

Wireless Power Transmitter Compliant with WPC V1.2.4 protocol of 5W

Features

- Compliant with the WPC V1.2.4 specifications transmitter design
- Support 5W applications
- Input withstand voltage up to 16V
- Integrate NMOS full bridge driver and full bridge power MOS
- Integrate voltage/current demodulator
- Support FOD (Foreign Object Detection) function
 - ✧ High sensitivity
 - ✧ Support dynamic FOD
- Low quiescent dissipation and high efficiency
 - ✧ 10mA quiescent current
 - ✧ Charging efficiency is up to 79%
- Compatible with NPO and CBB capacitors
- Support Dynamic Power Modulation (DPM) for insufficient USB power source
 - ✧ Support low voltage charger of 5V/500mA
- Input overvoltage, overcurrent protection
- Supports up to 2 LEDs for system states indication
- Package: ESOP8

Description

IP6805U is a wireless power transmitter controller SoC that integrates all required functions for the latest WPC Qi V1.2.4 specifications compliant wireless power transmitter design. Support A11 coil, support 5W charging. It used analog PING to detect a RX wireless device for charging with low standby power. Once RX device is detected, the IP6805U establish a communication with the RX wireless device and controls the coil power transfer by adjusting operation frequency, depended on calculating the data packages, received from RX device, with PID algorithm. IP6805U terminate power transfer when RX device is fully charged.

IP6805U integrate full-bridge driver and full bridge power MOS, includes voltage and current two-way ASK demodulation module, and input overvoltage/current protection and FOD module. IP6805U is a highly integrated SoC for small-size and low bom cost solutions and reduced time-to-market.

Applications

- Charge Jacket, wireless charging base
- Car wireless charging device

System Functional Diagram

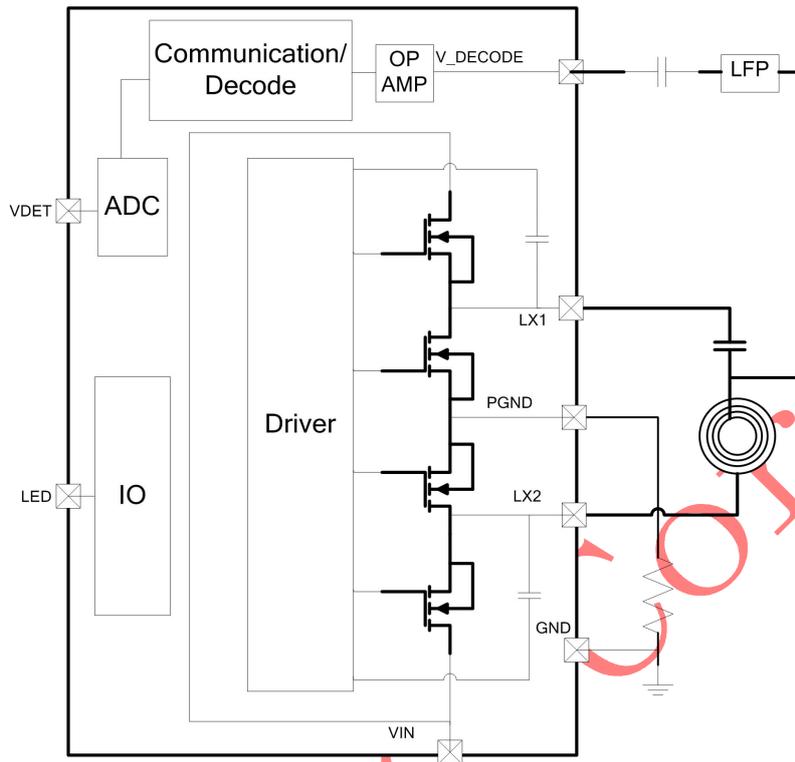
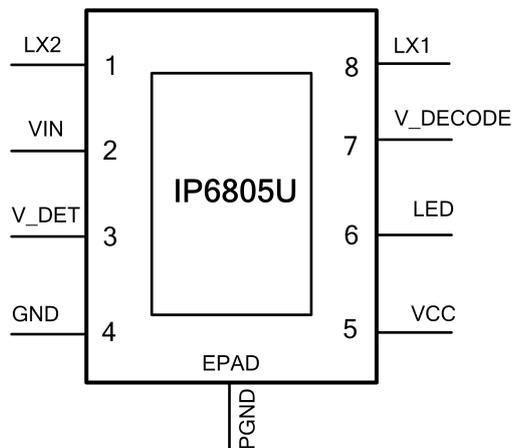


Figure System functional diagram

1. Pin Description



Pin No.	Pin Name	Description
1	LX2	H-bridge switching node 2
2	VIN	External voltage input PIN
3	V_DET	Coil voltage sense input
4	GND	Analog Ground, connected to the external 20 mΩ sampling resistor negative terminal
5	VCC	Internal VCC supply, connect 2.2uF capacitor
6	LED	LED output
7	V_DECODE	Voltage communication/demodulation input
8	LX1	H-bridge switching node 1
9	EPAD (PGND)	The power ground of the internal power MOS transistor is connected to the external 20 mΩ sampling resistor positive terminal

2. Absolute Maximum Ratings

Parameters	Symbol	Min	Max	Unit
Input Voltage Range	VIN	-0.3	16	V
Junction Temperature Range	T _J	-40	125	°C
Storage Temperature Range	T _{stg}	-60	125	°C
Package Thermal Resistance	θ _{JA}	40		°C/W
Human Body Model (HBM)	ESD	4KV		V

*Stresses beyond those listed under Absolute Maximum Ratings may cause permanent damage to the device.

Exposure to Absolute Maximum Rated conditions for extended periods may affect device reliability.

*Voltages are referenced to GND unless otherwise noted.

3. Recommended Operating Conditions

Parameters	Symbol	Min	Typ	Max	Unit
VIN input Voltage Range	VIN	4.5	5/9	12	V
I/O Voltage Range	LED1	GND-0.3		VCC+0.3	V

*Devices' performance cannot be guaranteed when working beyond those Recommended Operating Conditions.

4. Electrical Characteristics

Unless otherwise specified, TA = 25°C

Parameters	Symbol	Min	Typ	Max	Unit	Test Condition
VIN		4.5	5/9	12	V	
VCC		3.8	4.2	VIN	V	
VIH	Input high level	0.7xVCC			V	
VIL	Input low level			0.3xVCC	V	
VOH	Input high level		VCC		V	
VOL	Input low level		GND		V	
Source current	LED1 Output current capability		2	4	mA	Source current to output high level is 0.8*VCC
Thermal shut down temperature	T _{OTP}	100	120	140	°C	Rising temperature
Thermal shut down hysteresis	ΔT _{OTP}		40		°C	

5. Function Description

Full-bridge and Power MOS

IP6805U includes two symmetry half-bridge drive module with built-in power MOS, PWM frequency adjustable range is 110kHz~205kHz with 0.25kHz/step.

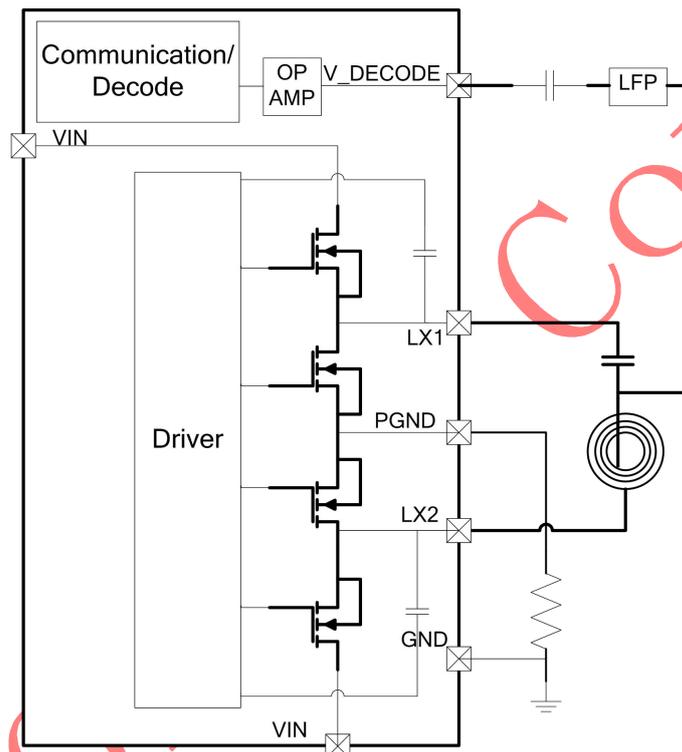


Figure full-bridge drive application circuit

DPM

IP6805U support Dynamic Power Management function for USB power source with insufficient power supply ability, which can guarantee the charging status will not break off or suspend. When the system detect the input voltage is lower than 4.3V, DPM function will be enabled and the transmitting power will be reduced. When the input voltage returns to above 4.75V and the input current is reduced by 200mA compared to when entering DPM, the system exits the DPM state.

Digital Demodulation

Integrate two-way ASK demodulation module, sampling the voltage and current of the coil separately. Current demodulation, additional separate devices are needed for low pass filters and first amplifier, signals is send to IC for digital demodulation and decode after DC blocked.

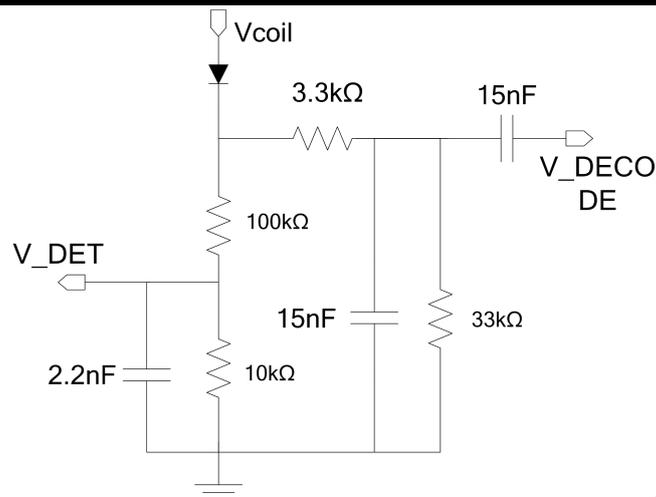


Figure Voltage ASK demodulation external circuit

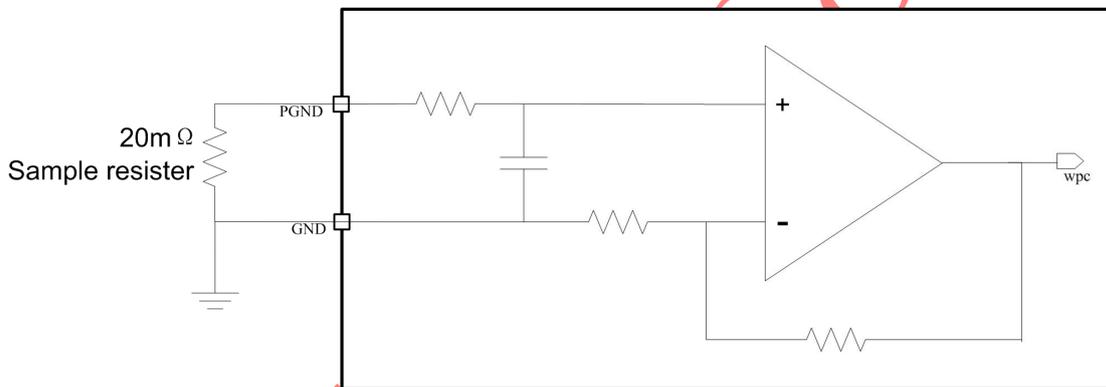


Figure Current ASK demodulation external circuit

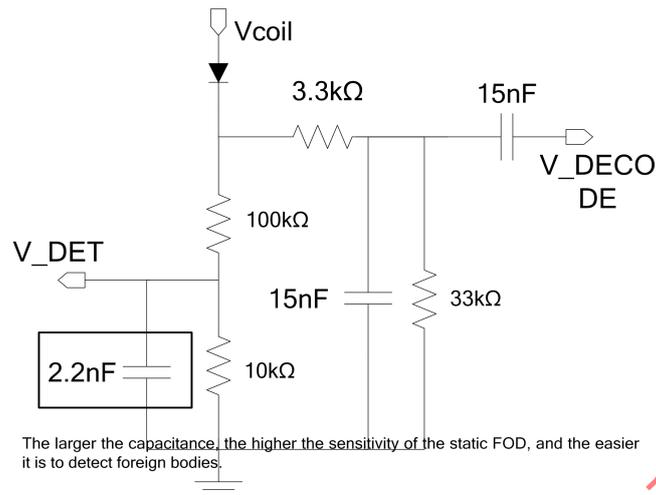
FOD parameter adjustment

IP6805U supports static FOD foreign object detection and dynamic FOD foreign object detection;

Static FOD means that foreign objects on the coil can be detected without wireless charging;

Dynamic FOD means that foreign objects on the coil can be detected while charging wirelessly, Need special custom firmware support if you need to adjust;

The IP6805U can adjust the sensitivity of the static FOD by adjusting the capacitance on the V_DET pin; the default is to connect the 2.2nF capacitor to ground, standard static FOD sensitivity: the greater the capacitance, the higher the sensitivity of static FOD, and the easier to detect foreign bodies.



LED Status Indicator

IP6805U can drive 1 LEDs directly through serial current-limit resistor. LEDs' status and system status relations are listed below:

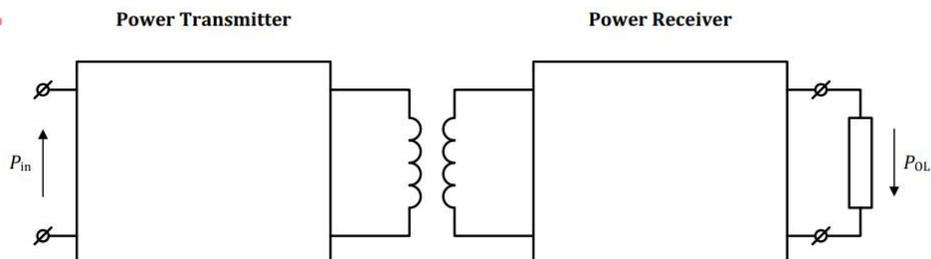
Status	LED1	LED2
Power-on	Flashing three times simultaneously	
Standby	Off	Off
Charging	On	Off
Abnormal	Off	Flashing

Support configuration tool to modify firmware;

Test Waveform

Using TI bq51020 solution for RX device, the relationship of efficiency and system output power and test method are outlined below. (VOUT=5V).

$$\eta_{\text{system}} = \frac{P_{\text{OL}}}{P_{\text{in}}}$$



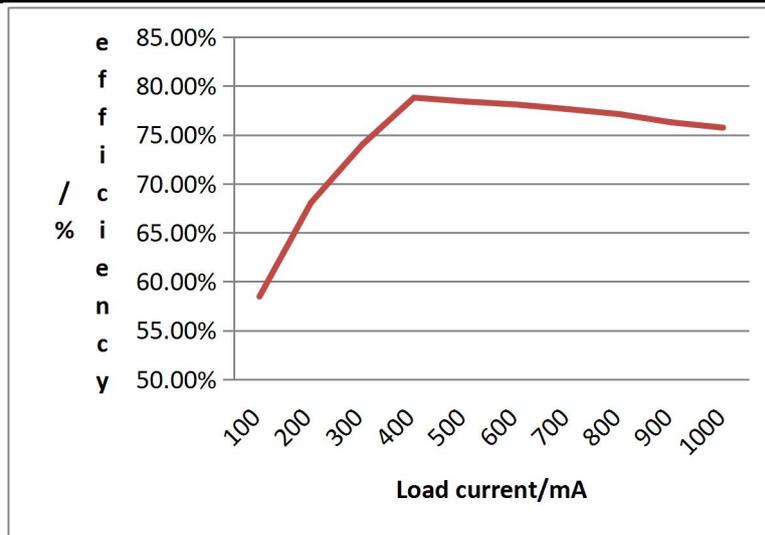
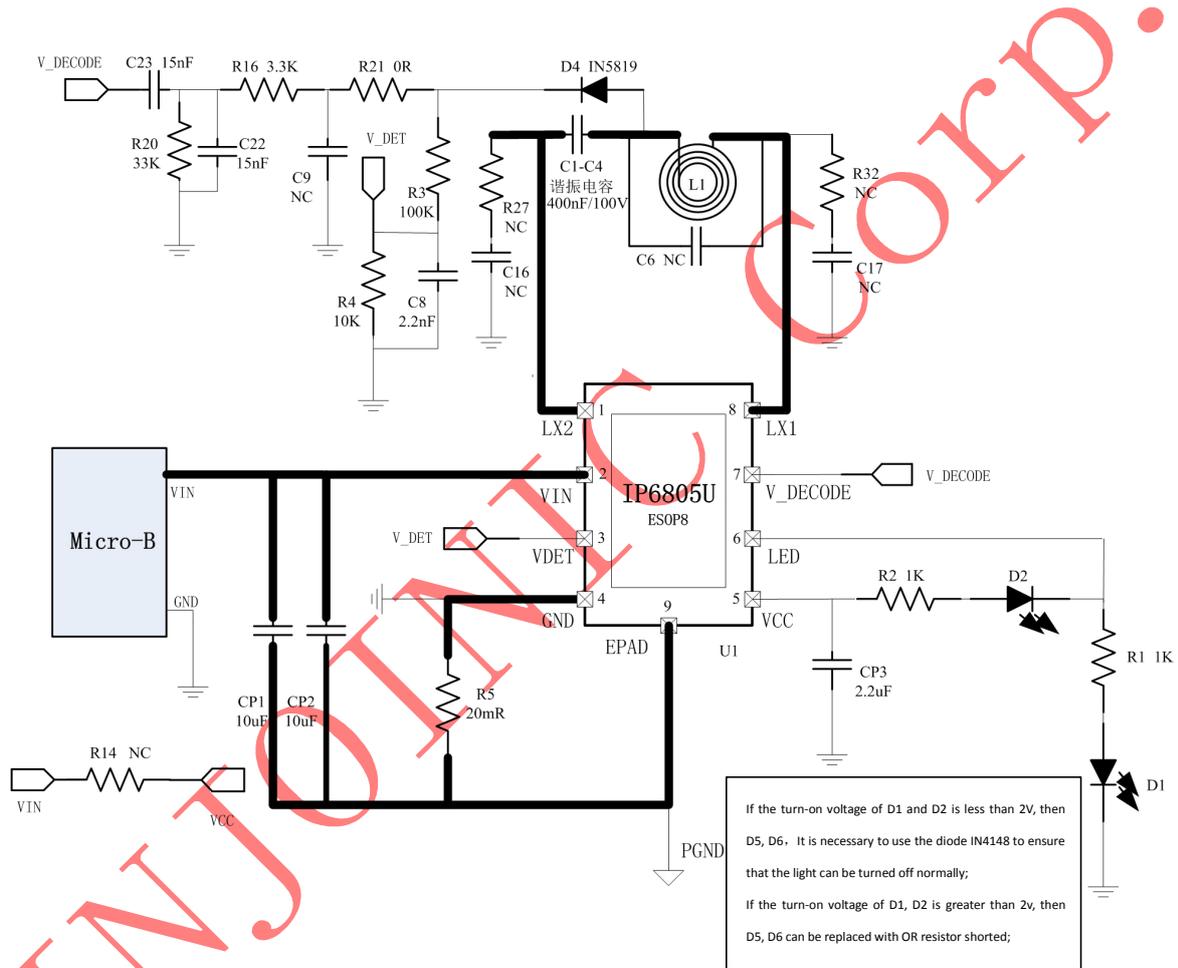


Figure System efficiency (using bq51020 RX)

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6. Typical Application Schematic

IP6805U wireless charging solution only needs capacitors, resistors and few passive devices.



BOM List

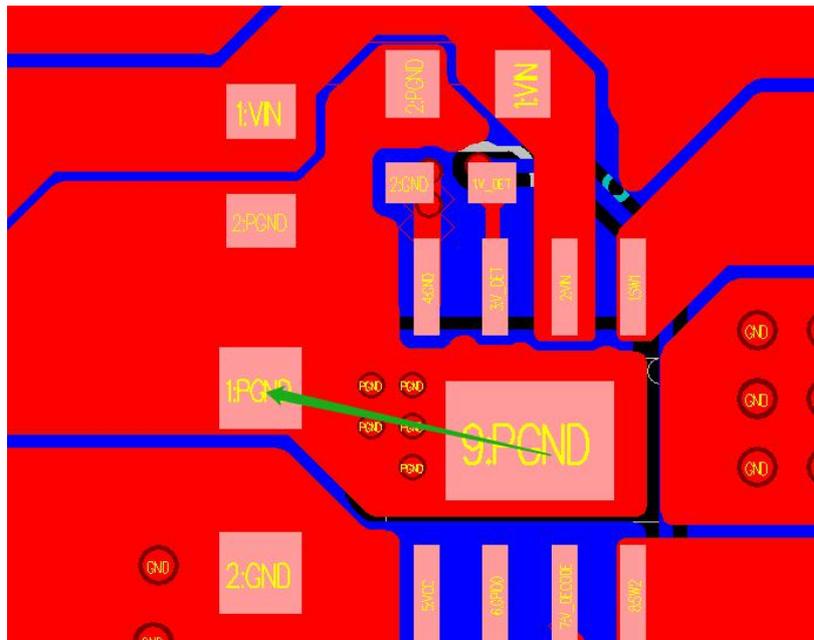
Item	Part Name	Description&specification	Description	Qty
1	IP6805U	ESOP8 IP6805U	U1	1
2	NPO or CBB capacitor	400nF 100V	C1-C4	1
3	Wireless charging coil	A11	L1	1
4	SMD capacitor	0603C 2.2uF 25V	CP3	1
5	SMD capacitor	0603C 15nF 25V	C22 C23	2
6	SMD capacitor	0603C 2.2nF 25V	C8	1
7	SMD capacitor	0805C 10uF 25V	CP1 CP2	2

8	Precision low temperature drift resistor	1206R 20mR 1%	R5	1
9	SMD resistor	0603R 0R	R21	1
10	SMD resistor	0603R 1K	R1 R2	2
11	SMD resistor	0603R 33K	R20	1
12	SMD resistor	0603R 3.3K	R16	1
13	SMD resistor	0603R 100K	R3	1
14	SMD resistor	0603R 10K	R4	1
15	SMD resistor	0603R NC	R14	1
16	NTC thermistor	IN5819	D4	1
17	Diode	0603D	D1 D2	2
18	Ordinary diode	SOD-123A, IN4148, Lights up according to D1 / D2 continuity Voltage selection OR resistance diode	D3, D5	2

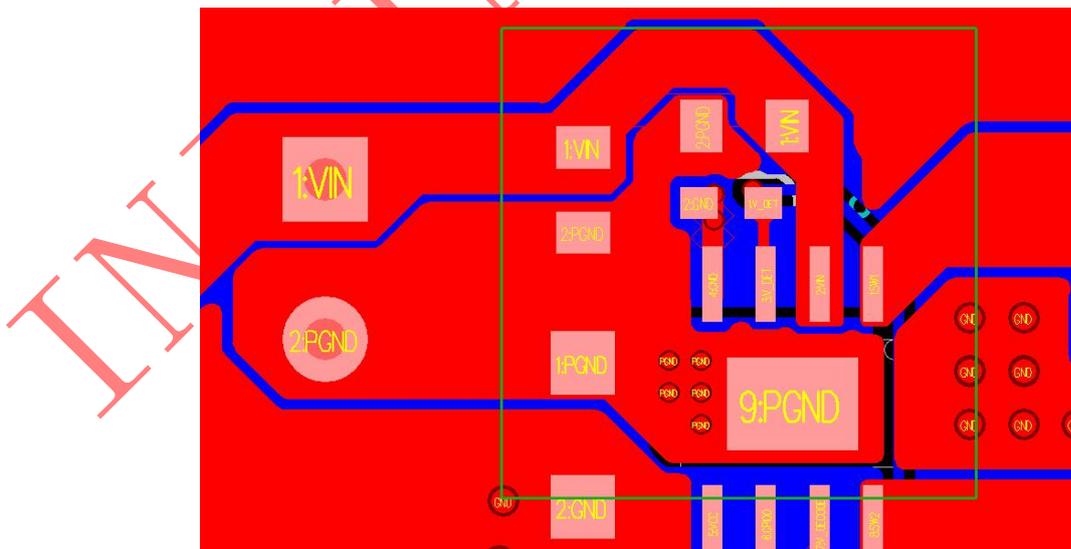
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7. Layout Notifications

- As shown in the following figure: current sampling resistance and IP6805U's PGND are power lines, which need to be as short as possible, and more holes need to be added when changing layers; The GNDP PIN of the IP6805U should also be as close as possible to the GND of 20 milliohms, reducing the impedance and improving the accuracy;

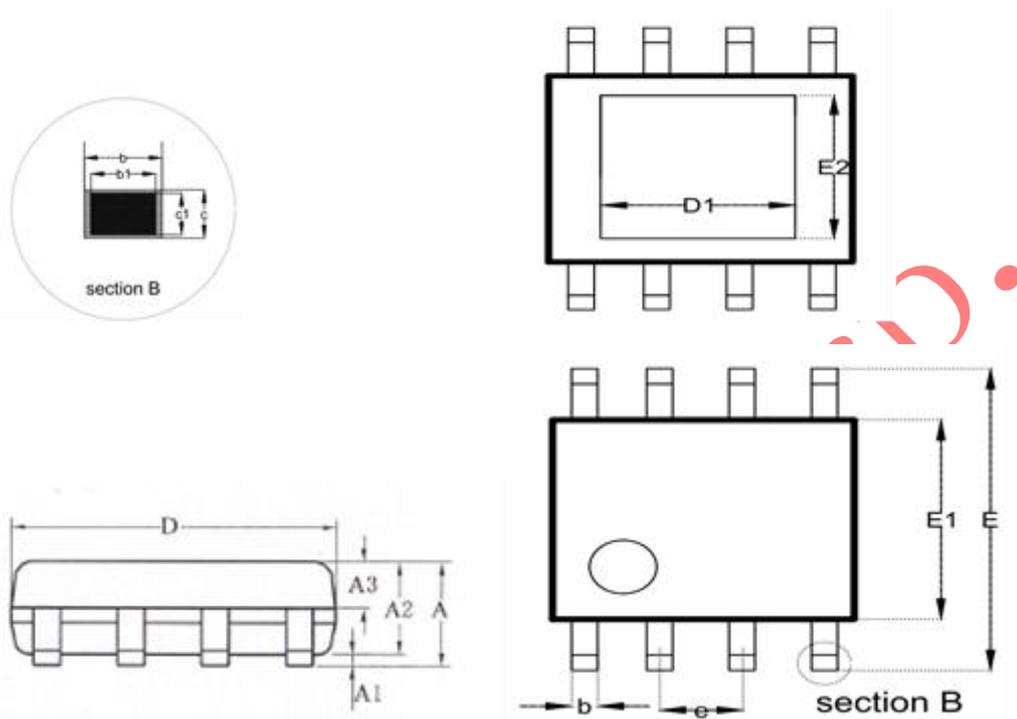


- As shown in the following figure: input the filter capacitance between VIN and PGND, the smaller the ring road area, the better; And the capacitor needs to be placed close to the input VIN;



- As shown in the following figure: The V_DECODE and V_DET routes of IP6805U are as far away as possible from resonant capacitors, coils and other power routes, and need to be surrounded by ground.

8. Package



SYMBOL	MILLIMETER		
	MIN	NOM	MAX
A	--	--	1.65
A1	0.05	--	0.15
A2	1.30	1.40	1.50
A3	0.60	0.65	0.70
b	0.39	--	0.48
b1	0.38	0.41	0.43
c	0.21	--	0.25
c1	0.19	0.20	0.21
D	4.70	4.90	5.10
E	5.80	6.00	6.20
E1	3.70	3.90	4.10
e	1.27BSC		
L	0.50	0.60	0.80
L1	1.05BSC		
θ	0	--	8°
D1	--	2.09	--
E2	--	2.09	--

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