

Wireless Charging Transmitter Microcontroller

1 Features

- **WPC qi compliant**
 - ✧ Supports BPP, PPDE, EPP protocols
 - ✧ Support 5W/ 7.5W/ 10W/ 15W charging
- **Integrated ASK communication demodulation module**
- **Integrated DP&DM application for 5V/ 9V/ 12V voltages**
- **Integrated single-channel touch key detection**
- **Integrated 8bit MCU and OTP ROM**
- **Built-in complete protection**
 - ✧ Support empty and loaded foreign object detection
 - ✧ Support NTC temperature detection
 - ✧ Support input overvoltage/undervoltage/overcurrent protection
- **Support CBB/NPO/X7R Resonant Capacitor**
- **Input Power Dynamic Power Management (DPM)**
 - ✧ Supports 5V@500mA adapter power supply
 - ✧ Support PC USB interface power supply
- **System power consumption**
 - ✧ Operating standby power consumption less than 10mA
 - ✧ Sleep mode power consumption 5uA
- **Package SOP16**

2 Applications

- Bluetooth speaker embedded with wireless charging
- Desk lamp embedded with wireless charging

- Electronic clock embedded with wireless charging
- Night light embedded with wireless charging

3 Description

IP6801 is a highly integrated, WPC qi compliant wireless charging transmitter control chip. Inside the chip, it integrates H-bridge driver module, ASK communication demodulation module, adapter fast charging Sink protocol and other necessary wireless charging resources.

IP6801 adopts the patented H-bridge driver architecture, which supports 12V direct power supply, solving the pain points such as traditional MCU transmitter solution cannot be powered by 12V directly and the poor reliability of the driver under small duty cycle.

IP6801 supports customisation of indicators, protocol functions, exception protection and other parameters in the PC-based host computer.

IP6801 adopts SOP16 package, PIN function layout optimised for wireless charging applications, very convenient for programme PCB drawing.

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4 Reversion History

Note: The page number of the previous version may differ from the page number of the current version.

Changes from Revision V1.0 0(January 2024)	Page
• ... First Release	1

5 Application Schematic

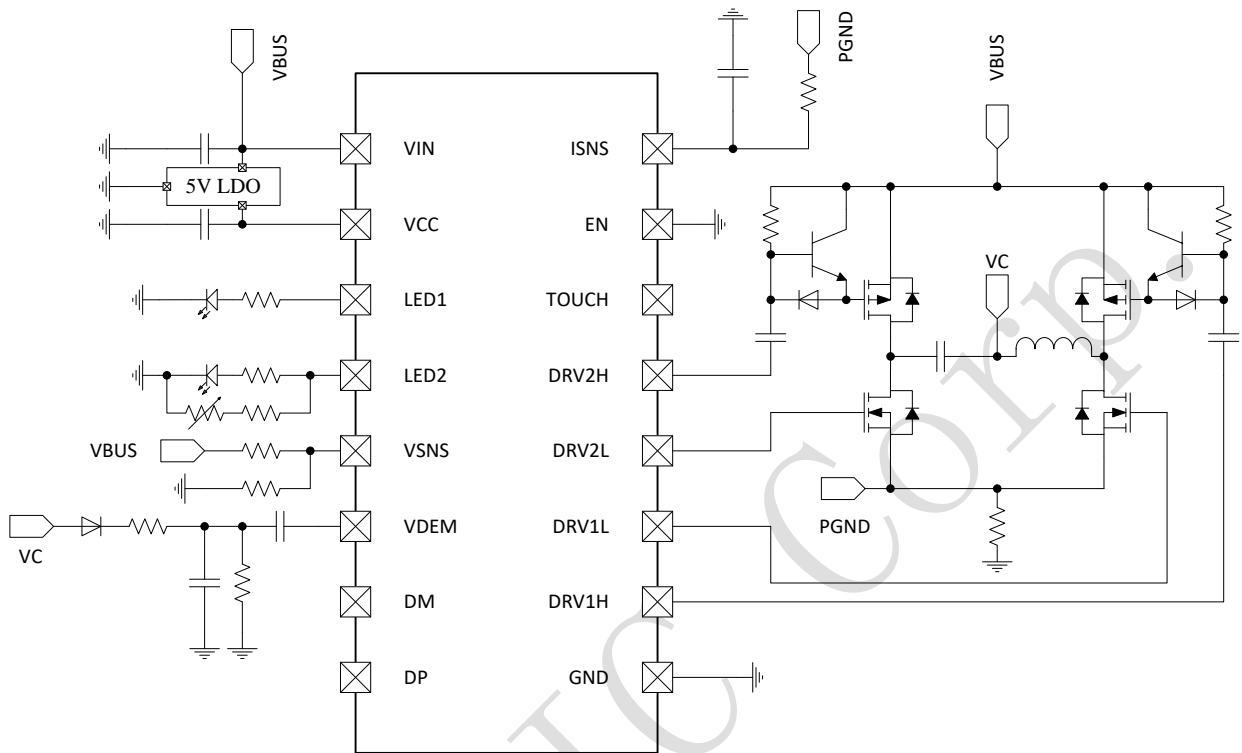


Figure 1 IP6801 Application Schematic

6 Pin Configuration And Function

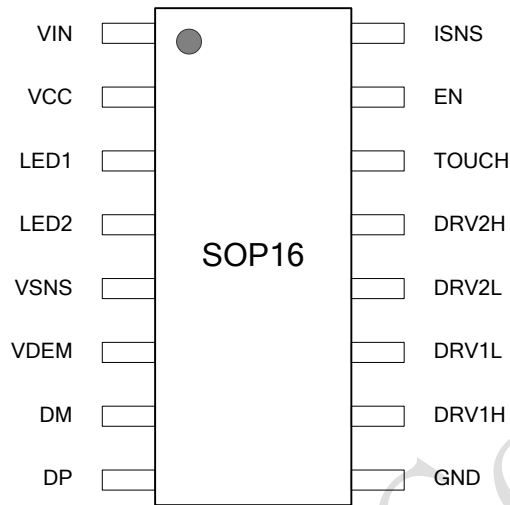


Figure 2 IP6801 Pin Diagram

Table 1 IP6801 Pin Information

Pin No.	Pin Name	I/O Properties	Description
1	VIN	PI	Input for external LDO
2	VCC	PI	IC VCC power input
3	LED1	I/O	Indicator Pins
4	LED2	I/O	Indicator and NTC Detect Pin
5	VSNS	I/O	H-bridge input voltage sampling pin
6	VDEM	I/O	ASK demodulation input pin
7	DM	I/O	USB DM
8	DP	I/O	USB DP
9	GND	-	System and Power Ground
10	DRV1H	I/O	DRV1 high-side PMOS drive
11	DRV1L	I/O	DRV1 low-side NMOS drive
12	DRV2L	I/O	DRV2 low-side NMOS drive
13	DRV2H	I/O	DRV1 high-side PMOS drive
14	TOUCH	I	Touch detection input (NC state maintained by default)
15	EN	I	IC enable pin, enable low active
16	ISNS	I/O	Current Sampling Input

7 Functional Block Diagram

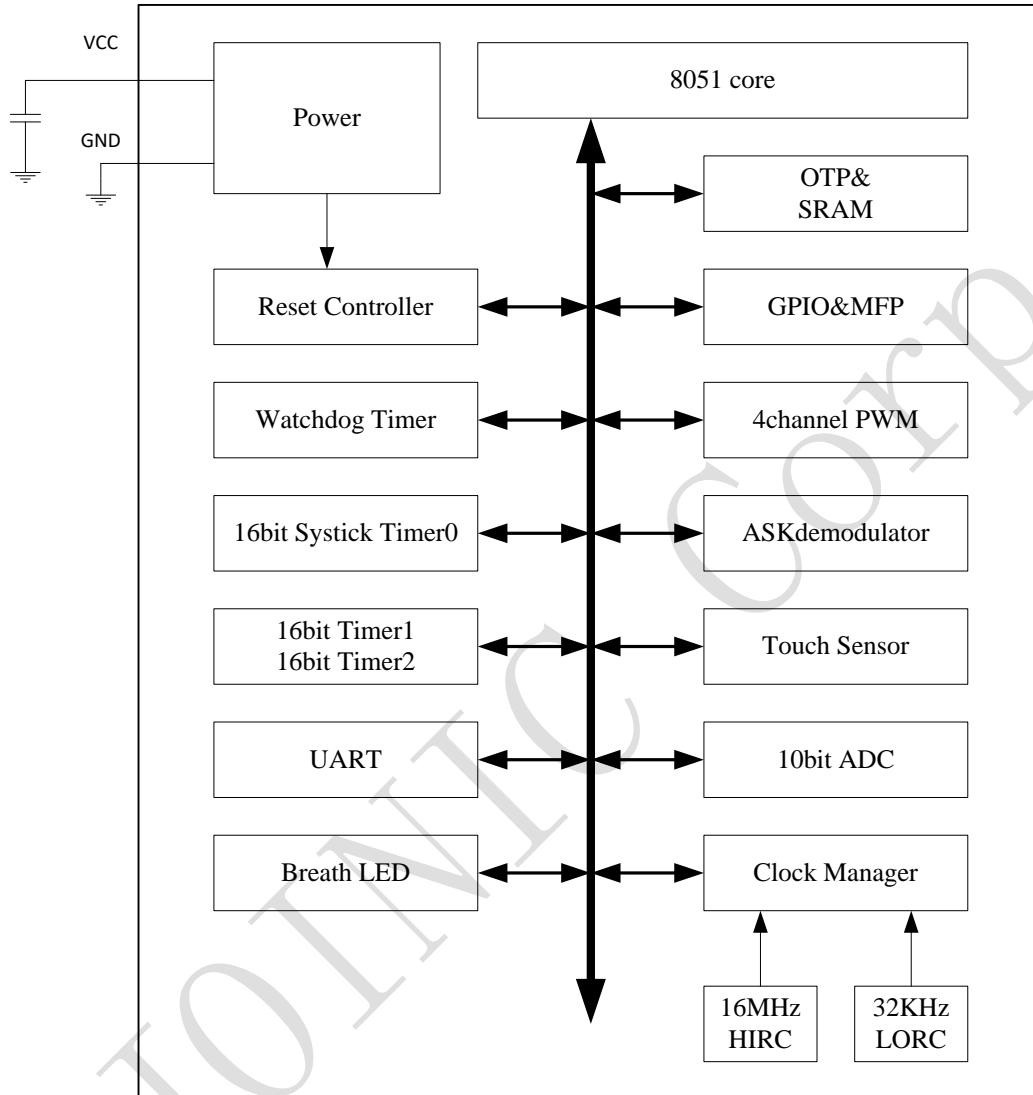


Figure 3 IP6801 Functional Block Diagram

8 Absolute Maximum Ratings

Over operating free-air temperature range (unless otherwise noted)

Parameters	Symbol	Min	Max	Unit
Input Voltage Range	V _{IN}	-0.3	24	V
	DRVxH, DRVxL	-0.3	7.5	V
	DP, DM	-0.3	7.5	V
	ISNS, VDEM, VCOIL, EN	-0.3	7.5	V
	LED1, LED2	-0.3	7.5	V
Junction Temperature Range	T _J	-40	125	°C
Storage Temperature Range	T _{stg}	-55	150	°C
Package Thermal Resistance (Junction Temperature to environment)	θ _{JA}		124	°C/W
Human Body Model (HBM)	ESD		4	KV

* 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.

9 Recommended Operating Conditions

Parameters	Symbol	Min	Typ	Max	Unit
V _{IN} supply voltage	V _{IN}	4	5/9/12	13	V
GPIO Input Voltage	LED1, LED2	-0.3	-	V _{CC} +0.3	V
	ISNS, VDEM, VCOIL, EN	-0.3	-	V _{CC} +0.3	V
Operating environment temperature	T _A	-20	-	85	°C

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

10 Electrical Characteristics

Unless otherwise specified, T_A=0°C ~85°C

Parameters	Symbol	Test Condition	Min	Typ	Max	Unit
Power Supply						
V _{IN} Operating voltage range	V _{IN}		4	-	13	V
V _{CC} Operating voltage range	V _{CC}		3.2	5	5.5	V
V _{CC} Standby Current	I _{Q_VCC}	V _{CC} =5V			10	mA
V _{CC} Sleep current	I _{SLEEP_VCC}	V _{CC} =3~5V			5	μA

11 Function Description

11.1 H-bridge drive

IP6801 first patented H-bridge drive architecture, drive peripheral P + NMOS H-bridge, support half-bridge / full-bridge operating mode. Solve the traditional microcontroller launch programme can not be 9V/12V half-bridge operation, as well as small duty cycle under the driving failure of the pain point.

IP6801 uses a 20mΩ sampling resistor to sample the H-bridge current on the low side, and the internal circuitry amplifies and AD converts the sampled current to achieve high-precision current detection, thus realising the accurate metal foreign object detection function. The RC filter piece of the sampling signal should be placed close to the IC to avoid noise interference.

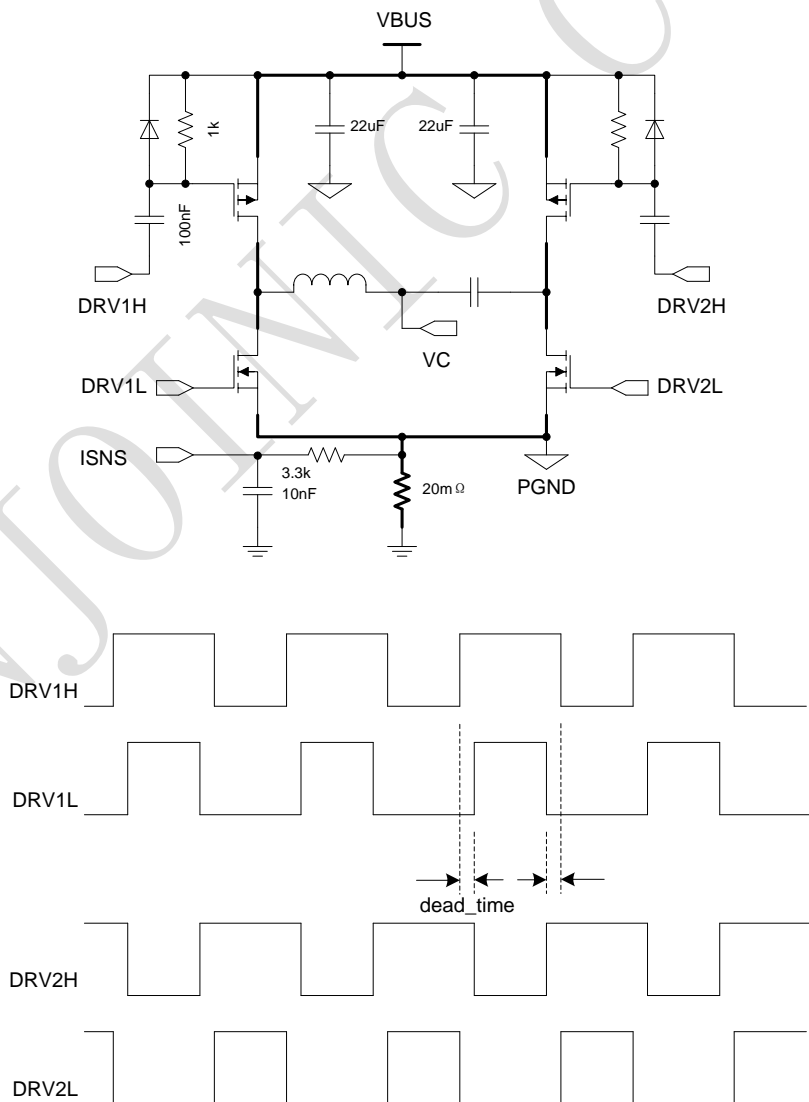


Figure 4 H-bridge drive diagram

11.2 ASK communication demodulation/FSK modulation

IP6801 has a built-in ASK demodulation module. For the ASK modulated signal from the receiving device, IP6801 collects the coil voltage to demodulate and decode the ASK signal. The system realises Qi wireless charging protocol according to the ASK decoded data.

IP6801 built-in FSK modulation function, through the FSK modulation, IP6801 can send information to the receiving device to achieve PPDE, EPP protocol.

11.3 NTC Thermal Protection

IP6801's PIN4 pin is time-multiplexed to realise the LED indicator and NTC detection function, and the recommended parameters of NTC resistor are $B=3950, 10k$.

The NTC detection pin of IP6801 can output $100\mu A$ constant current source, external $10k$ NTC resistor, $100\mu A$ constant current source will form a voltage on NTC resistor, and the internal ADC of the IC will detect this voltage to achieve temperature protection.

As shown in the figure below, the R_{limit} resistor is used to limit the current of LED2 IO when the NTC resistor is short-circuited or under high temperature. If the NTC function is not used, both R_{ntc} and R_{limit} can be NC.

When the user customises the NTC temperature protection threshold, proceed as follows:

- 1、 Check the datasheet of the NTC resistor to find the temperature-resistance relationship table;
- 2、 According to the protection temperature point, find the corresponding resistor value R_{ntc} , then the threshold value of the internal ADC to detect the voltage for protection is:

$$V_{ntc} = (R_{ntc} + R_{limit}) * 100\mu A \quad (\text{Unit mV}) ;$$

- 3、 Configure the host PC software with the parameters provided by the original factory, configure V_{ntc} into the firmware and the new temperature protection thresholds will take effect;
- 4、 The NTC protection threshold in the standard firmware is set to $60^{\circ}C$ ($576mV$) for power down (without charging) and $68^{\circ}C$ ($516mV$) for break charging and downshifting (downshifting means: switching to $10W$ at $15W$, switching to $5W$ at $10W$, and locking out from charging again after over-temperature in the $5W$ mode). The NTC recovery threshold is set to $50^{\circ}C$ ($688mV$) to resume charging when the detected V_{ntc} voltage is higher than $688mV$. Users can adjust the above thresholds appropriately according to the product's own situation (relative position of NTC resistor and heat source,

MOS package & internal resistance, PCB area, case heat dissipation channels, etc.).

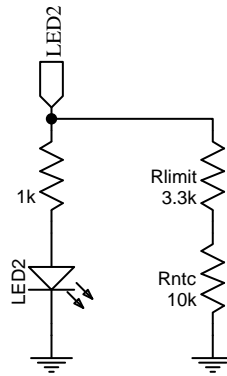


Figure 5 LED and NTC multiplexing schematic

11.4 Charging Indicator

IP6801 supports user-defined charging indicator (need to use the PC uplink provided by the original manufacturer), import the firmware into the uplink software, configure the indicator effect on the software interface, export the new firmware to get the desired indicator effect.

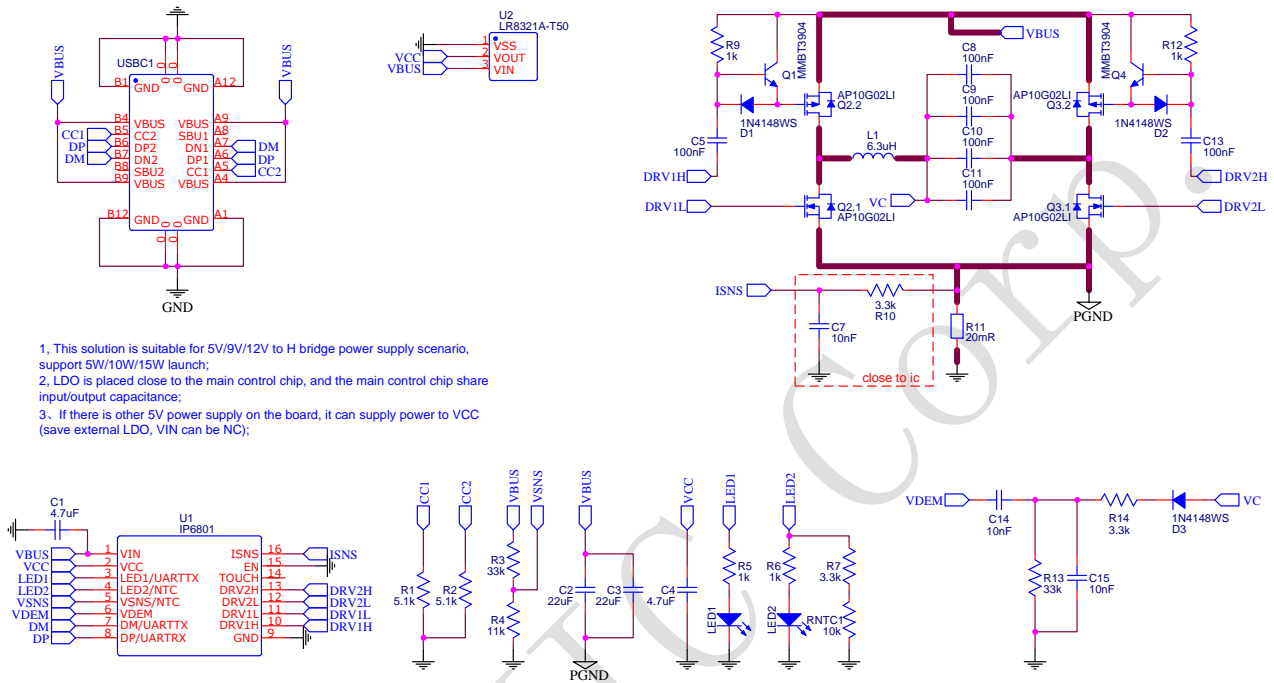
Note: Only PIN3 (LED1) supports breathing light mode, it is recommended to use PIN3 (LED1) as the charging indicator and PIN4 (LED2) as the exception indicator.

The standard firmware indicator status is as follows:

Charge Status	LED1	LED2
Power On	Three alternating flashes	
Standby	OFF	OFF
Charging	ON	OFF
FOD	OFF	Blink
Over Temperature	OFF	Blink
Overvoltage/Undervoltage	OFF	Blink
Charging Completed	OFF	ON

12 Typical Application Schematic

12.1 12V Application Schematic



1. This solution is suitable for 5V/9V/12V to H bridge power supply scenario, support 5W/10W/15W launch;
2. LDO is placed close to the main control chip, and the main control chip share input/output capacitance;
3. If there is other 5V power supply on the board, it can supply power to VCC (save external LDO, VIN can be NC);

Figure 6 IP6801 12V Application Schematic

Table 2 BOM Sheet for 12V Application Schematic

Item	Part Name	Description&Specification	Description	Qty
1	4.7uF	C1, C4	C0603	2
2	22uF	C2, C3	C0805	2
3	100nF	C5, C13	C0603	2
4	10nF	C7, C14, C15	C0603	3
5	100nF	C8, C9, C10, C11	C1206	4
6	1N4148WS	D1, D2, D3	SOD-323_L1.8-W1.3-LS2.5-RD	3
7	6.3uH	L1	IND-SMD_L4.5-W3.0	1
8	LED	LED1	LED0603_GREEN	1
9	LED	LED2	LED0603_RED	1
10	MMBT3904	Q1, Q4	SOT-23-3_L2.9-W1.3-P0.95-LS2.4-BR	2
11	5.1k	R1, R2	R0603	2
12	33k	R3, R13	R0603	2
13	11k	R4	R0603	1
14	1k	R5, R6, R9, R12	R0603	4
15	3.3k	R7, R10, R14	R0603	3
16	20mR	R11	R1206	1
17	10k	RNTC1	R0603	1
18	TYPE-C-31-M-12	USBC1	USB-C_SMD-TYPE-C-31-M-12	1
19	LR8321A-T50	U2	SOT-23-3_L2.9-W1.6-P1.90-LS2.8-BR	1
20	AP10G02LI	Q2, Q3	SOT-23-6_L2.9-W1.6-P0.95-LS2.7-BL	2
21	IP6801	U1	SOP16L	1

12.2 9V Application Schematic

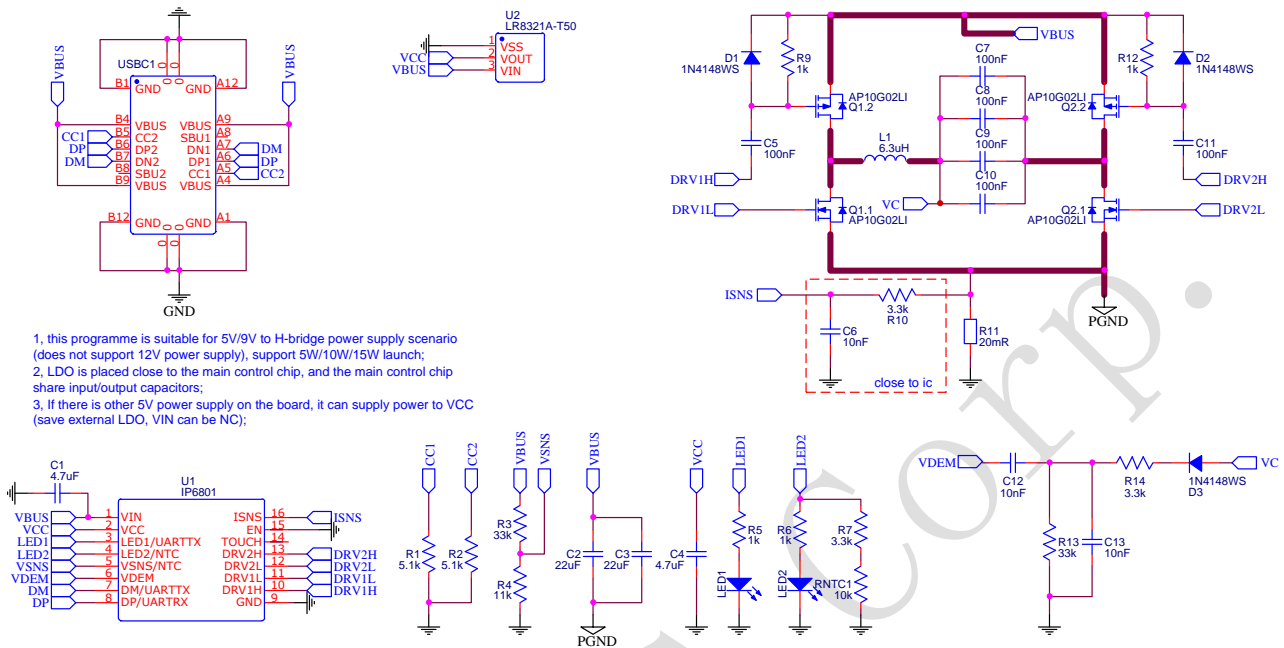
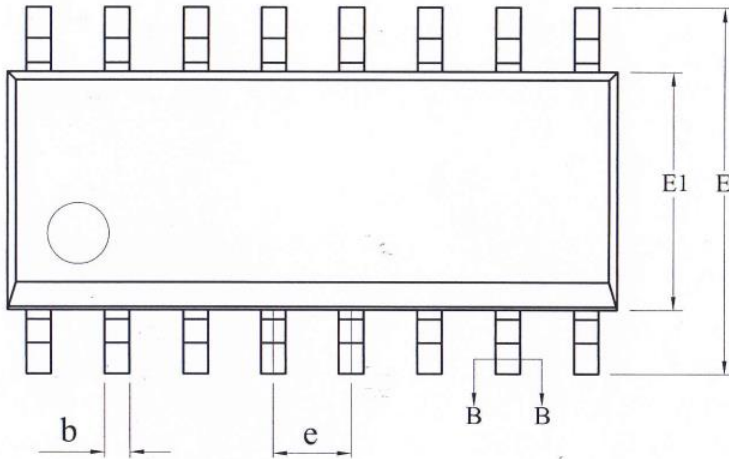
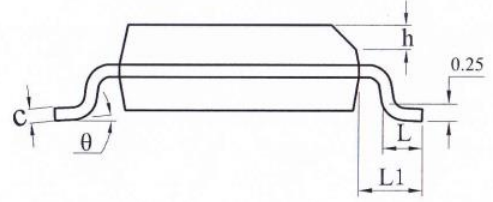
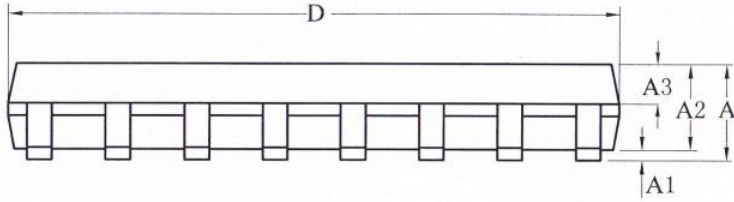


Figure 7 IP6801 9V Application Schematic

Table 3 BOM Sheet for 9V Application Schematic

Item	Part Name	Description&Specification	Description	Qty
1	4.7uF	C1, C4	C0603	2
2	22uF	C2, C3	C0805	2
3	100nF	C5, C11	C0603	2
4	10nF	C6, C12, C13	C0603	3
5	100nF	C7, C8, C9, C10	C1206	4
6	1N4148WS	D1, D2, D3	SOD-323_L1. 8-W1. 3-LS2. 5-RD	3
7	6.3uH	L1	IND-SMD_L4. 5-W3. 0	1
8	LED	LED1	LED0603_GREEN	1
9	LED	LED2	LED0603_RED	1
10	5.1k	R1, R2	R0603	2
11	33k	R3, R13	R0603	2
12	11k	R4	R0603	1
13	1k	R5, R6, R9, R12	R0603	4
14	3.3k	R7, R10, R14	R0603	3
15	20mR	R11	R1206	1
16	10k	RNTC1	R0603	1
17	TYPE-C-31-M-12	USBC1	USB-C_SMD-TYPE-C-31-M-12	1
18	LR8321A-T50	U2	SOT-23-3_L2. 9-W1. 6-P1. 90-LS2. 8-BR	1
19	AP10G02LI	Q1, Q2	SOT-23-6_L2. 9-W1. 6-P0. 95-LS2. 7-BL	2
20	IP6801	U1	SOP16L	1

13 Package



SYMBOL	MILLIMETER		
	MIN	NOM	MAX
A	—	—	1.75
A1	0.10	—	0.225
A2	1.30	1.40	1.50
A3	0.60	0.65	0.70
b	0.39	—	0.47
b1	0.38	0.41	0.44
c	0.20	—	0.24
c1	0.19	0.20	0.21
D	9.80	9.90	10.00
E	5.80	6.00	6.20
E1	3.80	3.90	4.00
e	1.27BSC		
h	0.25	—	0.50
L	0.50	—	0.80
L1	1.05REF		
θ	0	—	8°

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