HG-S7

样品规格承认书

SAMPLE SPECIFICATION FOR APPROVAL

Version: V 2.1

2021/07/11

HUAGON

Shenzhen huagon technology ., Ltd
SZ Office: 6th floor No.2, Lingbei 4 road , the first industrial area of Phoenix, Fuyong town Bao'an District, Shenzhen (518000)
Tel: +86-15219486699   www.huagon.cn

客户名称/Customer	
版本号/ Part No	
客户版本号/ Customer Part No	
制定日期/Date	
软件版本/Software Version	

客户承认签章：
Customer Approval and Signature

华功确认：
HG-Tech Approval

1, 签样内容/Sample Information

1）新规格/New Spec   2）追加材料/New Material   3）变更/ECR

2, 变更的规格说明/Reason of Spec Change

变更前规格/Original Spec	变更理由/Reason	变更后规格/New Spec

备注/Remark:

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Please sign and return this document, in order to fulfill the production requirements of HG-Tech. Failing to return this document shall

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目 录

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一、产品规格/Product Spec

版本/History

| 日期/Date	版本号/Revsion	备注/Note
04/11/2019	V2.0	
03/04/2021	V2.1	QI EPP 15W certificate software

1、Product Brief

This product uses S7 main control IC, supports Type-C interface communication upgrade, supports PD, AFC, QC communication protocols, a complete work protection system, low cost, ultra-low operating temperature, ultra-high working efficiency, can pass all export certifications, QI certification, able to quickly and wirelessly charge Samsung, iPhone, Huawei, Xiaomi, LG, Google, ZTE, Sony, Nokia, Hammer, Gionee and many other mobile phone brands that meet the QI standard with built-in wireless charging W wireless fast charging, at the same time, it has perfect compatibility with 15W wireless charging mobile phones that meet the QI standard, and can support Qi standard receivers such as Ti, IDT, PANASONIC and so on.

2、Product Features

1. The scheme complies with QI 1.2.4 specifications.

2. Perfectly compatible with the full range of mobile phones in the market that meet the QI standard wireless fast charging 10W.

3. The HG-S7 chip supports PD, QC2.0, QC3.0, and AFC fast charging protocols.

4. Wide voltage operation: 5V, 9V, 12V.

5. The highest output rated power to the receiving end: 15W.

6. Inductive charging distance: 1 ～ 10mm.

7. BPP / EPP working frequency: 105Khz ～ 205Khz.

8. Metal foreign object detection (static FOD) during standby and metal foreign object detection (dynamic FOD) when working.

9. Work efficiency is as high as 85%.

10. Ultra-low working temperature (long-term working temperature of 45 ℃ under load 15W).

11. OTP over-temperature protection, OCP over-current protection, OVP over-voltage protection, UVP under-voltage protection.

12. Can pass KC, FCC, CE, BSMI, NCC and other export certifications.

13. Can pass BPP_5W_QI certification, EPP_10W / 15W_QI certification.

14. Support Type-C interface communication upgrade.

15. The 5V-1A input dynamically limits the output power (to prevent the adapter protection from restarting).

16. High degree of program integration, ultra-simplified peripheral circuits.

3、HG-S7 main control chip information

3.1 HG-S7 chip pin diagram
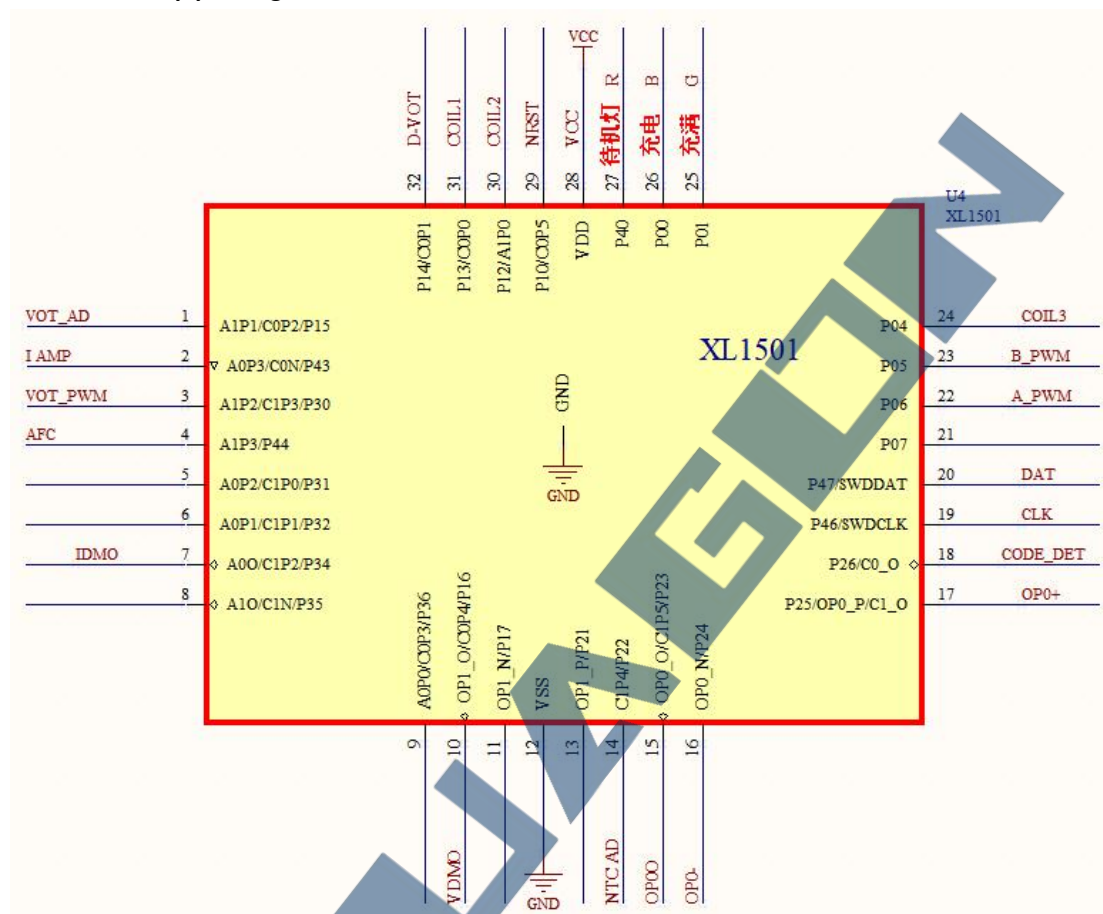
3.2、HG-S7 chip pin function description

Serial number	I/O	Functional description
1	P15	Input voltage detection
2	P43	Wireless charging flow detection
3	P30	1、EPP circuit modulation voltage PWM 2、I/O
4	P44	1、AFC protocol communication 2、I/O
5	P31	1、PD protocol communication 2、I/O
6	P32	1、PD protocol communication 2、I/O
7	P34	1、Wireless charging stream decoding
8	P35	1、PD protocol communication 2、I/O
9	P36	1、PD protocol communication 2、I/O

10	P16	Wireless charging and decoding
11	P17	I/O
12	VSS	GND
13	P21	I/O
14	P22	Thermal detection circuit
15	P23	Wireless charging operational amplifier output
16	P24	Wireless charging operational amplifier negative input
17	P25	Wireless charging op amp positive input
18	P26	Wireless charging oscillation voltage detection
19	P46	HG-S7 chip burning clock line
20	P47	HG-S7 chip burning data cable
21	P07	I/O
22	P06	Wireless charging work A bridge PWM
23	P05	Wireless charging work B bridge PWM
24	P04	1、Three coil control pins for wireless charging 2、I/O
25	P01	1、Wireless charging work full indication output pin (low level) 2、I/O
26	P00	1、Wireless charging work charging instruction output pin (low level) 2、I/O
27	P40	1、Wireless charging work standby indication output pin (low level) 2、I/O
28	VDD	HG-S7 chip power input（3.3V/50mA）
29	P10	1、HG-S7 chip reset enable pin 2、HG-S7 chip data printing pin
30	P12	1、Wireless charging dual coil control pin 2、I/O
31	P13	1、Dual coil control pin for wireless charging 2、I/O
32	P14	1、QC protocol communication 2、I/O

Note: All pin functions are locked and cannot be modified, and I / O identification is HG-S7 chip pins can be reused.

3.3、HG-S7 chip electrical parameter rating

symbol	parameter	Rated value	Minimum value	Maximum	unit
VDD-VSS	voltage	3.3	-0.3	5.8	V
VIN	Input voltage	-	Vss-0.3	VDD+0.3	V
PE	Power consumption：Vcc=3.3V	40	35	45	mW
TA	Operating temperature	-	-40	+105	℃
TST	Storage temperature	-	-55	+105	℃

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IDD	VDD Maximum input current	50	-	120	mA
ISS	VSS Maximum input current	50	-	120	mA
IIO	Single I / O maximum sink current	20	-	50	mA
	Single I / O maximum current	20	-	40	mA
	Maximum sink current of all I / O	50	-	100	mA
	Maximum current of all I / O	50	-	100	mA

3.4、HG-S7 chip package size

QFN32
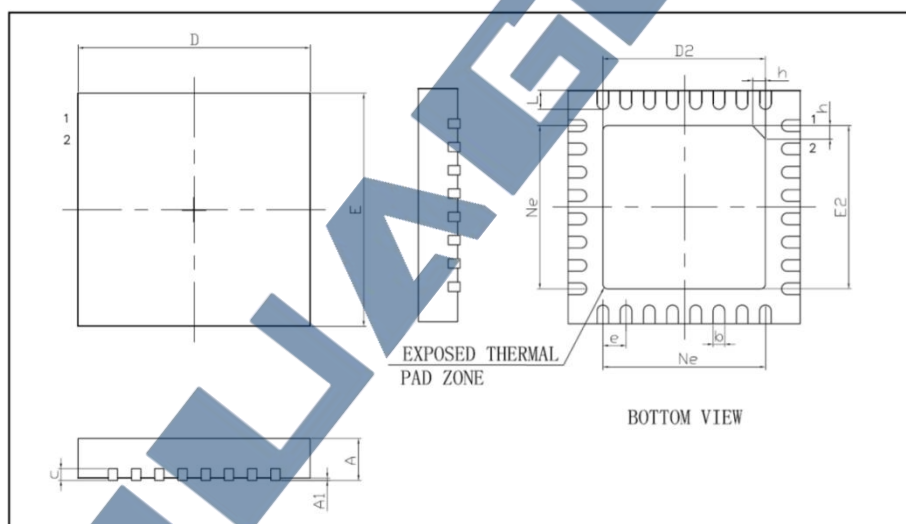
Symbol	Millimeter		
	Min	Nom	Max
A	0.70	0.75	0.80
A1	-	0.02	0.05
b	0.18	0.25	0.30
c	0.18	0.20	0.25
D	4.90	5.00	5.10
D2	3.40	3.50	3.60
e	0.5BSC		
Ne	3.5BSC		
E	4.90	5.00	5.10
E2	3.40	3.50	3.60
L	0.35	0.40	0.45
h	0.30	0.35	0.40

4、 Working parameter

	Test Conditions	Rated value	Minimum value	Maximum	unit
Standby power consumption	Vcc=5V	125	80	150	mW
Operating Voltage	VCC=5V	5	4.5	5.8	V
	VCC=9V	9	8	13	V
	VCC=12V	12	8	13	V
Working current	VCC=5V	1.5	0.5	1.65	A
	VCC=9V	1	0.5	1.65	A
	VCC=12V	0.8	0.5	1.65	A
Working distance	Samsung S8 + mobile phone	2	1	10	mm
working frequency	Adjust load offset	-	105	205	Khz
Protection current	VCC=5V	1.6	1.55	1.65	A
	VCC=9V	1.6	1.55	1.65	A
	VCC=12V	1.6	1.55	1.65	A
Output Power	VCC=5V	5	4	5	W
	VCC=9V	10	7	12	W
	VCC=12V	10	7	15	W
Transmission efficiency		80	50	85	%
Protection temperature		60	55	65	℃

5、 Other parameters

PCBA board size	40*30*3MM
On-board device height	1.7MM
Coil size	50*50*2.5MM
Coil length	15MM

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6 LED status indication

LED	Power-on	Standby	Charge	full	FOD/Report an error
Red	Red / Blue / turn on and off 1S	bright	turn off	turn off	Blue / red alternating 0.3S flash
Bule		turn off	bright	bright	

7 Wireless charging principle framework diagram

S7 schematic

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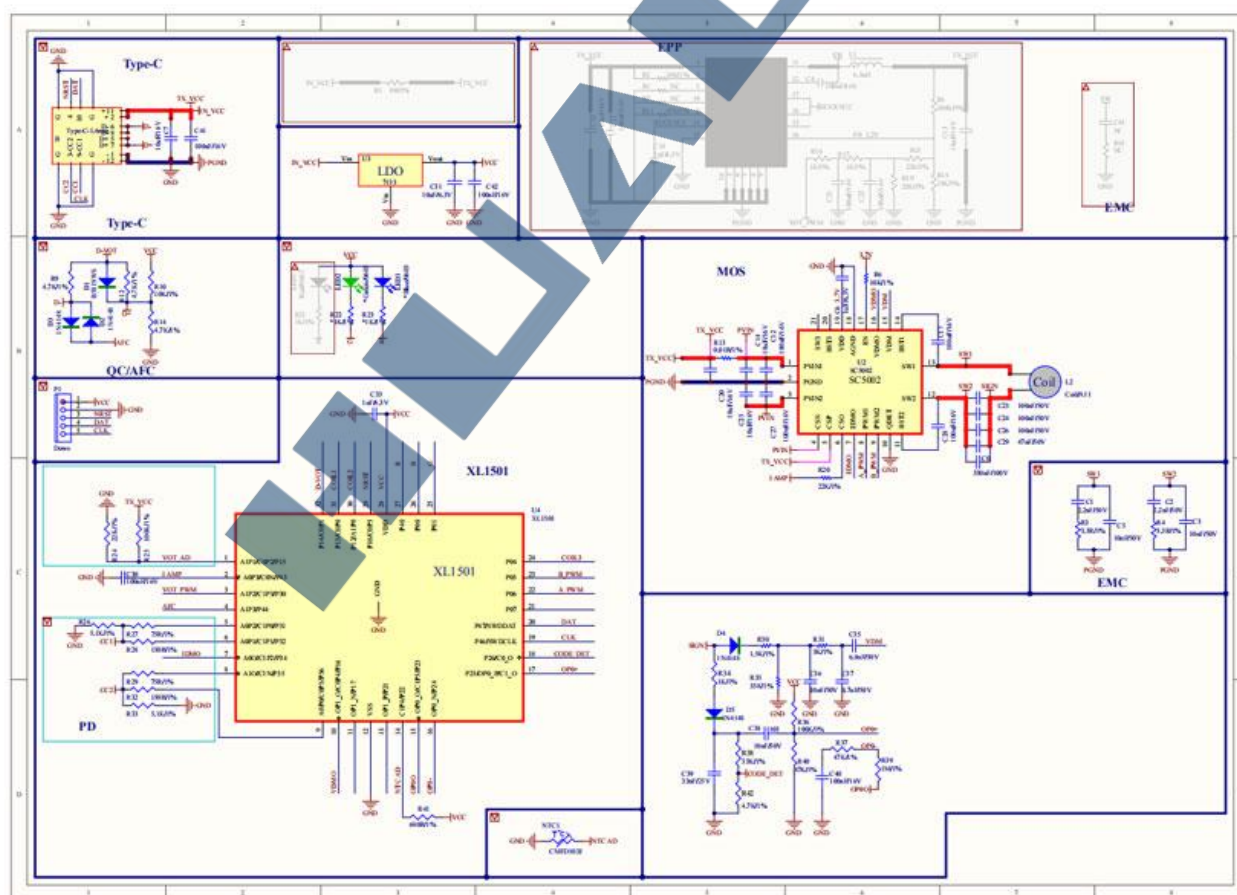
8 Efficiency test

8.1、test tools
Digitally controlled DC power supply, electronic load meter, aging tester receiver.

Working distance	Input voltage	Input Current	The output voltage	Output current	Transmission efficiency
2mm	12.01V	0.790A	9.04V	0.9A	85.7%
5mm	12.03V	0.827A	9.03V	0.9A	81.6%
2mm	9.05V	1.047A	9.01V	0.9A	85.5%
5mm	9.05V	1.100A	9.00V	0.9A	81.3%
2mm	5.03V	1.132A	5.01V	0.9A	79.2%
5mm	5.02V	1.207A	5.00V	0.9A	74.2%

Note: The above test data is for reference only, the actual test shall prevail.

8.2、Transmission efficiency
The ratio of output power to input power is the wireless charging transmission efficiency.

8.3、Test Methods
Connected to digital control DC power supply, the input voltage is adjusted to 5V / 9V / 12V, the output of the receiving end is connected to the load meter, the load meter outputs in a constant current mode, and the output is adjusted to 0.9A in a range of 100mA.

8.4、Precautions
The wiring from the DC power supply to the input end of the product should be as short and thick as possible to reduce DC loss. The measurement input voltage point should be placed at the product interface, subject to the actual input voltage. Similarly, the wiring from the output end to the load meter is as short and thick as possible. The output voltage is based on the output port voltage of the receiving end. The effective distance between the transmitter board and the receiver is maintained at about 2 ~ 5mm to achieve the best test result.

9、PD Compatibility test

9.1、Test compatible brand model list

Serial number	Brand	Model	Serial number	Brand	Model
1	Samsung	EP-TA800	29	hammer	CD106
2	Samsung	EP-TA845	30	Nanfu	NFTAC203
3	iPhone	A2166	31	Made in Beijing and Tokyo	TC-012
4	iPhone	A1947	32	Taiwan Speed Cruiser	RY-U32
5	iPhone	A1882	33	Google	G1000-US

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6	iPhone	A1695	34	Llano	HPM6-PD3.0
7	Huawei	HW-200325CP0	35	Ascot	EC7C
8	Xiaomi	CDQ07ZM	36	Flash	FJ-SW618H-1C
9	Xiaomi	AD16ZM	37	Purple Rice	HA711
10	ANKER	A2041	38	Xuan yang	XY18W-1204
11	ANKER	A2029	39	Xie Yang	XY-0041
12	ANKER	A2615	40	Letv	EV-24ACN
13	ANKER	A2017	41	Hechuang Green Energy	TC-012
14	ANKER	A2616	42	Yubo	RY-U32
15	ANKER	A2014	43	Star speed	RY-U32
16	UGREEN	CD127	44	Mcdodo	TC-061PD
17	UGREEN	CD137	45	Humixx	CDRZ28
18	NetEase Intelligence	NIT-TAC-01-PD18W-WH	46	DIVI	P2207
19	NetEase Intelligence	NIT-TAC-01-65W-WH	47	PISEN	TS-C118
20	First guard	P2207	48	SDILHD	DLP4322C
21	First guard	P2208	49	MOMAX	UM12
22	BASEUS	BS-CH910	50	Ravpower	RP-PC120
23	BASEUS	BS-C915	51	Airchorge	NFDP007
24	Philips	DLP5320C	52	Thinkpllus	C45
25	Philips	DLP4321C	53	biaze	FC87C
26	Philips	BS-CH905	54	ROCK	HPM6-PD3.0
27	Lenovo	PA65	55	Aoqiang	OH-W23
28	Tulas	CDRA13	56	ROMOSS	AC18C

Note: The above is a random selection of more than 50 PD adapter brands and models on the market. The test conditions are all PASS.

10、Long-term work aging test

10.1、test environment
Temperature: 26 ° C Humidity: 62 rH
Input: 18W Output: 15W
Load: aging tester
Test working time: 5H

10.2、Single coil

Device surface temperature:	SC8101	6R8 inductor	SC5002	HG-S7	Resonant capacitor
BPP scheme single coil:	-	-	44.2℃	31.4℃	43.1℃
EPP scheme single coil:	48.7℃	49.3℃	45.3℃	37.3℃	43.1℃

10.3、Double coil

Device surface temperature:	SC8101	6R8 inductor	SC5002	HG-S7	Resonant capacitor	SC8101
BPP scheme single coil:	-	-	44.1℃	34.6℃	43.7℃	47.3℃
EPP scheme single coil:	49.2℃	50.1℃	45.9℃	37.8℃	45.2℃	47.7℃

11 Wireless charging protection logic design

11.1 FOD metal foreign body detection

Static FOD: After working normally after power-on, when entering standby mode and not working, the static FOD function works. At this time, place a metal object about 2MM directly above the coil, covering half of the coil, and the metal content reaches a certain level, At this time, the static FOD triggers and enters the error reporting state, and the indicator flashes immediately to indicate the error.

Dynamic FOD: After normal operation after power-on, after entering the charging mode from the standby mode, the dynamic FOD function works. At this time, if there is a metal object between the transmitting coil and the receiving coil, it is converted according to the transmitting power of the transmitting board and the received feedback power If the loss of conversion efficiency is too large, it is judged to be affected by metal objects. At this time, dynamic FOD is triggered. This conversion process depends on the actual situation. Normally, the error state is entered in about 15 seconds, and the error state is entered in up to 1 minute. And the indicator flashes immediately to prompt an error.

Test items	Test Conditions	Test Results
Static FOD test	Place a 1 yuan coin at 2MM directly above the transmitting coil, and cover the half of the coil.	1. No device damage 2. Trigger FOD in about 3 seconds 3. The indicator flashes quickly
Dynamic FOD test 1	Use the aging tester as the load, and put a 1 yuan coin between transmission and reception after work	1. No device damage 2.Limit output 1.6A 3. FOD is triggered in about 5 seconds 4. The indicator flashes quickly
Dynamic FOD test 2	Use Samsung S8 + mobile phone as the load, the interval is 2MM, put 1 yuan coin between transmission and reception after work	1. No device damage 2.Limit output 1.6A 3. FOD is triggered in about 5 seconds 4. The indicator flashes quickly

11.2 OVP overvoltage protection

The working voltage of the power-on input voltage is 13V. If the input exceeds the limit value, the indicator status prompts an error, and the system is restarted to perform the test again.

Test items	Test Conditions	Test Results
Input overvoltage test	Using digital power input + 13.5V voltage	1. No device damage 2. Not working properly 3. System restart

11.3 OCP overcurrent protection

The maximum output current is 1.65A. When it exceeds 1.65A, the output current will be limited immediatel

Test items	Test Conditions	Test Results
Output current overcurrent test 1	Use the aging tester as the load. After working, put a 1 yuan coin between the transmitter and the receiver, and the working current reaches 1.6A	1. No device damage 2.Limit output 1.65A 3. FOD is triggered after 5 seconds 4. The indicator flashes

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		quickly
Output current overcurrent test 2	Use Samsung S8 + mobile phone as the load, put 1 yuan coin between transmitting and receiving after working, the working current reaches 1.6A	1. No device damage 2. Limit output 1.65A 3. FOD is triggered after 5 seconds 4. The indicator flashes quickly

11.4 UVP undervoltage protection

After power on, the working voltage needs to be in the range of 4.5-5.8V, 8V-13V. If it is not within this range, if it is below or exceeds, the indicator status will indicate an error, and restart the system to re-detect.

Test items	Test Conditions	Test Results
Unconventional working voltage test	1. Adopt digital power input + 4.1V 2. Adopt digital power input + 6V 3. Adopt digital power input + 7.5V	1. No device damage 2. Not working properly 3. System restart

11.5, OTP over temperature protection

The temperature is abnormal (60 ℃) during standby and working. The indicator flashes quickly to indicate an error during standby, and the error status is exited after the temperature is normal. If the temperature rises during operation, the protection temperature threshold (55 ℃) is set immediately. To limit the power output, if it still rises to the set protection temperature (60 ℃):

1. Immediately exit the working state and flash the indicator light to prompt an error. If the receiving load is not removed, check whether the temperature returns to normal (below 60 ℃) after 1 minute, and then continue working normally, such as at 55 ℃ -60 ℃ Then limit the power output.

If the load is removed immediately after the temperature is reported, it will immediately start to detect whether the temperature is normal.

Test items	Test Conditions	Test Results
Standby over temperature protection test	Use digital power input + 5V / + 9V, use a hot air gun to heat the thermistor to the protection temperature value (60 ℃)	1. No device damage 2. The light flashes and reports an error
Working over temperature protection critical value test	Use Samsung S8 mobile phone as the load, use a hot air gun to heat the thermistor to the critical temperature protection temperature (55 ℃) after work	1. No device damage 2. Limit output power
Working over temperature protection test 1	Use Samsung S8 mobile phone as the load, use a hot air gun to heat the thermistor to the protection temperature value (60 ℃) after work, and stop heating without removing the load.	1. No device damage 2. Limit output power 3. The flashing light reports an error 4. Continue working after 1 minute
Working over temperature protection test 2	Use Samsung S8 mobile phone as the load, use a hot air gun to heat the thermistor to the protection temperature value (60 ℃) after the work, stop heating, and remove the load.	1. No device damage 2. Limit output power 3. The flashing light reports an error 4. Enter standby after 3 seconds

11.6. Description of temperature protection

There is a chip negative temperature resistance sensor on the PCBA board by default, which has a dynamic setting protection function, that is, the power output will be reduced when the temperature reaches 55 ° C, and an alarm will be given if the temperature exceeds 60 ° C. If you want to increase the protection temperature, you can increase the resistance as shown in the figure. The larger the resistance, the higher the protection temperature value, and vice versa. The default resistance is 680R / 1%.

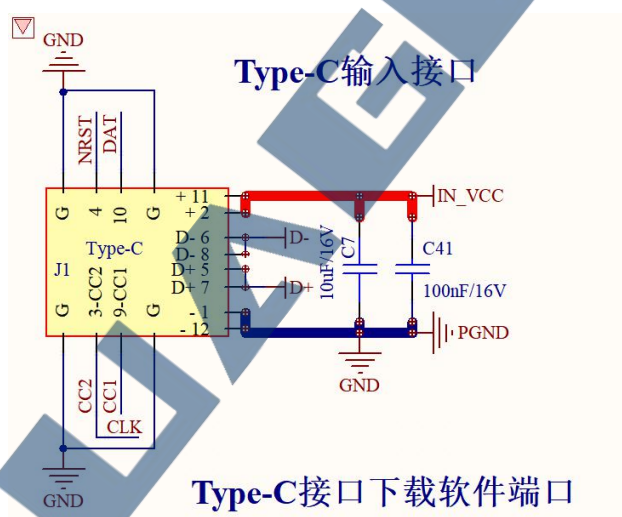## 12. Electromagnetic compatibility (EMC) 3M test

12.1 Vertical test

Data: 309   File: E:\测试资料\X\芯狼\20190820.EM6 (309)   Date: 2020-04-02 Time: 10:12:56

Level (dBuV/m)

EN55022 CLASS B
-6dB

Frequency (MHz)

```
Site      : chamber
Condition: EN55022 CLASS B 3m ANT-ZHF VERTICAL
        : RBW:120.000KHz  VBW:300.000KHz  SWT:Auto
eut       : 华为充头+闪魔0.5线+SC5002单线圈+手机S8+
mode      :
memo      :
```

	Freq	Limit Line	Over Limit	Level
	MHz	dBuV/m	dB	dBuV/m
1 pp	109.41	40.00	-5.12	34.88
2	473.83	47.00	-8.20	38.80

12.2. Level test

Data: 308   File: E:\测试资料\X\芯狼\20190820.EM6 (309)   Date: 2020-04-02 Time: 10:12:26

Level (dBuV/m)

EN55022 CLASS B
-6dB

Frequency (MHz)

```
Site      : chamber
Condition: EN55022 CLASS B 3m ANT-ZHF HORIZONTAL
        : RBW:120.000KHz  VBW:300.000KHz  SWT:Auto
eut       : 华为充头+闪魔0.5线+SC5002单线圈+手机S8+
mode      :
memo      :
```

	Freq	Limit Line	Over Limit	Level
	MHz	dBuV/m	dB	dBuV/m
1 pp	124.57	40.00	-8.50	31.50
2	301.42	47.00	-10.77	36.23

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13 Maximum ratings of working parameters

parameter	symbol	Rated value	unit
Working temperature	Ta	-20～+50	℃
stored temperature	Tstg	-30～+100	℃
Storage humidity	Tstr	< 95%	RH
Supply voltage	Vcc	-0.5～+13V	V
Supply current	Imax	1.65	A

14 Schematic data

14.1 (Type-C interface circuit)

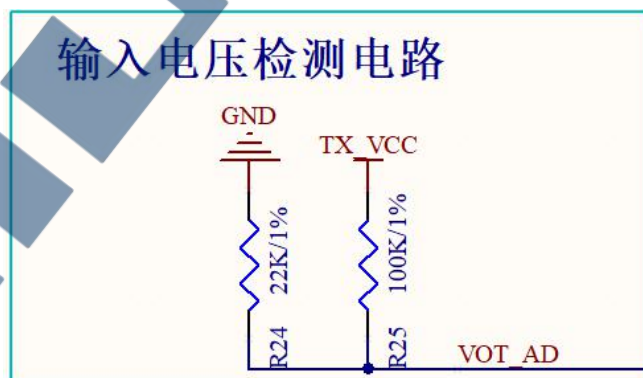### 14.2, (input through output power supply short-circuit resistance)

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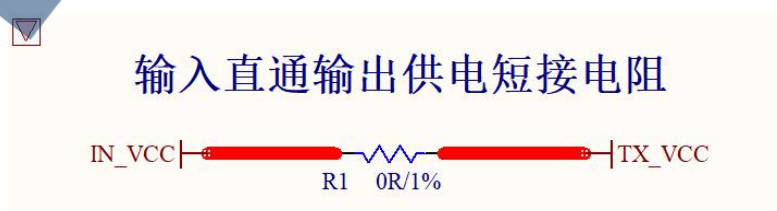
14.3, (main control chip power supply circuit)

主控芯片供电电路

IN_VCC | Vin U3 | Vout | VCC

LDO
7133

Vss

GND

C31
10uF/6.3V

C42
100nF/16V

GND GND
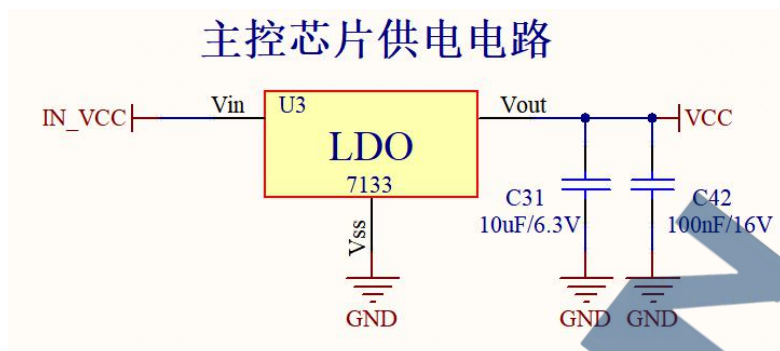
14.4. (EPP fixed frequency voltage regulating circuit)

EPP定频调压电路

电磁兼容（EMC）改善电路
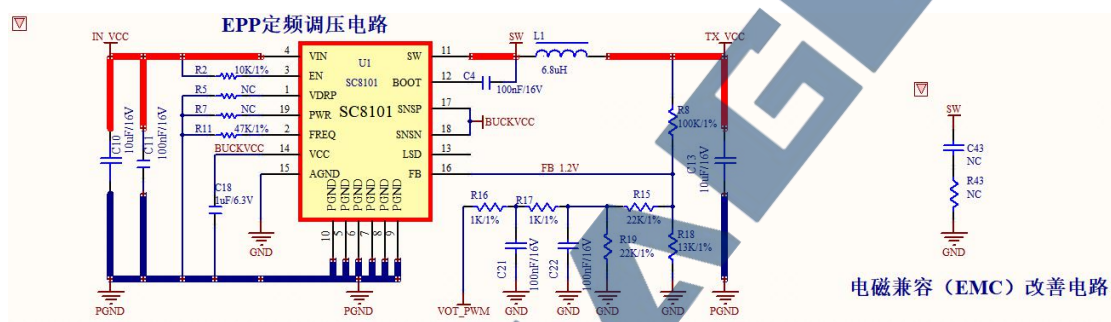
14.5, (input voltage detection circuit)

输入电压检测电路

GND   TX_VCC

R24 22K/1%   R25 100K/1%   VOT_AD

14.6 (QC / AFC fast charge protocol circuit)

QC/AFC快充协议电路

D-VOT   VCC

R9 4.7K/1%   D1 B5819WS   R12 4.7K/1%   R10 10K/1%

D-

D3 1N4148   D2 1N4148   D+

AFC   R14 4.7K/1%

GND

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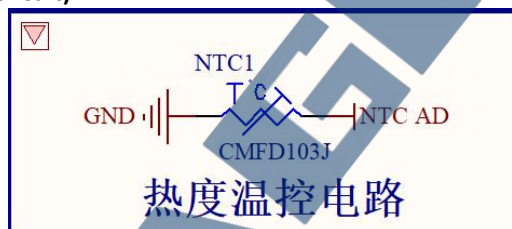Tel: +86-15219486699   www.huagon.cn
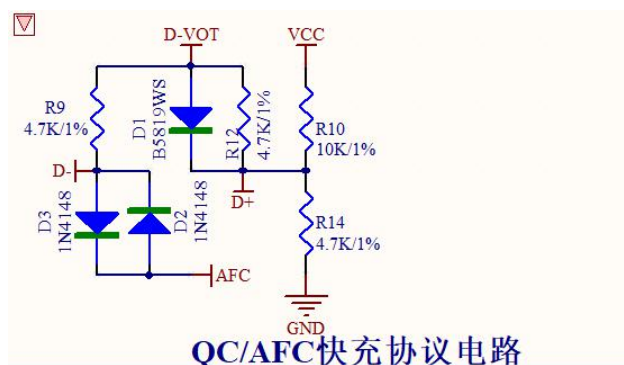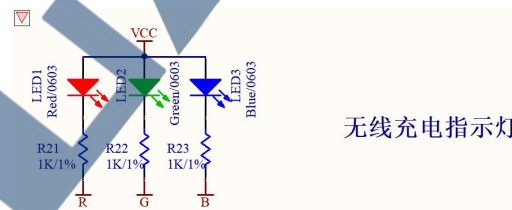
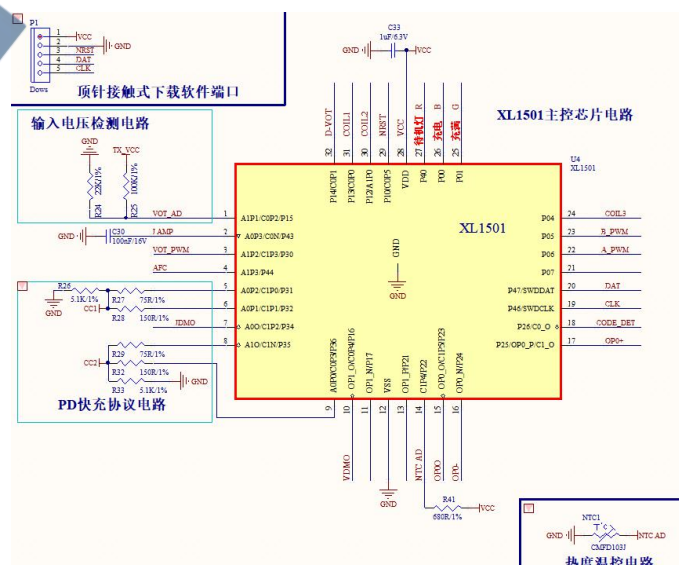### 14.7, (PD fast charging protocol circuit)
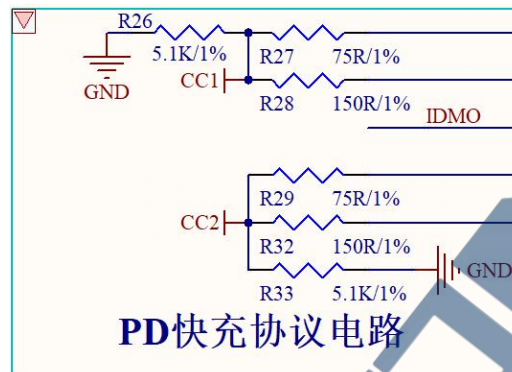
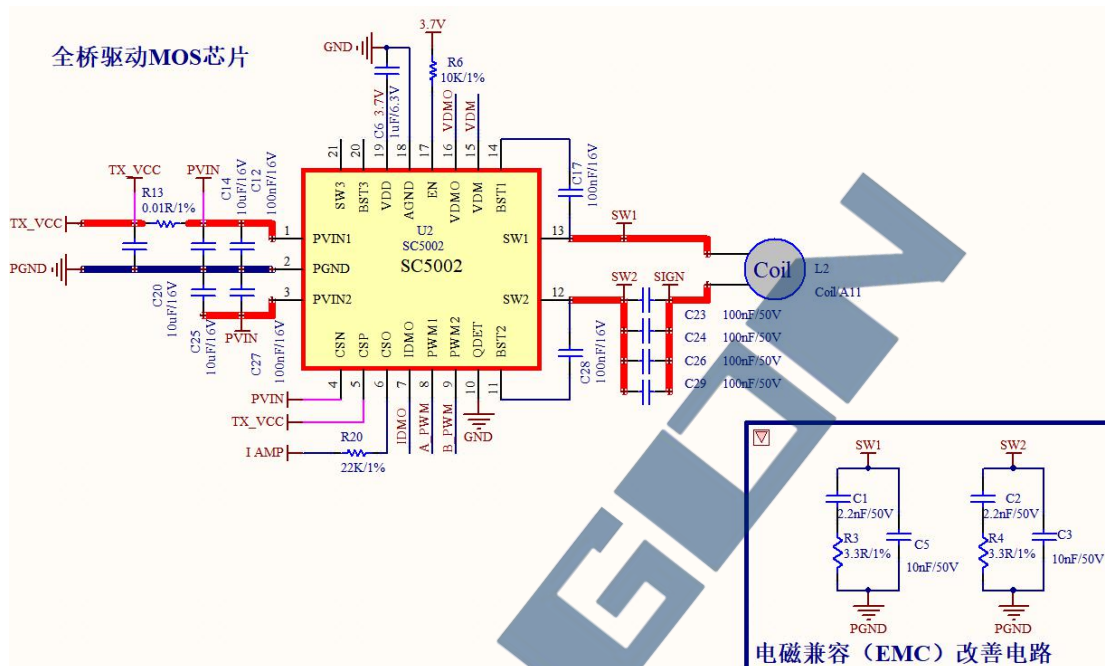### 14.8, (heat temperature control circuit)

14.9. (Wireless charging indicator circuit)

14.10, (HG-S7 main control chip circuit)

14.11, (Full-bridge drive MOS circuit)

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14.12. (Wireless charging and decoding circuit)

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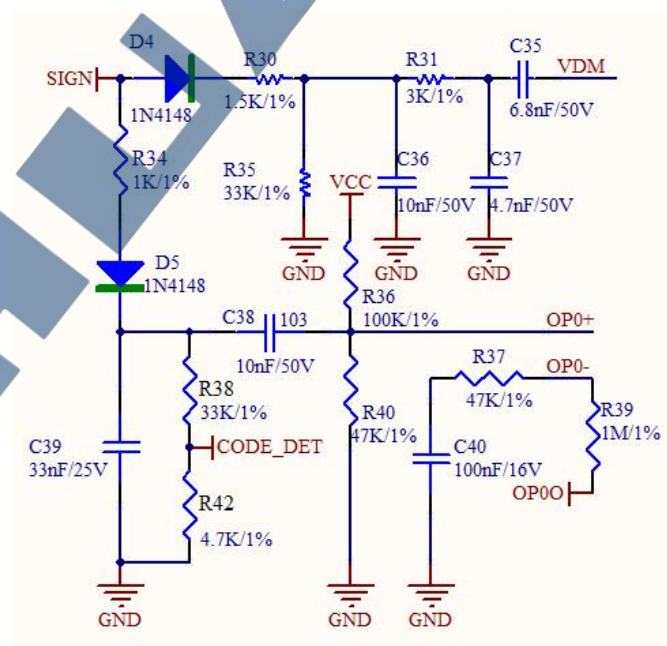
14.13. (Double coil switching MOS circuit)
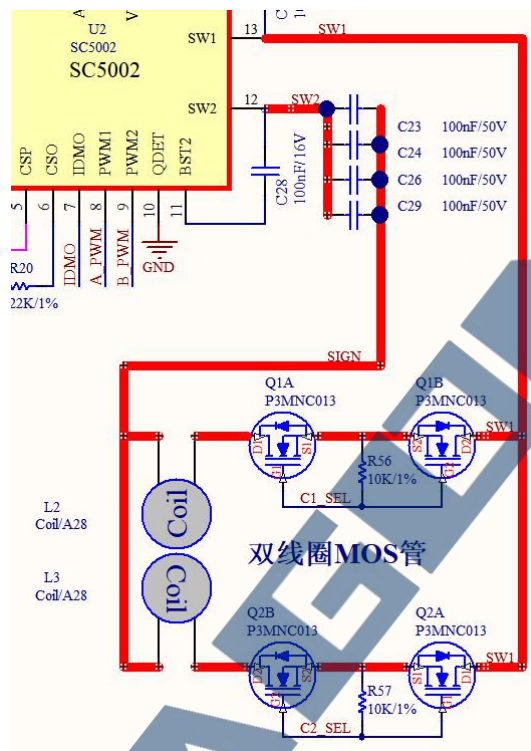
14.14. (Double coil selection circuit)

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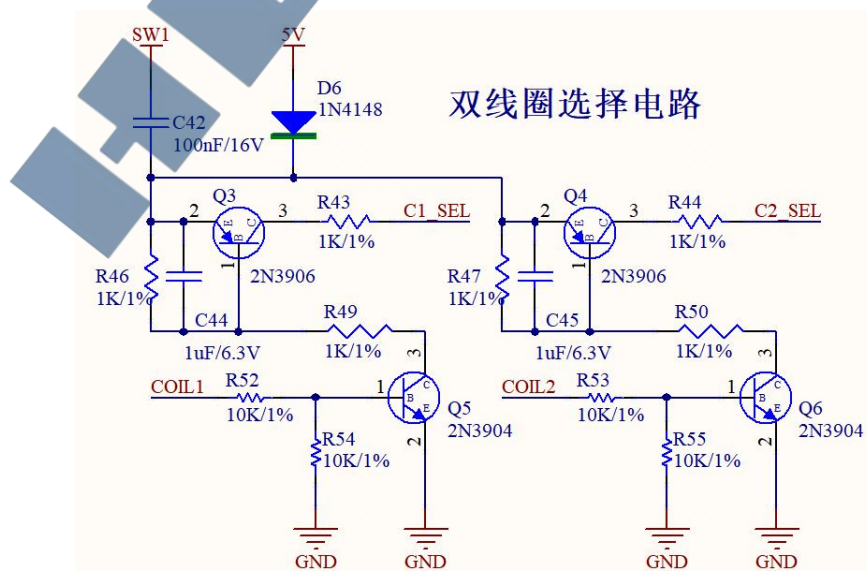
14.Low-level circuit diagram

Low-level circuit diagram

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Tel: +86-15219486699   www.huagon.cn
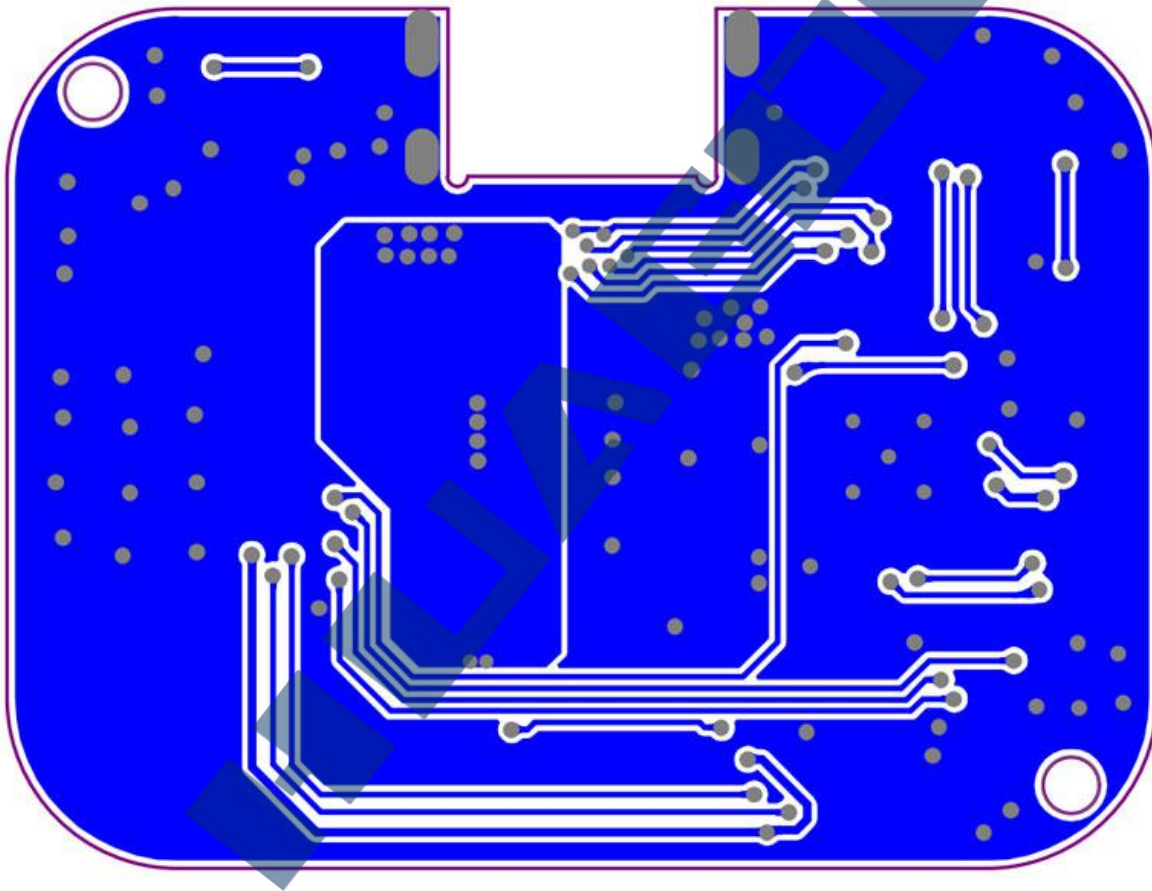
15.Top line diagram

Top line diagram

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16.S7 patch map

S7 patch map

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二、样品实物图/Product pictur

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