2.5W Wireless Charging Receiving Control SOC

1. Overview

CV8011 is a high-integration, high-efficiency, low-consumption wireless charging receiver chip in compliance with the WPC 1.2 . 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.

CV8011 Using QFN 24 package, small size, can significantly reduce the PCB size and reduce the cost of BOM.

2. Application

- Smart watches, bracelets and other wearable devices
- Finders
- TWS earphone charging cases
- Electric toothbrush
- Low-power smart devices
- Smart home

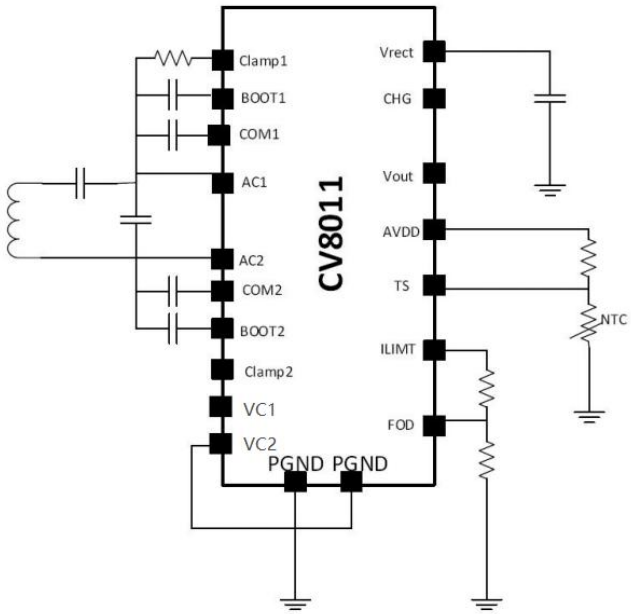
3. Features

- Highly integrated 2.5W wireless charging receiving chip
- Complply with Qi specifications of WPC V1.2
- WPC BPP certification
- The output voltage is 5V
- Adjustable output current of up to 500 mA
- Built-in 12bits 11 channel ADC
- Embedded 8-bit RISC compact kernel
- Reliable over-voltage, over-temperature and output Over-current protection
- Temperature check
- Built-in low-voltage protection
- Compliant with high-standard EMI / EMC specifications

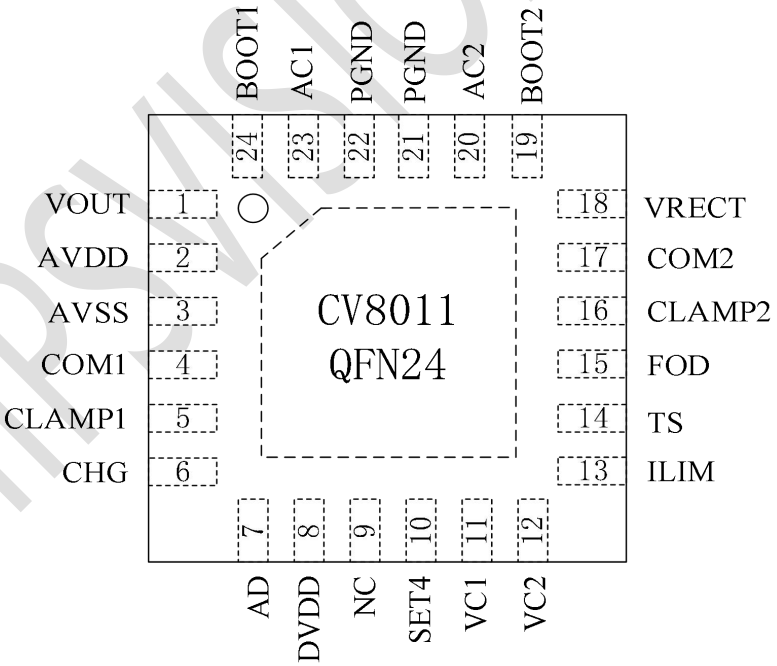
4. Product information

Model	package	Dimensions
CV8011	QFN24	4.00 *4.00 * 0.75 mm

1. Application Circuit Diagram



2. Pin Definition



CV8011 Pin Diagram

3. CV8011 Pin Description

Pin No.	Pin name	Description
1	VOUT	Output 5V to power the external load
2	AVDD	VDD internal power supply output, need to be external 1uF capacitance to the ground
3	AVSS	Ground
4	COM1	The signal modulation pin, connect the capacitor to the AC end.
5	CLAMP1	over-voltage clamp protection pin, connect the resistance to the AC end
6	CHG	If the output pin opens, when the VOUT output is open
7	AD	NC
8	DVDD	Digital power supply output port
9	NC	NC
10	SET4	Internal configuration stud
11	VC1	1. Output voltage 4.2V,suspended treatment; 2. Output voltage 4.35V,grounding treatment; 3. The output voltage is 5V,suspended processing.
12	VC2	1, output voltage 4.2V, suspended treatment; 2, output voltage 4.35V, suspended treatment; 3, the output voltage is 5V, and the grounding processing.
13	ILIM	Flow limiting setting pin, connecting different resistances can obtain different flow limit settings
14	TS	Over temperature protection pin, external temperature sensitive resistance, different resistances can obtain different over temperature protection
15	FOD	Receive power set pin, related to the setting of FOD
16	CLAMP 2	over-voltage clamp protection pin, connect the resistance to the AC end
17	COM2	The signal modulation pin, connect the capacitor to the AC end
18	VRECT	The output end of the rectifier bridge connects the

		capacitor to the ground
19	BOOT2	The external lifting capacitor is connected to the AC end to provide a high-end drive for the synchronous rectifier bridge
20	AC2	The AC input port, which connect to the receiving coil
21	PGND	Ground
22	PGND	Ground
23	AC1	AC input port, connect the resonance capacitor
24	BOOT1	The external lifting capacitor is connected to the AC end to provide a high-end drive for the synchronous rectifier bridge

4. Limit Parameters

Parameter	Symbol	Minimum Value	Maximum Value	Unit
Voltage range	CHG,FOD,TS,ILMT，OUT	-0.3	7	V
	AVSS,GND	-0.3	0.3	V
	Other Pin	-0.3	20	V
Current range	AC1，AC2		2	A（RMS）
Junction temperature range	T_J		125	℃
Storage temperature range	T_{stg}	-40	150	℃
Thermal resistance (junction temperature to the environment)	θ_{JA}	30		℃/W
Human body model (HBM)	ESD	-2000	2000	V

5. Recommended Working Conditions

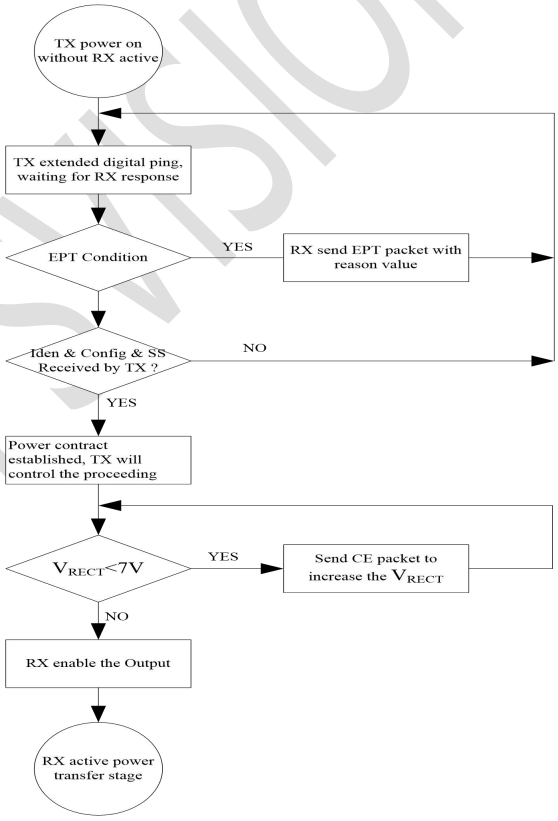
Parameter	Symbol	Minimum Value	Typical Value	Maxmum Value	Unit
Input voltage range	Vrect	4		10	V
Input current	Irect			1	A
Output current	Iout			500	mA
COM current	Icom			0.5	A
Undervoltage protection	UVLO	2.8	3.0	3.2	V

over-voltage crowbar	VRECT(OVP)		14		V
V_{AVDD}	Internal LDO output voltage	4.25	4.5	4.75	V
Communication frequency	fcomm		2.0		Kb/S
Working temperature range	T_A	-40		85	℃

6. WPC Flow

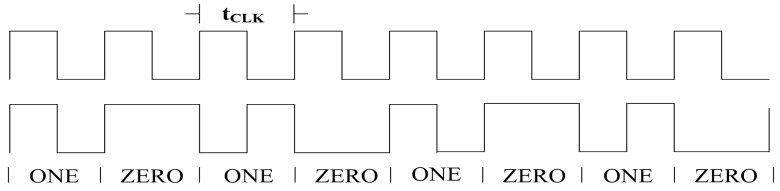
A wireless power charging system has a base station with one or more transmitters that transmit power through a strongly coupled inductor to receivers in mobile devices. The amount of power transferred to a mobile device is controlled by the receiver. The receiver sends communication packets to the transmitter 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.

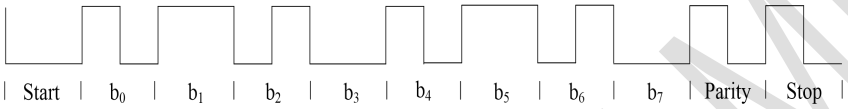


7. QI Communication

CV8011 has a built-in QI transmit unit, which conforms to the WPC specifications.
According to the WPC specifications, QI_TX uses a 2 kHz 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:



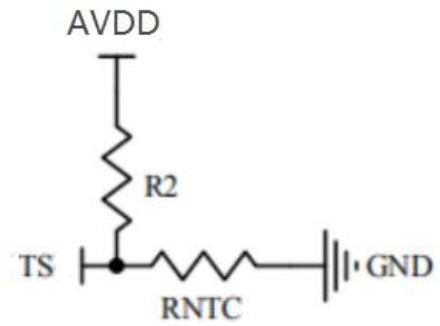
The following figure shows the format of packet sent by WPC:

8. Over-voltage and Over-current Protection

CV8011 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 0.5 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.

9. Temperature protection

CV8011 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 TS pin of CV8011 can be connected to an external NTC resistor network to monitor the temperature of the external circuit. TS forms a bleeder circuit with the RNTC resistor through the pull-up resistor R2. The divided value is sent to the ADC by TS.



10. Foreign Body 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.

CV8011 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.

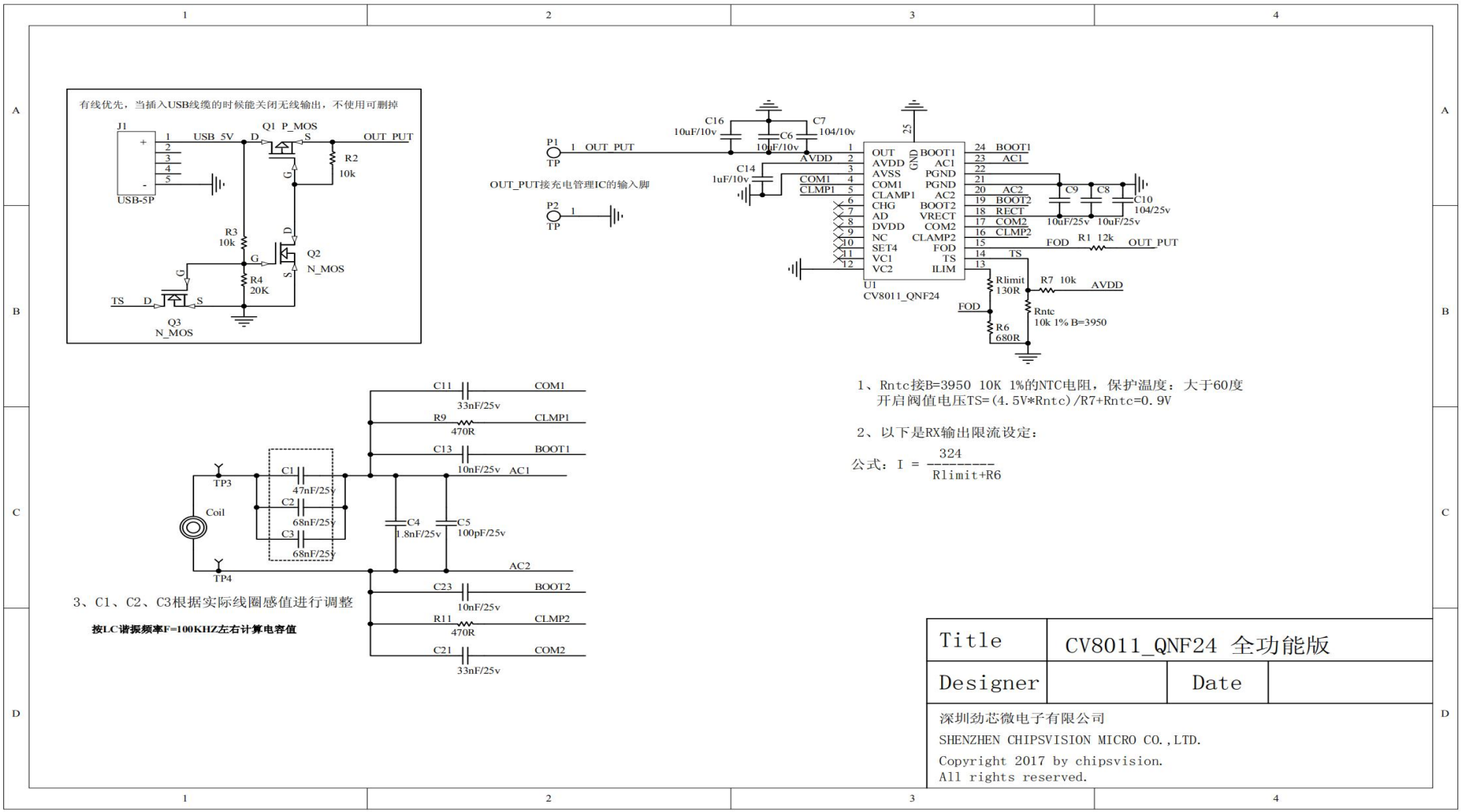
11. Schematic Diagram of Application

For schematic diagram of CV8011 application, see page 8.

12. Package Information

For the packaging information of CV8011, see the last page.

Model	Dimensions	Moisture Resistance Level	Packaging	MPQ
CV8011	QFN24 (4.00 * 4.00 * 0.75 mm)	Level 3	Taping	4000 PCS


有线优先，当插入USB线缆的时候能关闭无线输出，不使用可删掉
J1
USB-5P
USB_5V
Q1 P_MOS
OUT_PUT
R2 10k
R3 10k
R4 20K
Q2 N_MOS
Q3 N_MOS
TS
OUT_PUT接充电管理IC的输入脚
P1 TP
P2 TP
C16 10uF/10v
C7 104/10v
C6 10uF/10v
C14 1uF/10v
AVDD
COM1
CLMP1
U1 CV8011_QNF24
OUT
AVDD
AVSS
COM1
CLAMP1
CHG
AD
DVDD
NC
SET4
VC1
VC2
GND
BOOT1
AC1
PGND
PGND
AC2
BOOT2
VRECT
COM2
CLAMP2
FOD
TS
ILIM
C9
C8
C10 104/25v
10uF/25v
10uF/25v
FOD
R1 12k
OUT_PUT
Rlimit 130R
R7 10k
AVDD
Rntc 10k 1% B=3950
R6 680R
1、Rntc接B=3950 10K 1%的NTC电阻，保护温度：大于60度
开启阀值电压TS=(4.5V*Rntc)/R7+Rntc=0.9V
2、以下是RX输出限流设定：
公式：I = 324 / (Rlimit+R6)
C11 33nF/25v
COM1
R9 470R
CLMP1
C13 10nF/25v
BOOT1
TP3
C1 47nF/25v
AC1
Coil
C2 68nF/25v
C3 68nF/25v
C4 1.8nF/25v
C5 100pF/25v
TP4
AC2
C23 10nF/25v
BOOT2
R11 470R
CLMP2
C21 33nF/25v
COM2
3、C1、C2、C3根据实际线圈感值进行调整
按LC谐振频率F=100KHZ左右计算电容值
Title
CV8011_QNF24 全功能版
Designer
Date
深圳劲芯微电子有限公司
SHENZHEN CHIPSVISION MICRO CO.,LTD.
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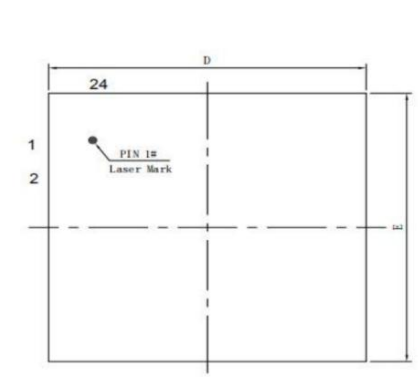

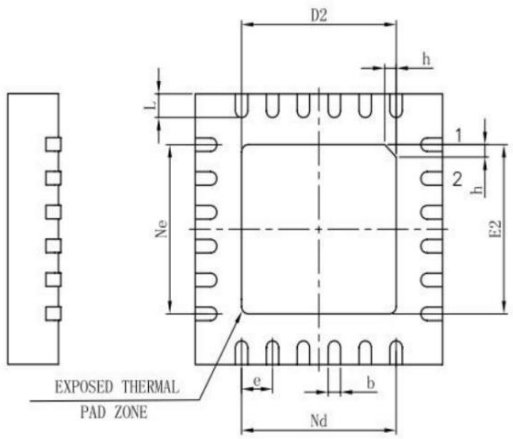

SYMBOL	MILLIMETER		
	MIN	NOM	MAX
A	0.70	0.75	0.80
A1	0	0.02	0.05
b	0.20	0.25	0.30
c	0.18	0.20	0.23
D	3.90	4.00	4.10
D2	2.7REF		
e	0.50BSC		
Ne	2.50BSC		
Nd	2.50BSC		
E	3.90	4.00	4.10
E2	2.7REF		
L	0.30	0.40	0.5
h	0.30REF		

深圳劲芯微电子有限公司 SHENZHEN CHIPSVISION MICRO CO.,LTO.			TITLE: QFN24(4*4*0.75-0.50) PACKAGE OUTLINE DIVENSION	
DWG NO: JXW-POD-003			File: QFN24	Unit: mm
	Name	Date	劲芯微电子 CHIPSVISION MICRO	Edition: A0
Draw	张春林	2020/11/10		
Approved	周喜云	2020/11/10		