

Wireless Charging Transmitter Control SOC

1 Features

- **Compliant with WPC qi standard**
 - ✧ Supports BPP, PPDE, EPP protocols
- **Integrated 2P2N H-bridge driver**
 - ✧ External full-bridge power MOS
 - ✧ Support 5W~15W charging
- **Integrated ASK communication demodulation module**
- **Integrated DP&DM and PD fast charging**
 - ✧ Support DP/DM pin application adapter fast charging
 - ✧ Support PD3.0 fast charging protocol
 - ✧ Fast charging voltage support 5V/9V/12V slot
- **Integrated MTP ROM, support firmware upgrade**
- **Built-in perfect protection measures**
 - ✧ Support no-load and loaded foreign object detection
 - ✧ Supports NTC temperature detection
 - ✧ Supports coil voltage maximum amplitude limitation
 - ✧ Supports input overvoltage /undervoltage /overcurrent protection
- **Supports CBB /NPO /X7R resonant capacitors**
- **Input power supply dynamic power management (DPM)**
 - ✧ Supports 5V@500mA adapter power supply
 - ✧ Supports PC USB interface power supply
- **System power consumption**
 - ✧ Operating standby power consumption 10mA

- ✧ Sleep mode power consumption less than 50uA

- **Package SOP16**

2 Applications

- **Wireless charging base**

3 Description

IP6821 is a highly integrated, WPC qi compliant wireless charging transmitter control chip. The chip internally integrates H-bridge driver module, ASK communication demodulation module, adapter fast charging Sink protocol and other necessary wireless charging resources.

IP6821 supports customisation of protocols, foreign object detection sensitivity, indicator lights and other functions.

IP6821 adopts SOP16 package, PIN pin function layout is optimised for wireless charging application, which is very convenient for PCB drawing.

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4 Reversion History

NOTE: Page numbers for previous revisions may differ from page numbers in the current version.

Change version V1.0 (July 2023)

● First release.....	1
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5 Application Schematic

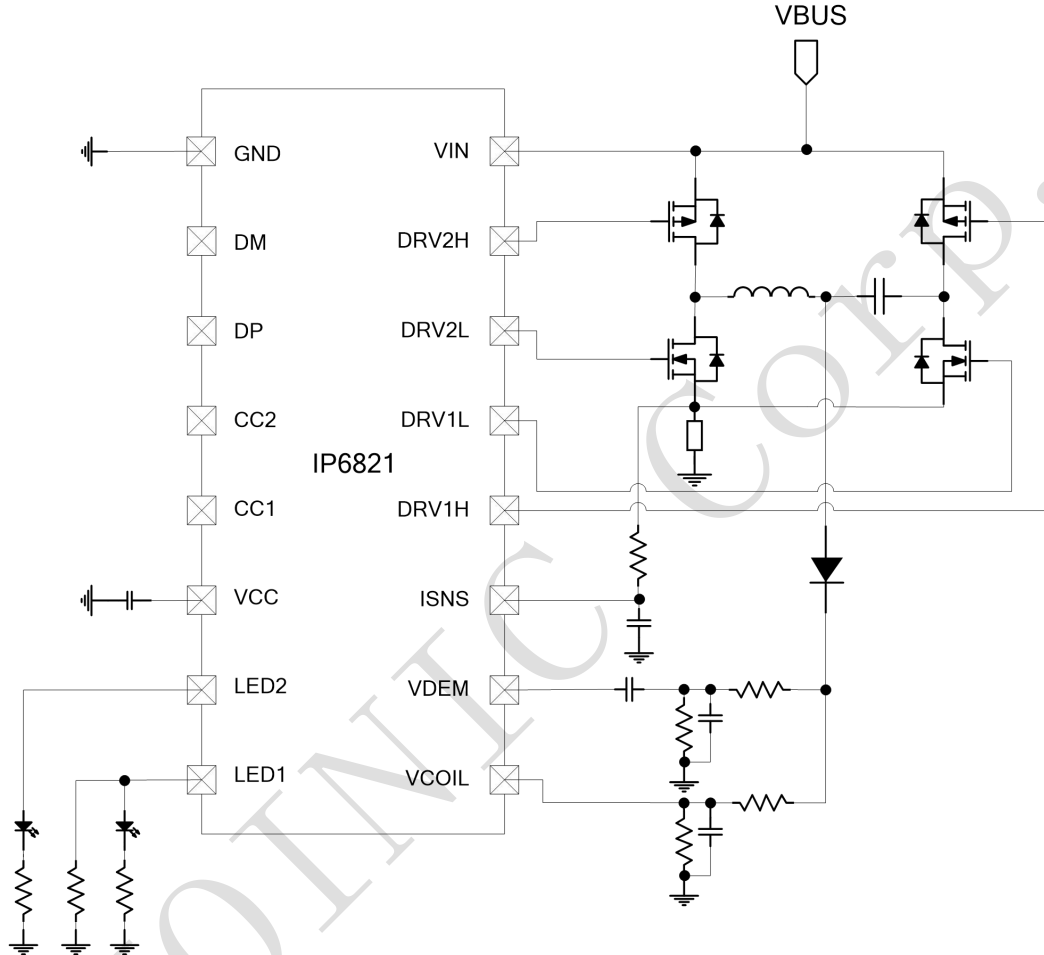


Figure 1 IP6821 Application Schematic

6 Pin Configuration

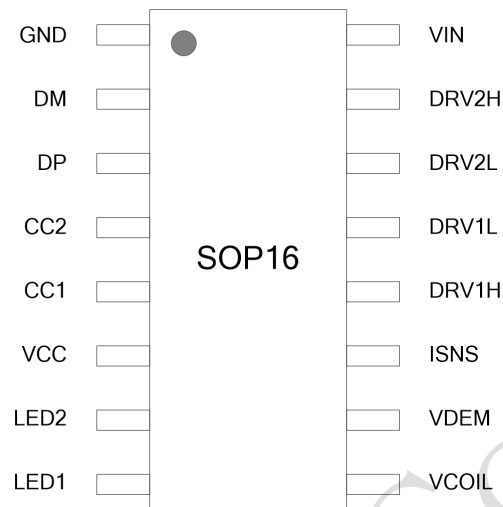


Figure 2 IP6821 Pin Diagram

序号	名称	I/O 属性	描述
1	GND	-	System and Power Ground
2	DM	I/O	USB DM
3	DP	I/O	USB DP
4	CC2	I/O	Type_C detect pin CC2
5	CC1	I/O	Type_C detect pin CC1
6	VCC	PO	Internal VCC supply, external 2.2uF capacitor to GND
7	LED2	I/O	Lamp display control pin
8	LED1	I/O	Lamp display and NTC detection pin
9	VCOIL	I/O	Coil voltage detection pin
10	VDEM	I/O	Voltage decode input pin
11	ISNS	I/O	Current sampling input pin
12	DRV1H	I/O	DRV1 high-side drive
13	DRV1L	I/O	DRV1 low-side drive
14	DRV2L	I/O	DRV2 low-side drive
15	DRV2H	I/O	DRV2 high-side drive
16	VIN	PI	Power supply pin

7 Functional Block Diagram

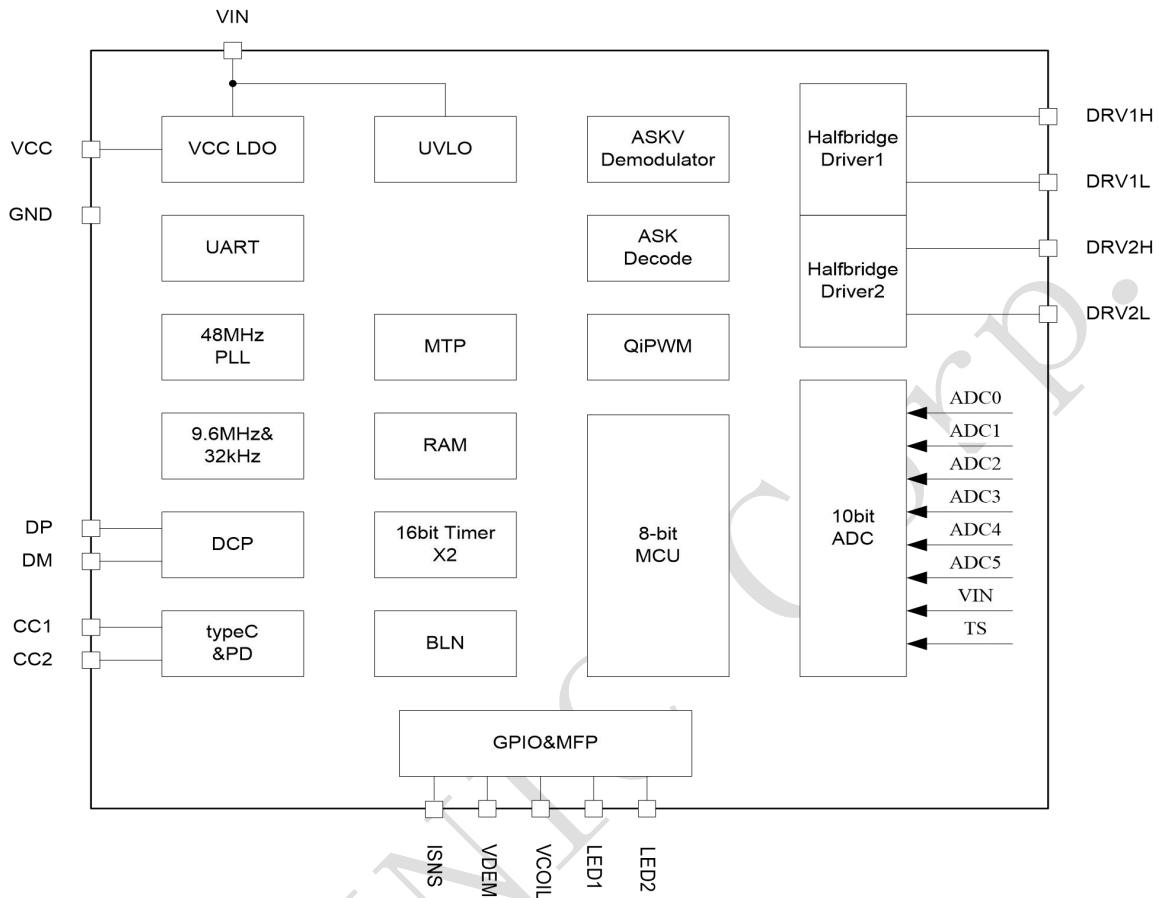


Figure 3 IP6821 Functional Block Diagram

8 Absolute Maximum Ratings

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

Parameters	Symbol	Min	Max	Unit
Input Voltage Range	VIN, DRV1H, DRV2H	-0.3	15	V
		-0.3	8	V
	CC1, CC2, DP, DM	-0.3	8	V
	ISNS, VDEM, VCOIL	-0.3	8	V
	LED1, LED2	-0.3	8	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	-0.3	-	V _{CC} +0.3	V
Operating Ambient 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
VIN						
V _{IN} Operating Voltage Range	V _{IN}		4	-	13	V
V _{IN} Standby Current	I _{Q_VIN}	V _{IN} =5V		10	15	mA
V _{IN} Sleep Current	I _{SLEEP_VIN}	V _{IN} =3~5V	30	-	50	uA
System						
VCC Voltage	VCC	V _{IN} = 5V		4.8		V
VCC Load Capacity I _{VCC}	I _{VCC}	VCC Maximum Load Current			50	mA
Thermal Shutdown Junction Temperature	T _{OTP}	Rising Temperature	130	140	150	°C
Thermal Shutdown Hysteresis	ΔT _{OTP}	Thermal shutdown recovery hysteresis	30	40	50	°C

11 Function Description

11.1 H-Bridge Driver

The IP6821 incorporates two symmetrical half-bridge driver modules to drive an external N+PMOS H-bridge. The dead time and drive strength of the driver modules can be software configured to different levels. During EMI EMC testing, the EMI margin can be improved by configuring the drive capability in lower gears, thus saving external RC devices.

The IP6821 uses a 20mΩ sampling resistor for low-side sampling of the H-bridge current, and the RC filter device for the sampled signal should be placed close to the IC to avoid noise interference.

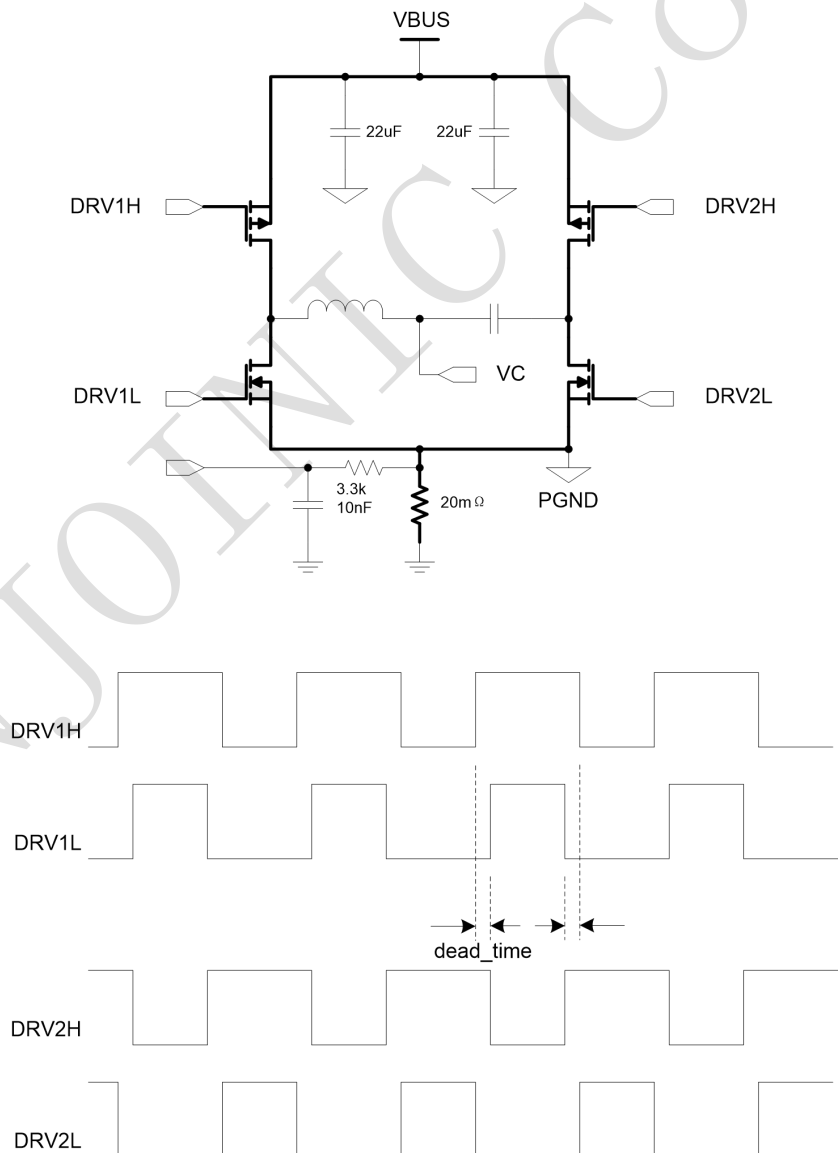


Figure 4 H-bridge drive schematic

11.2 ASK Communication Demodulation/FSK Modulation

IP6821 has a built-in ASK demodulation module. For the ASK modulation signal from the receiving device, IP6821 collects the coil voltage and current respectively to demodulate and decode the ASK signal. The system implements the qi wireless charging protocol based on the ASK decoded data.

The IP6821 has a built-in FSK modulation function. Through FSK modulation, the IP6821 can send information to the receiving device to implement PPDE and EPP protocols.

11.3 Input Fast Charging

IP6821 has built-in USB PD protocol, applying voltage to PD adapter through CC1, CC2 pins.

IP6821 has built-in DP/DM class adapter fast charging protocol, applying voltage to the adapter through DP, DM pins.

11.4 NTC Temperature Protection

The IP6821's LED1 pin is time-multiplexed to realise the LED indicator and NTC detection function. The recommended parameters for the NTC resistor are B=3950,100k.

The NTC detection pin of IP6821 can output 20uA constant current source, external 100k NTC resistor, 20uA constant current source forms voltage on NTC resistor, and the internal ADC of IC detects this voltage to achieve temperature protection. If the NTC function is not used, this pin is connected to 100K resistor to ground.

Users should follow the steps below when customising the NTC temperature protection threshold:

- 1、 Check the datasheet of NTC resistor to find the temperature-resistance relationship table;
- 2、 According to the protection temperature point, find the corresponding resistance value R_{NTC} , then the internal ADC detects the voltage for protection threshold: $V_{NTC} = R_{NTC} * 20 \mu A$ (unit mV);
- 3、 Use the parameters provided by the original factory to configure the host computer software, V_{NTC} configuration to the firmware, the new temperature protection threshold will take effect;
- 4、 The standard firmware NTC protection threshold is set to 60 °C (480mV), when the NTC voltage is detected to be lower than 480mV protection. NTC recovery threshold is set to 50 °C (700mV), when the NTC voltage is detected to be higher than 700mV to resume charging.

11.5 Charging Indicator Light

IP6821 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, and export the new firmware to get the desired indicator effect.

Note: Only LED2 (PIN7) supports breathing light mode.

The standard firmware indicator status is as follows:

Charging status	LED1	LED2
Power up	Three alternating flashes.	
Standby	off	off
Charging	on	off
FOD	off	flashing
Over Temperature	off	flashing
Over/Under Voltage	off	flashing
Charging complete	off	On

11.6 Firmware Upgrade

The IP6821 integrates MTP ROM and supports firmware upgrade, the firmware download interface is DP/DM pin. To download the firmware, you need to use the burner provided by the original manufacturer.

12 Typical Application Schematic

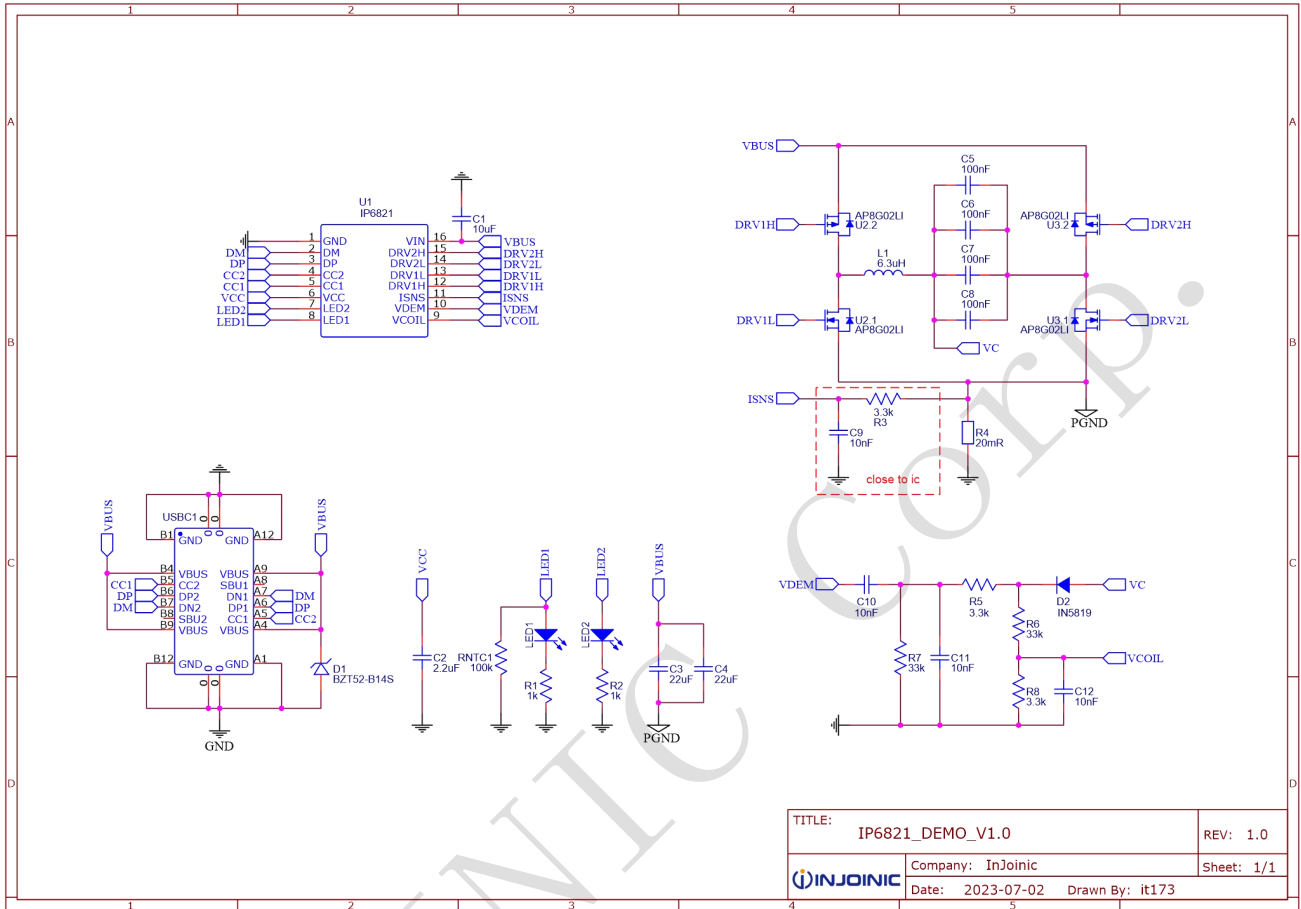


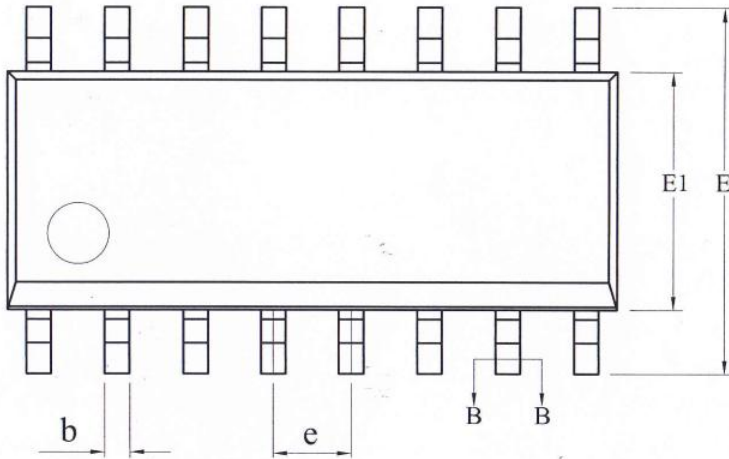
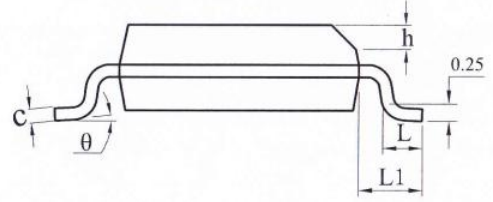
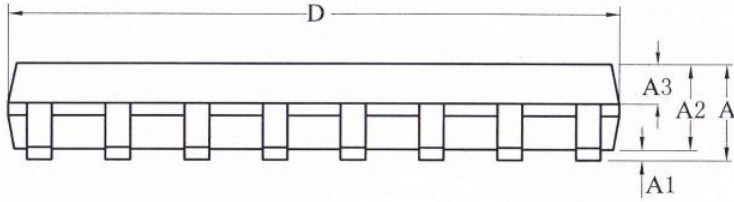
Figure 5 IP6821 Typical Application Schematic

13 BOM

Item	Part Name	Description&Specification	Description	Qty
1	IP6821	U1	SOP16L	1
2	AP8G02LI	U2, U3	SOT-23-6_L2.9-W1.6-P0.95-LS2.7-BL	2
3	10uF	C1	C0603	1
4	2.2uF	C2	C0603	1
5	22uF	C3, C4	C0805	2
6	100nF	C5, C6, C7, C8	C1206	4
7	10nF	C9, C10, C11, C12	C0603	4
8	BZT52-B14S	D1	SOD-323_L1.9-W1.3-LS2.5-RD-1	1
9	IN5819	D2	SOD-123_L2.7-W1.6-LS3.7-R-RD	1
10	6.3uH	L1	IND-SMD_L4.5-W3.0	1
11	LED	LED1	LED0603_RED	1
12	LED	LED2	LED0603_GREEN	1
13	1k	R1, R2	R0603	2
14	3.3k	R3, R5, R8	R0603	3
15	20mR	R4	R1206	1
16	33k	R6, R7	R0603	2
17	100k	RNTC1	R0603	1
18	TYPE-C-31-M-12	USBC1	USB-C_SMD-TYPE-C-31-M-12	1

Note: The parameter of voltage regulator D1 must be a nominal regulated value of 14V with 2% accuracy (the regulated range is 13.72V~14.28V).

14 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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