4W Wireless charging receiver control SOC

Description

CV8083 is a high-integration, high-efficiency, low-consumption wireless charging receiver chip in compliance with the WPC 1.2.4 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.

CV8083 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.

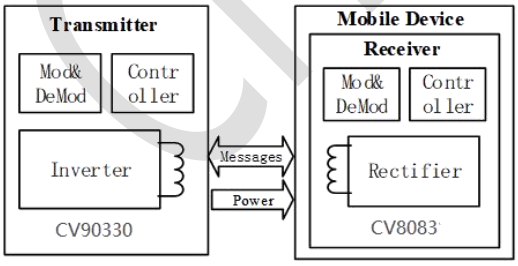
Typical Applications

☆ TWS earphone charging cases
☆ Electric toothbrushes
☆ Smart watches, bracelets and other wearable devices
☆ Wireless power Rx solution for portable devices

Features

- Highly integrated 4W wireless charging receiver chip
- Compliance with WPC V1.2.4 BPP&EPP
- 8K bytes Multiple-time programmable(MTP) no-volatile memory for expanded feature support
- 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
- Ultra low standby current, Quiescent current less than 3uA
- Embedded 11channels 12bits high accuracy ADC
- Built-in 8-bit RISC core
- Reliable over-voltage, over-temperature and output over-current protection
- Temperature detection
- Built-in low voltage protection
- Support GPIO function and UART, UART can be single wire communication or dual wire communication protocol
- Comply with high standard EMI/EMC specification

Wireless power system



Product information

Model No	Package	dimension
CV8083	QFN24	4 * 4 * 0.75mm

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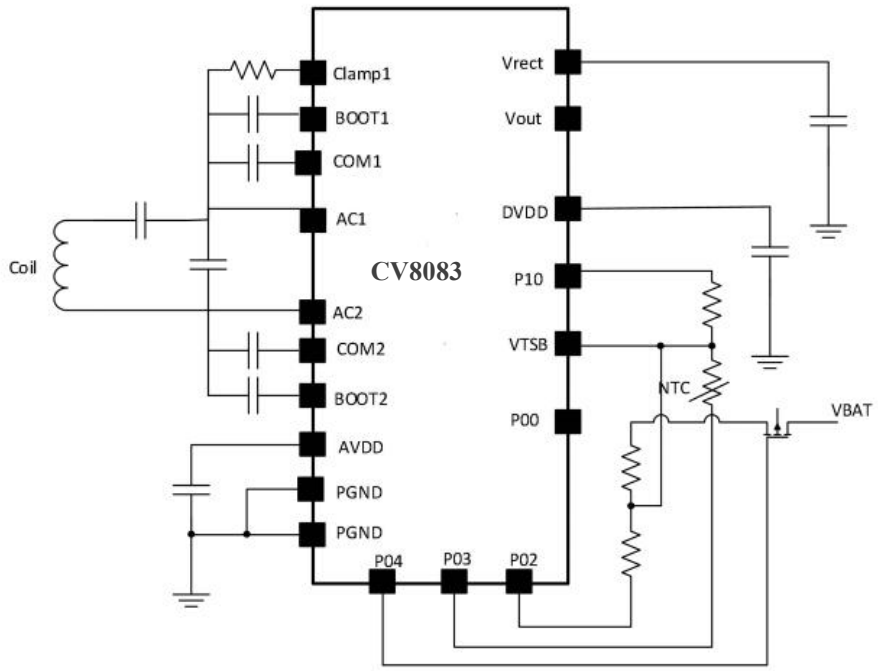
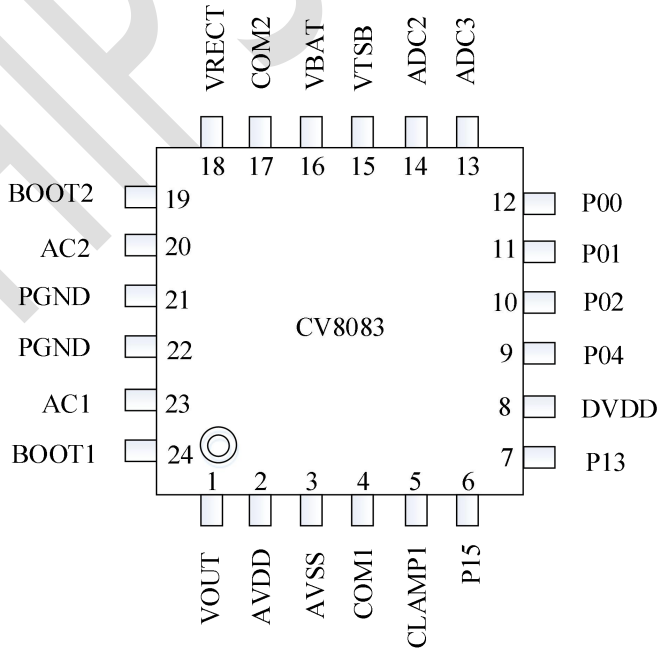
1 Application circuit diagram



2 Pin Assignments



3 Pin Description

Pin No.	Name	Description
1	VOUT	LDO output to charger IC
2	AVDD	internal power output, connected to ground through an external 1uF capacitor
3	AVSS	GND
4	COM1	Signal modulation pin, connecting the capacitor to AC terminal
5	CLAMP1	Over-voltage clamp protection pin, connecting the resistor to AC terminal
6	P15/TX1	General-purpose digital I/O pin; Serial 1 transmit data.
7	P13/INT3	General-purpose digital I/O pin; External Interrupt 3 input.
8	DVDD	1.8V output supply for internal digital circuit
9	P04/MDAT	General-purpose digital I/O pin; The data I/O during emulation and programming.
10	P02/TX0/MCLK	General-purpose digital I/O pin; Serial 0 transmit data; The data clock during emulation and programming
11	P01/INT1	General-purpose digital I/O pin External Interrupt 1 input
12	P00/INT0	General-purpose digital I/O pin External Interrupt 0 input
13	ADC3	External ADC channel
14	ADC2	External ADC channel
15	VTSB	Over-temperature protection pin, connected to an external temperature sensitive resistor.Different over-temperature protection levels can be achieved with different resistors.
16	VBAT	Lithium battery positive terminal connection port
17	COM2	Signal modulation pin, connecting the capacitor to AC terminal
18	VRECT	Rectifier bridge output, connecting the capacitor to ground
19	BOOT2	External bootstrap capacitor connected to AC terminal to provide high-end drive for synchronous rectifier bridge
20	AC2	AC input port, connected to the receiver coil
21	PGND	Power ground
22	PGND	Power ground
23	AC1	AC input port, connected to the resonant capacitor
24	BOOT1	External bootstrap capacitor connected to AC terminal to provide high-end drive for synchronous rectifier bridge

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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	0 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	4		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	3.2	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.

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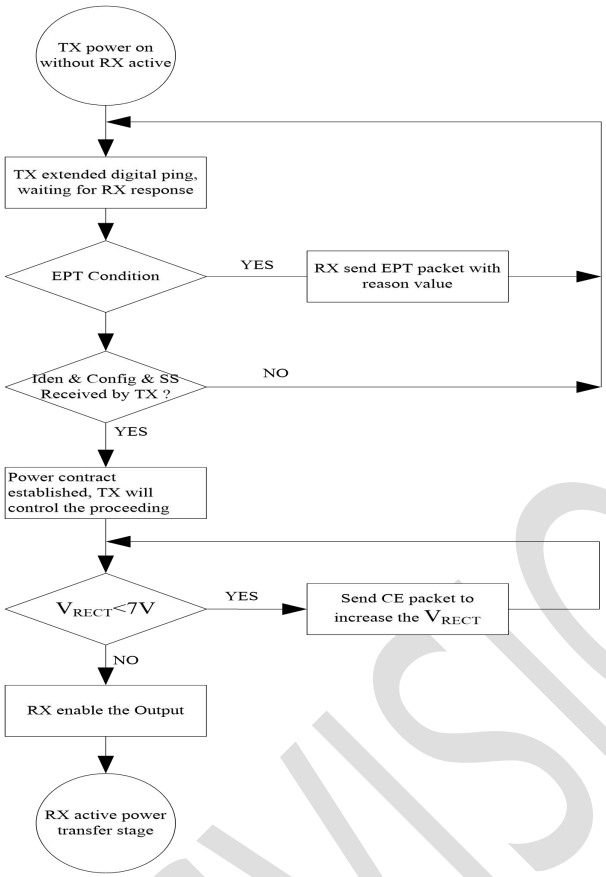
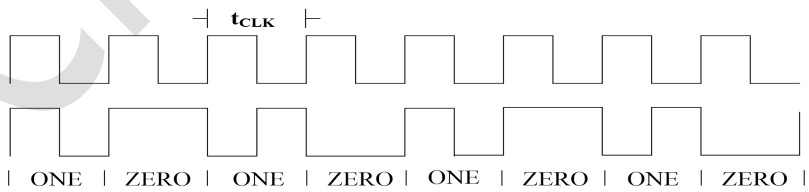


8 QI Communication

CV8083 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:

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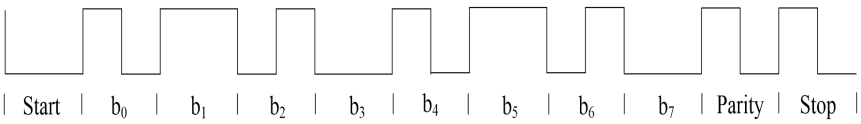


The following figure shows the format of packet sent by WPC:

Preamble	Header	Message	Checksum

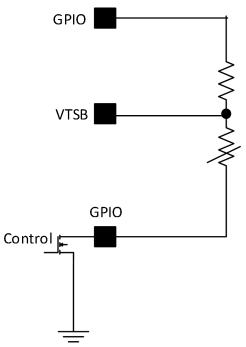
9 Over-voltage and Over-current Protection

CV8083 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

CV8083 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 CV8083 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.



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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.

CV8083 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

CV8083 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 Typical Applications Schematic

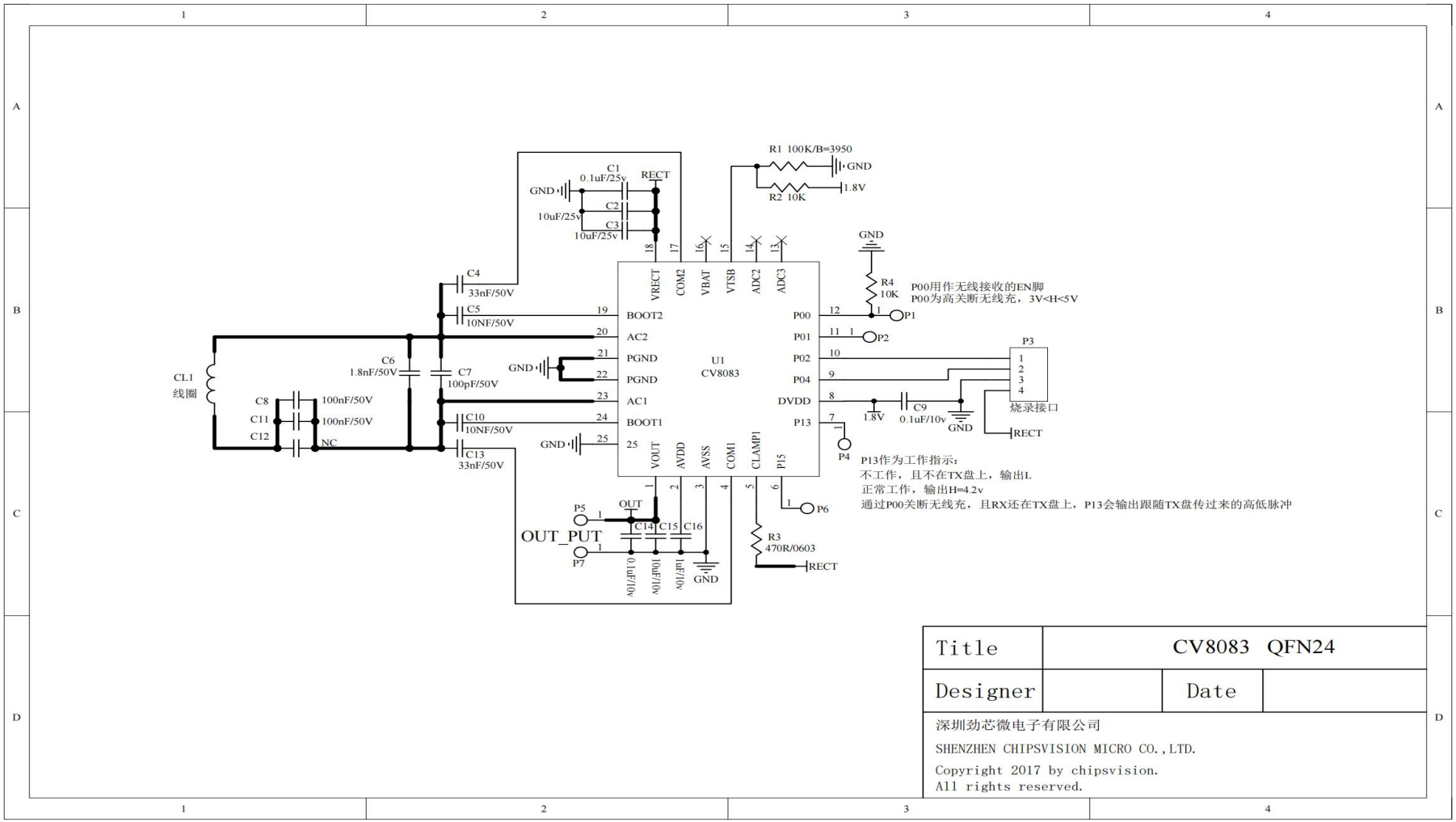
Typical Applications Schematic is on page 9 of this document.

14 Package Information

The package outline drawings are appended at the end of this document.

15 Ordering Information

Orderable Part Number	Package	MSL Rating	Shipping Packaging	Minimum Number of Packages
CV8083	QFN24(4.00 ×4.00 × 0.75 mm)	MSL3	Tape and reel	4000 PCS


R1 100K/B=3950
R2 10K
GND
1.8V
C1 0.1uF/25v
C2 10uF/25v
C3 10uF/25v
RECT
C4 33nF/50V
C5 10NF/50V
C6 1.8nF/50V
C7 100pF/50V
C8 100nF/50V
C11 100nF/50V
C12 NC
C10 10NF/50V
C13 33nF/50V
CL1 线圈
U1 CV8083
VRECT
COM2
VBAT
VTSB
ADC2
ADC3
BOOT2
AC2
PGND
PGND
AC1
BOOT1
VOUT
AVDD
AVSS
COM1
CLAMP1
P15
P00
P01
P02
P04
DVDD
P13
R4 10K
P00用作无线接收的EN脚
P00为高关断无线充，3V<H<5V
P1
P2
P3
烧录接口
C9 0.1uF/10v
P4
P13作为工作指示：
不工作，且不在TX盘上，输出L
正常工作，输出H=4.2v
通过P00关断无线充，且RX还在TX盘上，P13会输出跟随TX盘传过来的高低脉冲
P5
OUT
OUT_PUT
P7
C14
C15
C16
P6
R3 470R/0603
Title
CV8083 QFN24
Designer
Date
深圳劲芯微电子有限公司
SHENZHEN CHIPSVISION MICRO CO.,LTD.
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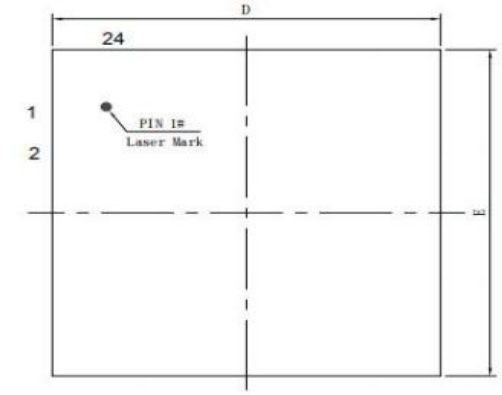

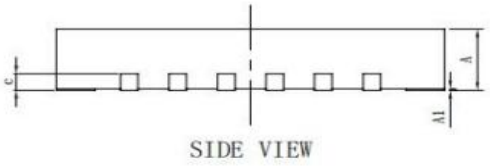

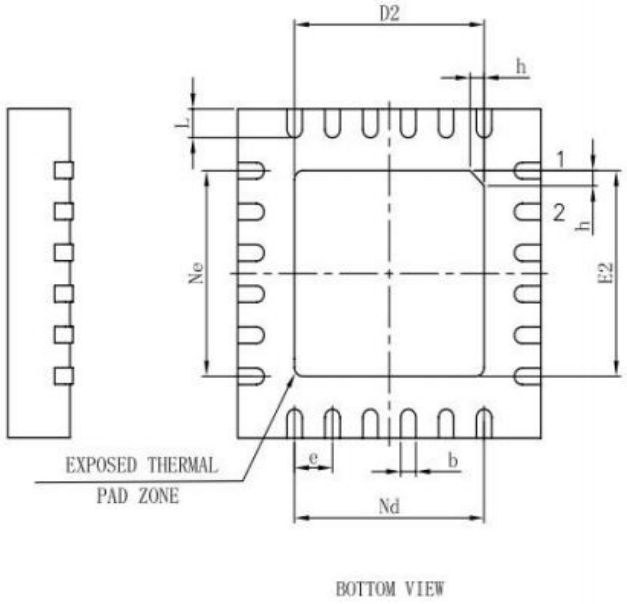

SYMBOL	MILLIMETER		
	MIN	NOM	MAX
A	0.70	0.75	0.80
A1	0	0.02	0.05
b	0.20	0.25	0.30
c	0.18	0.20	0.23
D	3.90	4.00	4.10
D2	2.7REF		
e	0.50BSC		
Ne	2.50BSC		
Nd	2.50BSC		
E	3.90	4.00	4.10
E2	2.7REF		
L	0.30	0.40	0.50
h	0.30REF		

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: POD-003			File: QFN24	Unit: mm
	Name	Date		
Draw	张春林	2020/11/10		Edition: A
Approved	周喜云	2020/11/10		