4W Wireless Charging Receiver Control SOC

Description

CV8032 is a high-integration, high-efficiency, low-consumption wireless charging receiver chip in compliance with the WPC 1.2、1.3 protocol. It integrates a high-efficiency full synchronous rectifier and a low dropout regulator (LDO), which can achieve a non-contact wireless charging receiver solution on a single chip.

CV8032 has multiple times programmable (MTP) non-volatile memory for easy updating of control firmware and device functions. The chip reserves 2 UARTs, both of which can implement standard two/single-wire communication. It also reserves 5 GPIOs, which provide a flexible solution for system development.

Typical Applications

☆ Smart watches, bracelets and other wearable devices

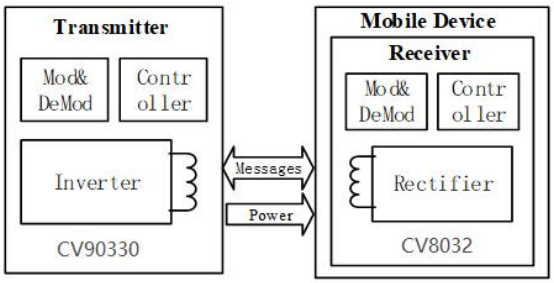
☆ TWS earphone charging cases

☆ Electric toothbrushes

☆ Low-power smart devices

☆ Wireless power Rx solution for portable devices

Wireless power system



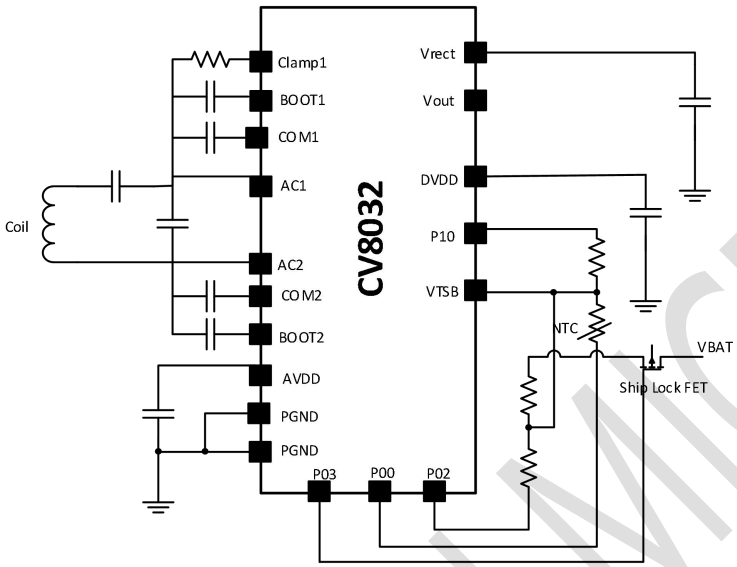
Features

- Highly integrated 4 W wireless charging receiver chip
- Compliance with WPC V1.2、V1.3 BPP
- 8K bytes Multiple-time programmable(MTP) no-volatile memory
- Support Voltage_follow function, which can be adjusted Vrect Voltage dynamically depend on Battery Voltage, To ensure highest system efficiency, The stepping accuracy reaches 100mV;
- Current Up to 800 mA
- Embedded 11channels 12bits high accuracy ADC
- Built-in 8-bit RISC core
- Reliable over-voltage, over-temperature and output over-current protection
- Temperature check
- Built-in low-voltage protection
- Support GPIO function and UART, UART can be single wire communication or dual wire communication potocol
- Compliant with high-standard EMI/EMC specifications

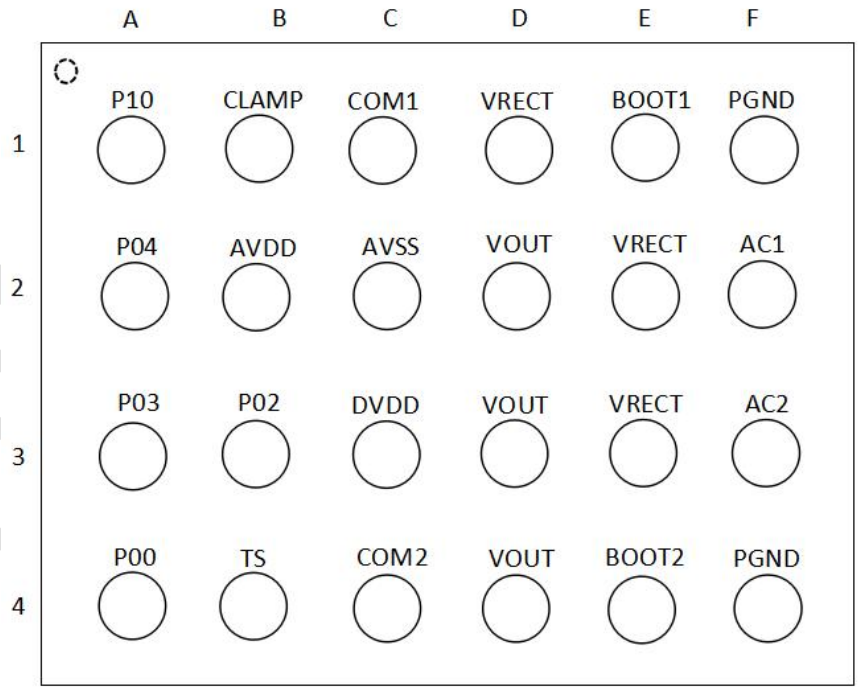
Product Information

Model	Package	Dimensions
CV8032	WLCSP24	1.86 mm × 2.77 mm × 0.50 mm

1 Application Circuit Diagram



2 Pin Assignments



Bottom View

3 Pin Descriptions

Pin No.	Pin Name	Description
A1	P10	Universal digital I/O port
A2	P04	Universal digital I/O port Programming interface
A3	P03	Universal digital I/O port
A4	P00	Universal digital I/O port
B1	CLAMP	Over-voltage clamp protection pin, connecting the resistor to AC terminal
B2	AVDD	VDD internal power output, connected to ground through an external 1uF capacitor
B3	P02	Universal digital I/O port Programming interface
B4	TS	Over-temperature protection pin, connected to an external temperature sensitive resistor. Different over-temperature protection levels can be achieved with different resistors.
C1	COM1	Signal modulation pin, connecting the capacitor to AC terminal
C2	AVSS	Ground
C3	DVDD	VDD internal power output, connected to ground through an external 0.1uF capacitor
C4	COM2	Signal modulation pin, connecting the capacitor to AC terminal
D1	VRECT	Rectifier bridge output, connecting the capacitor to ground
D2	VOUT	DC output, supplying power to external loads
D3	VOUT	DC output, supplying power to external loads
D4	VOUT	DC output, supplying power to external loads
E1	BOOT1	External bootstrap capacitor connected to AC terminal to provide high-end drive for synchronous rectifier bridge
E2	VRECT	Rectifier bridge output, connecting the capacitor to ground
E3	VRECT	Rectifier bridge output, connecting the capacitor to ground
E4	BOOT2	External bootstrap capacitor connected to AC terminal to provide high-end drive for synchronous rectifier bridge
F1	PGND	Ground
F2	AC1	AC input port, connected to the resonant capacitor

Pin No.	Pin Name	Description
F3	AC2	AC input port, connected to the receiver coil
F4	PGND	Ground

4 Absolute Maximum Ratings

Symbol/Pins	Parameter	Minimum Value	Maximum Value	Unit
VRECT, COM1, COM2, OUT, and CLAMP	Maximum voltage	-0.3	20	V
AC1 and AC2	Maximum voltage	-0.3	20	V
BOOT1 and BOOT2	Maximum voltage	-0.3	30	V
AVSS and PGND	Maximum voltage	-0.3	0.3	V
Other Pin	Maximum voltage	-0.3	5	V
AC1, AC2	Maximum RMS current		1.4	A
VOUT Output Current	Maximum RMS current		1.4	A
ESD	ESD – Human Body Model		2000	V
CDM	ESD – Charged Device Mode		500	V

Absolute maximum ratings are those values beyond which damage to the device may occur. Functional operation under these conditions is not implied.

5 Thermal Characteristics

Symbol	Parameter	Value	Units
θ_{JA}	Thermal Resistance Junction to Ambient	47	℃/W
θ_{JC}	Thermal Resistance Junction to Case	0.202	℃/W
θ_{JB}	Thermal Resistance Junction to Board	4.36	℃/W
T_J	Operating Junction Temperature	-5 to +125	℃
T_{AMB}	Ambient Operating Temperature	-40 to +85	℃
T_{STOR}	Storage Temperature	-55 to +150	℃
T_{BUMP}	Maximum Soldering Temperature (Reflow, Pb-Free)	260	℃

[a] The maximum power dissipation is PD(MAX) = (TJ(MAX) - TA) / θJA where TJ(MAX) is 125°C. Exceeding the maximum allowable power dissipation will result in excessive die temperature, and the device will enter thermal shutdown.
[b] This thermal rating was calculated on JEDEC 51 standard 4-layer board with dimensions 3″ x 4.5″ in still air conditions.
[c] Actual thermal resistance is affected by PCB size, solder joint quality, layer count, copper thickness, air flow, altitude, and other unlisted variables.

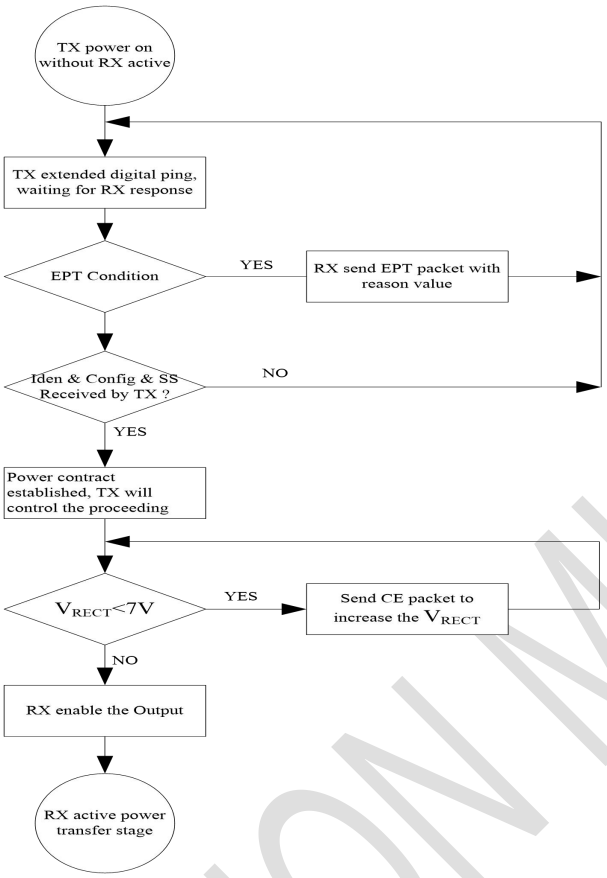
6 Electrical Characteristics Table

Parameter	Symbol	Minimum Value	Typical Value	Maximum Value	Unit
Input voltage range	Vrect	3.3		14	V
Sleep current	Isleep		10		uA
Input current	Irect			1	A
Output current	Iout			800	mA
COM current	Icom			0.5	A
Under-voltage protection	UVLO	2.8	3.0	3.1	V
Over-voltage protection	VRECT (OVP)		14		V
V_{AVDD}	Internal LDO output voltage	4.25	4.5	4.75	V
Communication frequency	fcomm		2.0		Kb/S

7 WPC Flow

A wireless power charging system has a base station with one or more transmitters that transmit power through a strongly coupled inductor to receivers in mobile devices. The amount of power transferred to a mobile device is controlled by the receiver. The receiver sends communication packets to the transmitter to increase power, decrease power, or maintain the power level. The communication is implemented entirely in digital, with the communication data carried over the power link between two coils.

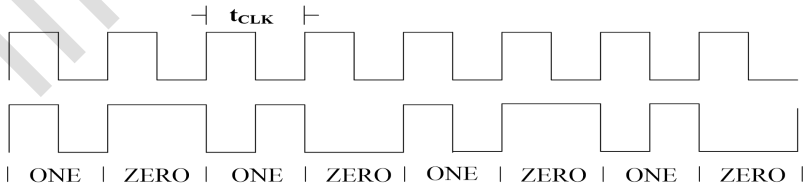
A feature of wireless charging system is that the transmitter remains in a low-consumption sleep mode when the wireless charging system does not charge mobile devices. The transmitter remains in this low-consumption mode and periodically pings the receiver until the transmitter detects the presence of a receiver. The transmitter enters the negotiation phase of the operation and starts power transfer only after detecting a valid receiver.



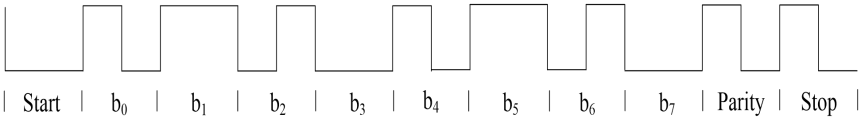
8 QI Communication

CV8032 has a built-in QI transmit unit, which conforms to the WPC specifications.

According to the WPC specifications, QI_TX uses a 2kHz clock frequency to modulate the data bits onto power signals by means of dual-phase differential encoding. A logical one is encoded using two narrow transitions, while a logical zero is encoded using two wide transitions, as shown in the following figure:



Each byte in the communication packet consists of 11 bits in asynchronous serial format, as shown in the following figure:



The following figure shows the format of packet sent by WPC:

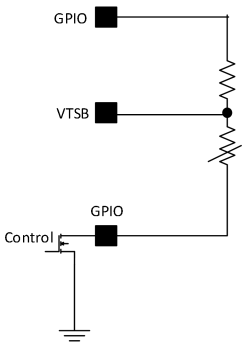
9 Over-voltage and Over-current Protection

CV8032 integrates the over-voltage and over-current protection functions. These thresholds are designed to protect the full bridge and wireless receiver unit from influence of voltages and/or currents that could cause system damage or unexpected behavior. The voltage detection is only performed at the initial startup. The over-current protection value can be set by software, and the default value is 0.7 A. The over-current detection is continuously implemented. When the over-current exceeds the threshold during operation, the chip stops power transfer and resumes operation only after restarting the power supply of the transmitter. When an over-voltage event occurs during startup, the power supply needs to be restarted and the voltage cannot exceed the over-voltage threshold during startup.

10 Over-temperature Protection

CV8032 integrates the over-temperature protection function to prevent damage due to overheating under fault conditions. If the chip temperature exceeds the over-temperature shutdown threshold by 150°C, the circuit will shut down or the device will reset.

The VSTB pin of CV8032 can be connected to an external NTC resistor network to monitor the temperature of the external circuit. VTSB forms a bleeder circuit with the RNTC resistor through the pull-up resistor R2. The divided value is sent to the ADC by VTSB.



11 Foreign Object Detection (FOD)

When the metal is placed in an alternating magnetic field, electromagnetic eddy currents heat the metal, such as coins, keys, and paper clips. The degree of heating depends on the amplitude and frequency of the coupled magnetic field, as well as on properties such as the resistivity, size and shape of the object. In a wireless energy transfer system, the heats are all energy losses, which reduce the energy transfer efficiency. If proper measures are not taken, the metal object will be continuously heated, resulting in high temperature, which may lead to other dangerous situations.

In addition, other metals may be present in the final product design of WPC power transmitters and receivers (these metals are neither part of the transmitter nor part of the receiver, but will absorb energy from the coupled AC magnetic field during power transfer, causing power loss, such as Li-ion batteries and metal ICs). Therefore, FOD also needs to compensate for the power loss caused by these metals.

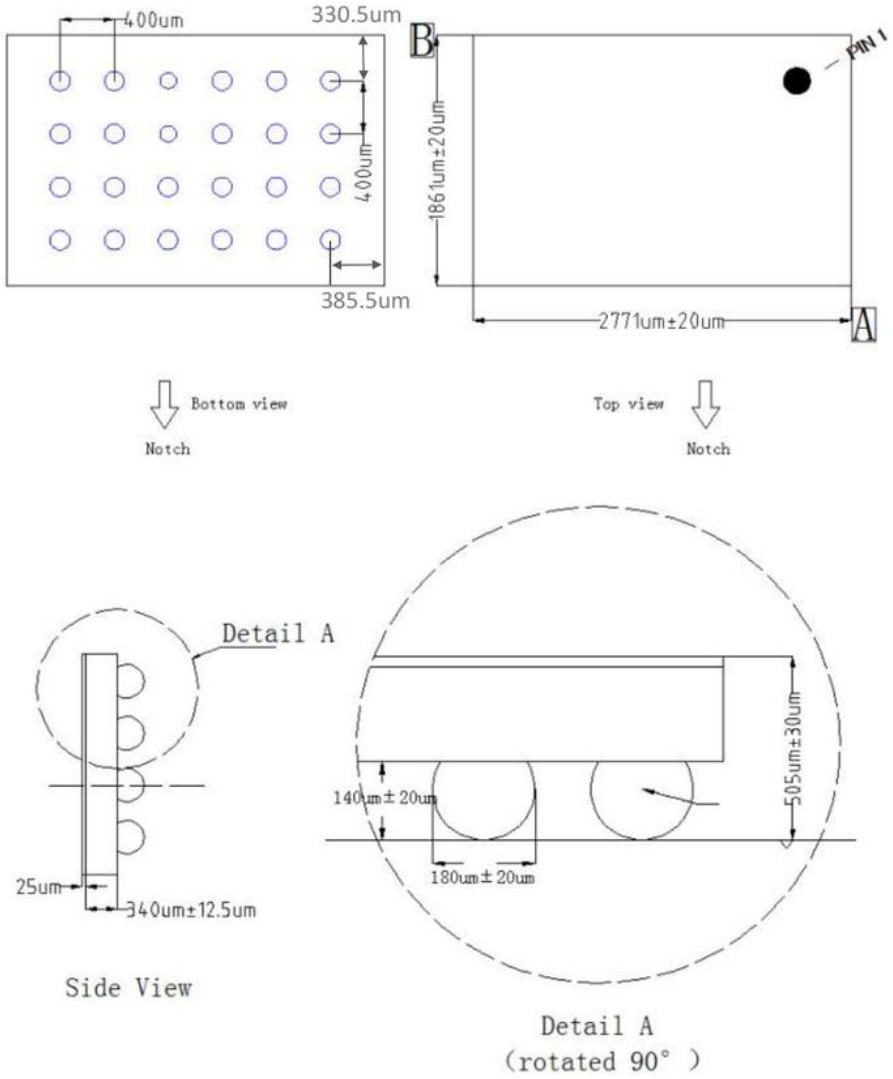
CV8032 leverages cutting-edge FOD technology to detect foreign objects placed on or near the transmitter base. FOD settings can be optimized through programming to match the power transfer characteristics of each specific WPC system, including the power loss of coils, batteries, shielding and housing materials under no-load to full-load conditions. These values are based on a comparison of the received power to a reference power curve so that any foreign objects can be detected when the received power differs from the expected system power.

12 Voltage_follow function

CV8032 can be adjusted Vrect Voltage dynamically depend on Battery Voltage, to keep a suitable voltage drop between Vout and Vbat, It is very helpful to reduce the power lose, and reduce heating, To ensure highest system efficiency, The stepping accuracy reaches 100mV ;

13 Package Information

Model	Package Form	Moisture Resistance Level	Packaging Mode	Minimum Number of Packages
CV8032	WLCSP24 (1.86 mm × 2.77 mm × 0.50 mm)	MSL1	Tape and reel	5000 PCS



14 Schematic Diagram of Application