

1. Power Input and Type-C Interface (USB 1.0): Provides power input with VBUS support.
Power management chip (STI3470, U3): Functioning as a DC-DC buck converter, it converts the input voltage into a stable +5V system power supply.

TVS diodes (D6) and filter capacitors (e.g., C77, C78) are employed for power input protection and filtering.

2. Wireless Charging Master Controller and Drive Master Controller Chip (HC5715, U4): Responsible for wireless charging frequency generation, power control, and communication protocol processing.

Drive chips (SC5001, U3, and SC5001, U1) drive the phone charging coil and earphone charging coil respectively.

The operating frequency range is 115kHz–205kHz, in line with Qi and other wireless charging standards.

Power MOSFETs (e.g., Q1, Q3, Q8, etc.) are used to switch coil currents and generate alternating magnetic fields.

Current detection resistors (e.g., R11, R61) enable real-time monitoring of charging current for closed-loop control.

3. Multi-channel wireless charging output: The mobile phone's wireless charging channel is powered by the SC5001 driver, which generates an electromagnetic field through coils, supporting a working frequency range of 115–205kHz.

Headphone wireless charging channel: Powered by SC5001, featuring independent coil with matching frequency range, specifically designed for headsets and similar small devices.

Watch charging module: The ST13470 delivers 5V output to directly power the watch module.

4. Signal Detection and Status Control CC1/CC2 (Type-C configuration channels): Detects inserted devices and performs power negotiation.

NTC1/NTC2: Temperature detection to prevent overheating.

IDMO/VDMO: Current/voltage monitoring outputs for power regulation and protection. PWM1 – PWM4: Control the switching frequency and duty cycle of MOSFETs.

EN1/EN2: Enable signals to control the switching of each module.

5. Status indicators and user interface: LED1 (green) and LED2 (blue) indicate power supply and charging status.

Keys (S1, S2): User operation interface.

J-Link (J3): For debugging and programming.

6. Auxiliary Power Supply and Protection Circuit: The LDO and filter network (e.g., C35, C38) provide clean analog and digital power.

Overvoltage/overcurrent protection: implemented through TVS, fuse resistors, and Schottky diodes (e.g., D4, D5).

EMI suppression: Employ CBB capacitors (e.g., CBB1) and common-mode inductors (e.g., CL1 – CL3) to filter out high-frequency noise.

This circuit design is intended to support the wireless charging or communication functions of Samsung watches and Apple watches, achieving energy transmission or data exchange through inductive coupling. The core working principle is as follows:

Common inductance components

Both of the two watches (Samsung and Apple) use the same specification of inductor coil, with an inductance value of 7.9μH, ensuring compatibility in physical structure.

2. Capacitor Configuration Differences

Samsung Watch: Three 100nF capacitors are connected in parallel in the circuit, with a total capacitance of 300nF. This is used to match its specific resonant frequency or filtering requirements.

Apple Watch: Utilizing only a 68nF capacitor to meet the varying resonant point requirements of Apple devices.

3. Working Principle of Resonant Circuit

An LC resonant circuit is formed by the inductor (7.9 μH) and the capacitor (Samsung 300 nF / Apple 68 nF), which is used to achieve efficient transmission of energy or signals at a specific frequency.

By adjusting the capacitance value, the circuit can be adapted to the communication protocols or charging frequencies of different watch brands, ensuring compatibility and efficiency.

4. Encryption Mechanism

The schematic diagram indicates "Watch Encryption", indicating that this circuit may incorporate authentication or communication encryption functions, used to prevent unauthorized devices from accessing, and ensure that only legitimate watches can establish connections or receive energy.

5. Application Scenarios

This circuit can be used in wireless charging bases or near-field communication modules. It achieves energy transmission or bidirectional data communication through inductive coupling, and also realizes brand differentiation support and security protection through capacitor configuration and encryption mechanism.

RF specification [Ⓢ]	
Operating frequency range: [Ⓢ]	Coil 1&2 (Phone): 115-205kHz [Ⓢ] Coil 3 (Earphone): 115-205kHz [Ⓢ] Coil 4 (Watch): 115-205kHz [Ⓢ]
Wireless output: [Ⓢ]	Mobile Phone: 15W/ 10W/ 7.5W/ 5W [Ⓢ] Watch: 2.5W $\pm$ 0.5W [Ⓢ] Headset: 5W [Ⓢ]
Modulation type: [Ⓢ]	ASK [Ⓢ]
Antenna type: [Ⓢ]	Coil [Ⓢ]