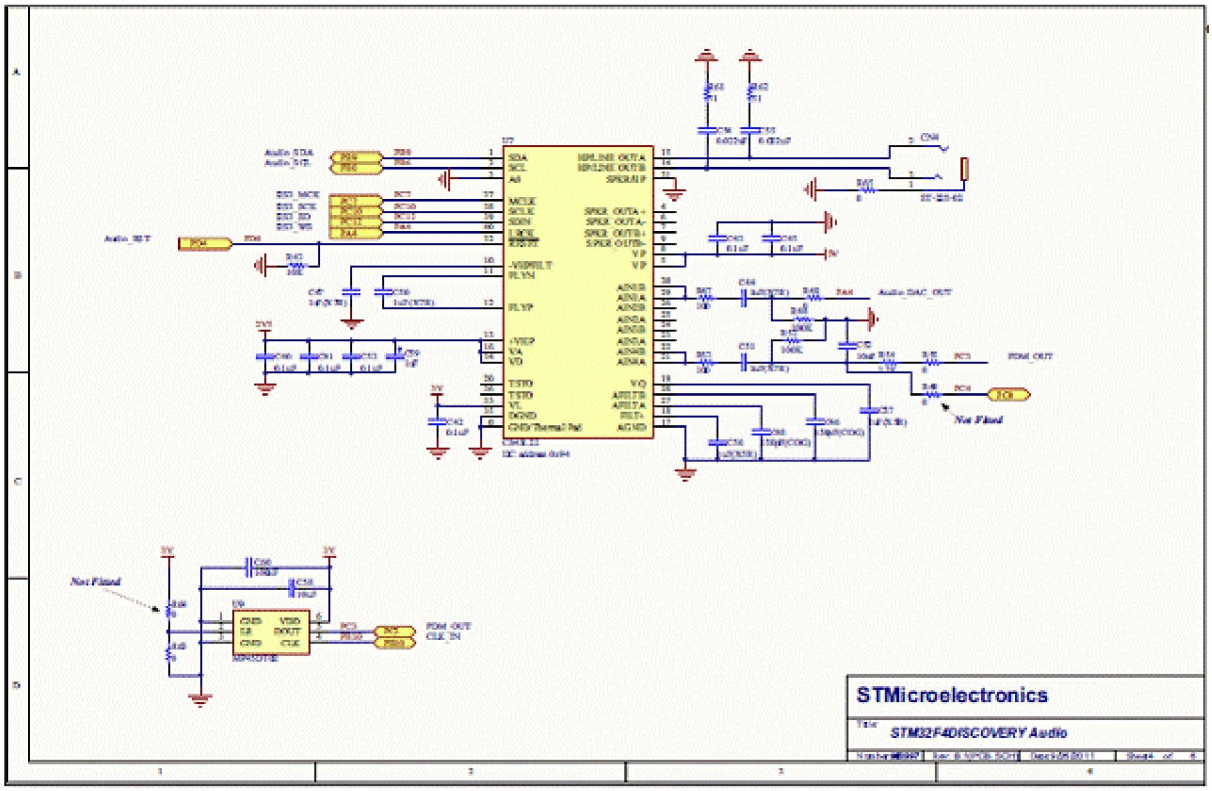

图 7。STM32F4DISCOVERY 板电路图（4）

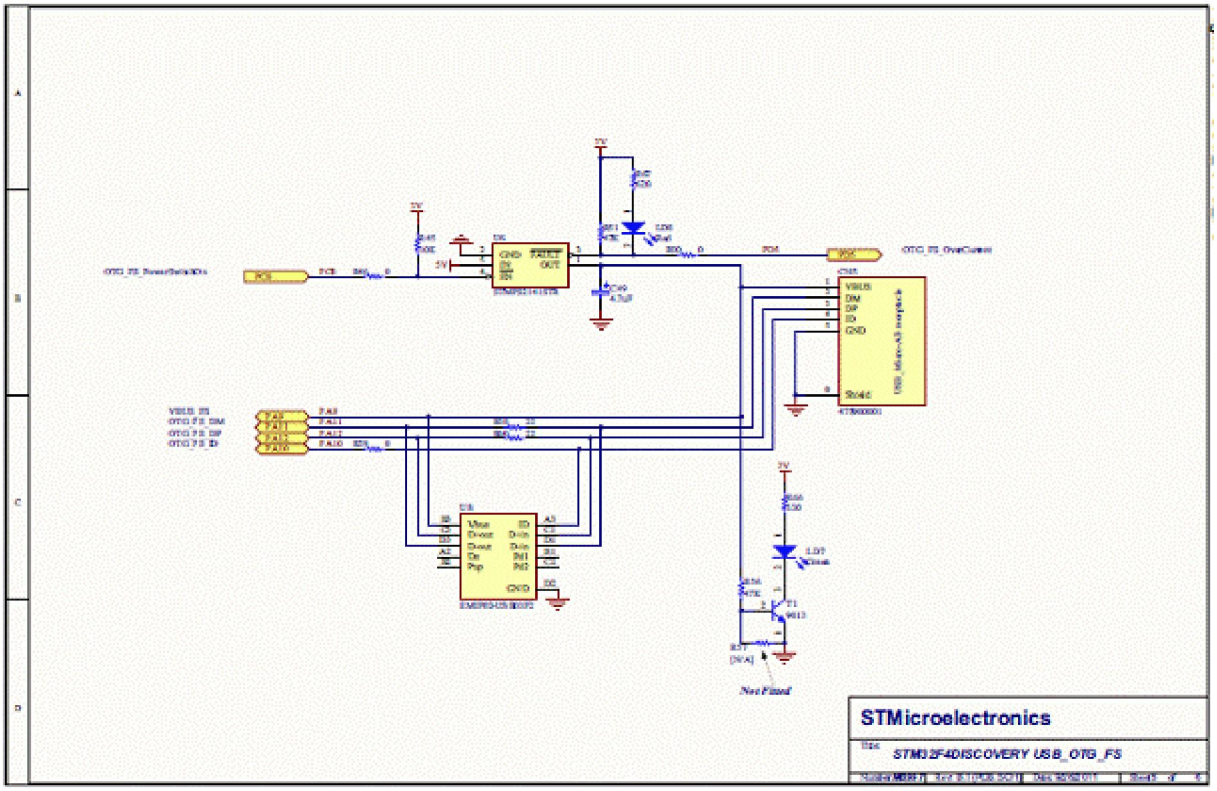

图 8。STM32F4DISCOVERY 板电路图（5）

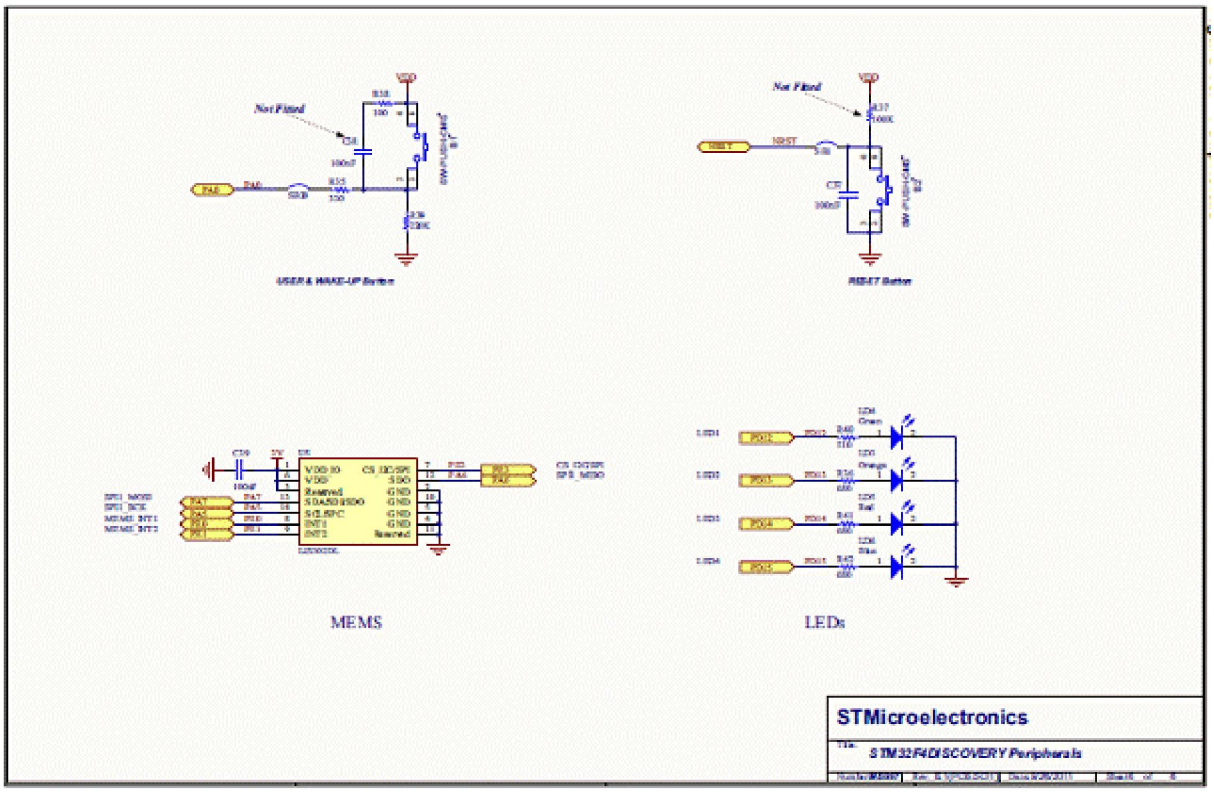

图 9。STM32F4DISCOVERY 板电路图（6）

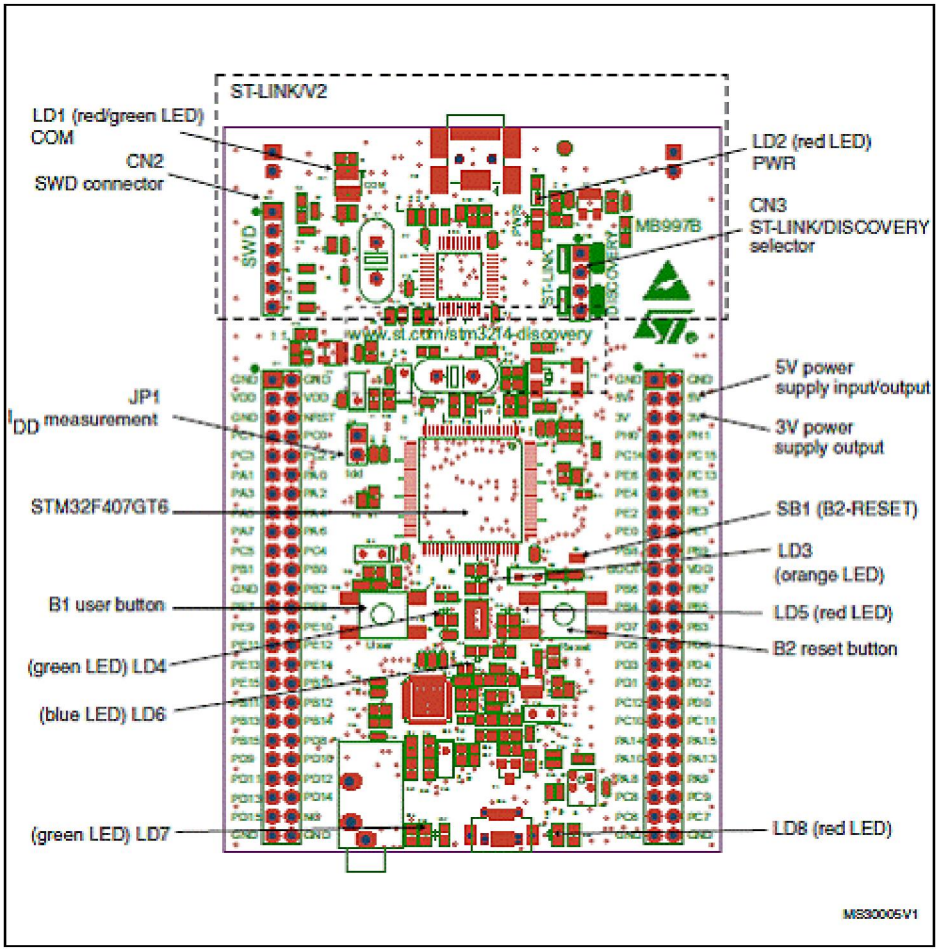

图 10。STM32F4DISCOVERY 板元件布局图

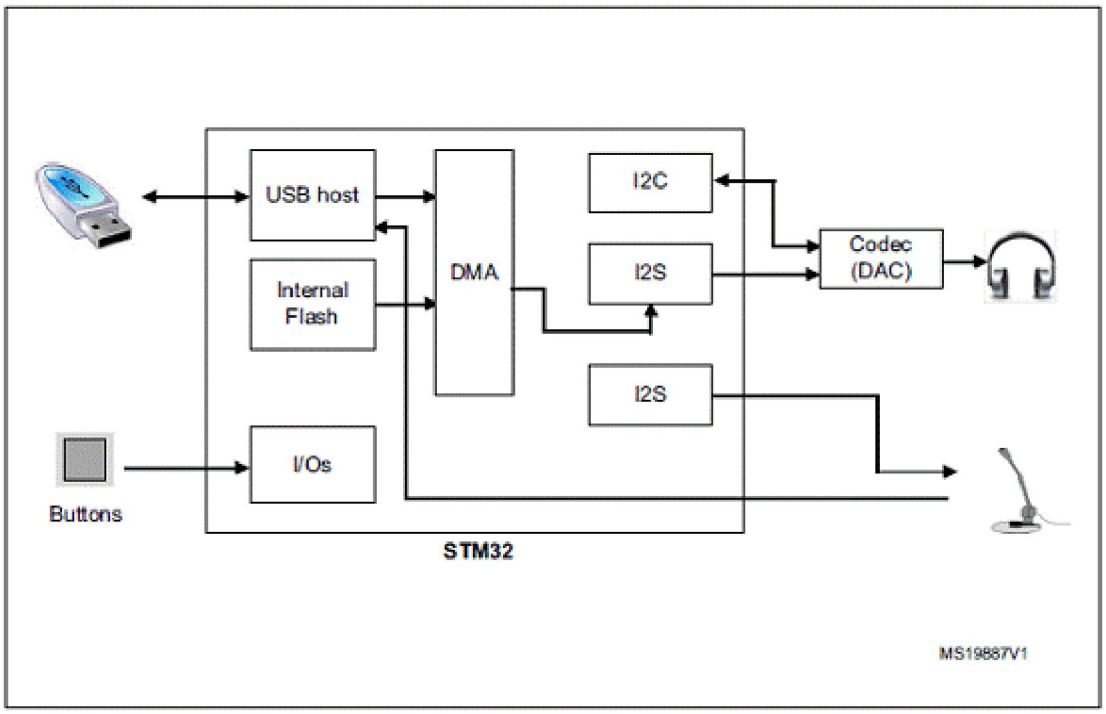

图 11。采用 STM32F4xx 和 STM32F4-DISCOVERY 板的音频播放和录音模块框图

详情请见：

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