Wireless charging transmitter control SOC

1 Features

- **WPC QI compliant**
  - ✧ 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 10bit ADC**
  - ✧ Support no-load and on-load foreign object detection
  - ✧ Support NTC temperature detection
  - ✧ Support coil voltage maximum amplitude limit
- **Integrated DP&DM, PD fast charging**
  - ✧ Support DP/DM pin application adapter fast charging
  - ✧ Support PD3.0 fast charging protocol
  - ✧ Fast charging voltage support 5V/9V/12V gears
- **Built-in MTP ROM, support firmware upgrade**
- **Support input overvoltage/ undervoltage/ overcurrent protection**
- **Support CBB/NPO capacitor**
- **Input power dynamic power management (DPM)**
  - ✧ Support 5V@500mA adapter power supply
  - ✧ Support PC USB interface power supply
- **System power consumption**
  - ✧ Operating standby power consumption 10mA
  - ✧ Power consumption less than 50uA in sleep mode
- **3mm*3mm 0.5 pith QFN16 package**

2 Applications

- Wireless charging for smartphones
- Wireless charging for smartwatches

3 Description

IP6822 is a highly integrated, WPC QI compliant wireless charging transmitter controller chip. The chip internally integrates H-bridge driver module, ASK communication demodulation module, adapter fast charging Sink protocol and other necessary wireless charging resources.

IP6822 has a built-in 8-bit MCU and rich peripheral resources to support protocol, foreign object detection sensitivity, indicator and other function customization.

IP6822 adopts QFN16 (3mm*3mm) package, with peripheral streamlined application circuitry, which greatly saves PCB footprint and facilitates application to compact space product design.

Contents

4 Reversion History

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

First edition release (June 2023)

5 Application Schematic

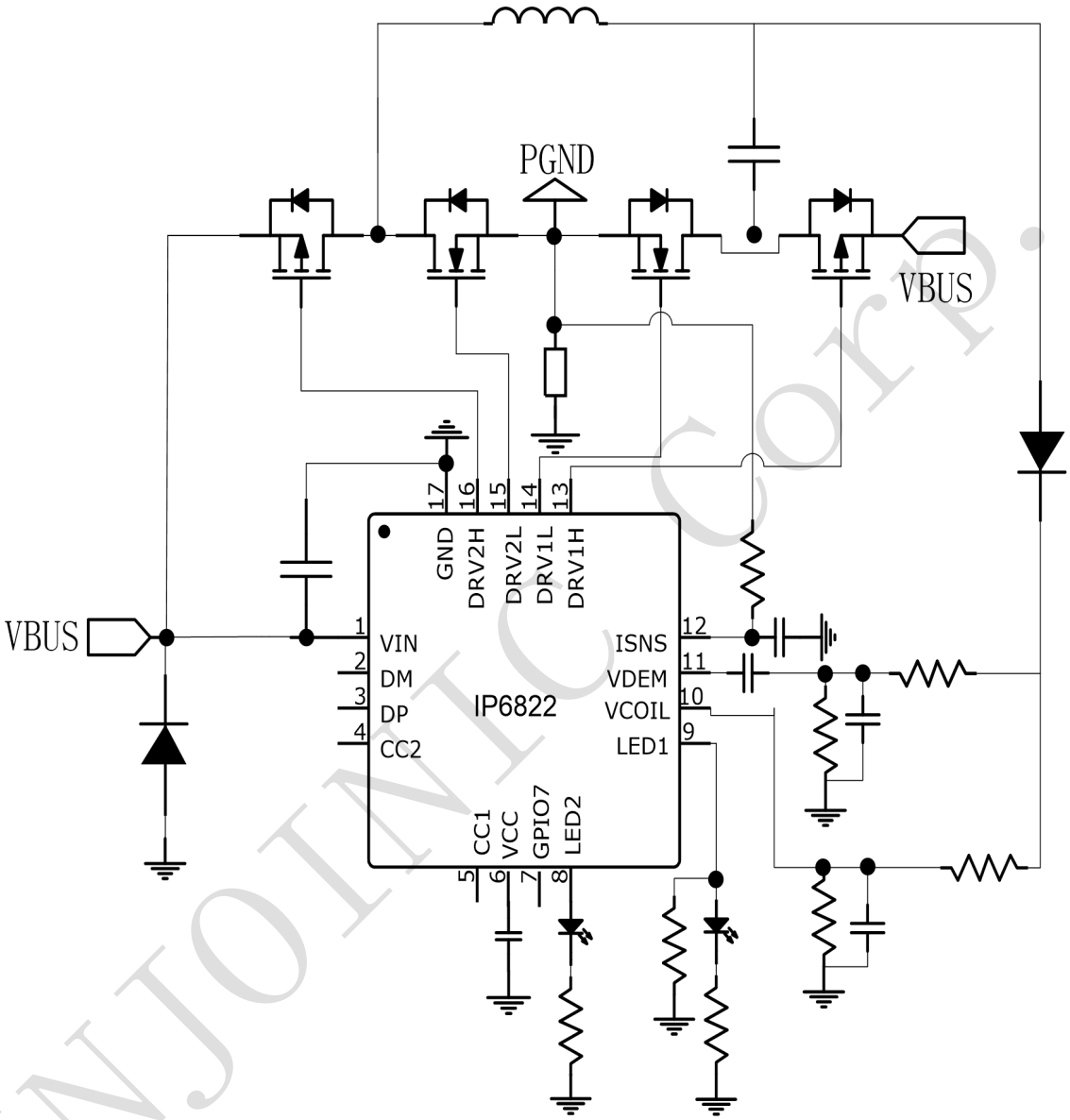


Figure 1 IP6822 Application Schematic

6 Pin Configuration And Function

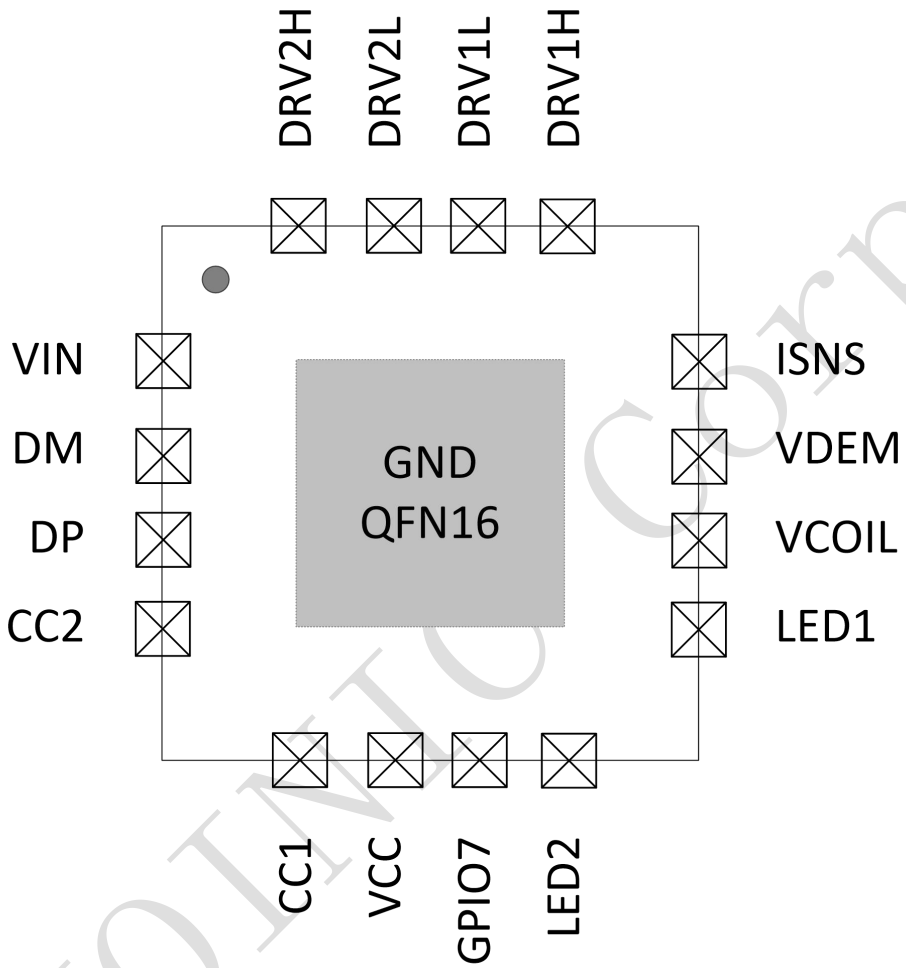


Figure 2 IP6822 Pin Diagram

Pin No.	Pin Name	I/O Properties	Description
1	VIN	PI	Power supply pin
2	DM	I/O	USB DM
3	DP	I/O	USB DP
4	CC2	I/O	Type_C detection pin CC2
5	CC1	I/O	Type_C detection pin CC1
6	VCC	PO	Internal VCC power supply, output connected to 2.2μF capacitor to ground
7	GPIO7	I/O	GPIO
8	LED2	I/O	Light display control pin
9	LED1	I/O	Lamp display and NTC detection pin
10	VCOIL	I/O	Coil voltage detection pin
11	VDEM	I/O	Voltage decoding input pin
12	ISNS	I/O	Current sampling input pin
13	DRV1H	I/O	DRV1 upper tube driver
14	DRV1L	I/O	DRV1 lower tube driver
15	DRV2L	I/O	DRV2 lower tube driver
16	DRV2H	I/O	DRV2 upper tube drive
17	GND	-	System and power ground

7 Functional Block Diagram

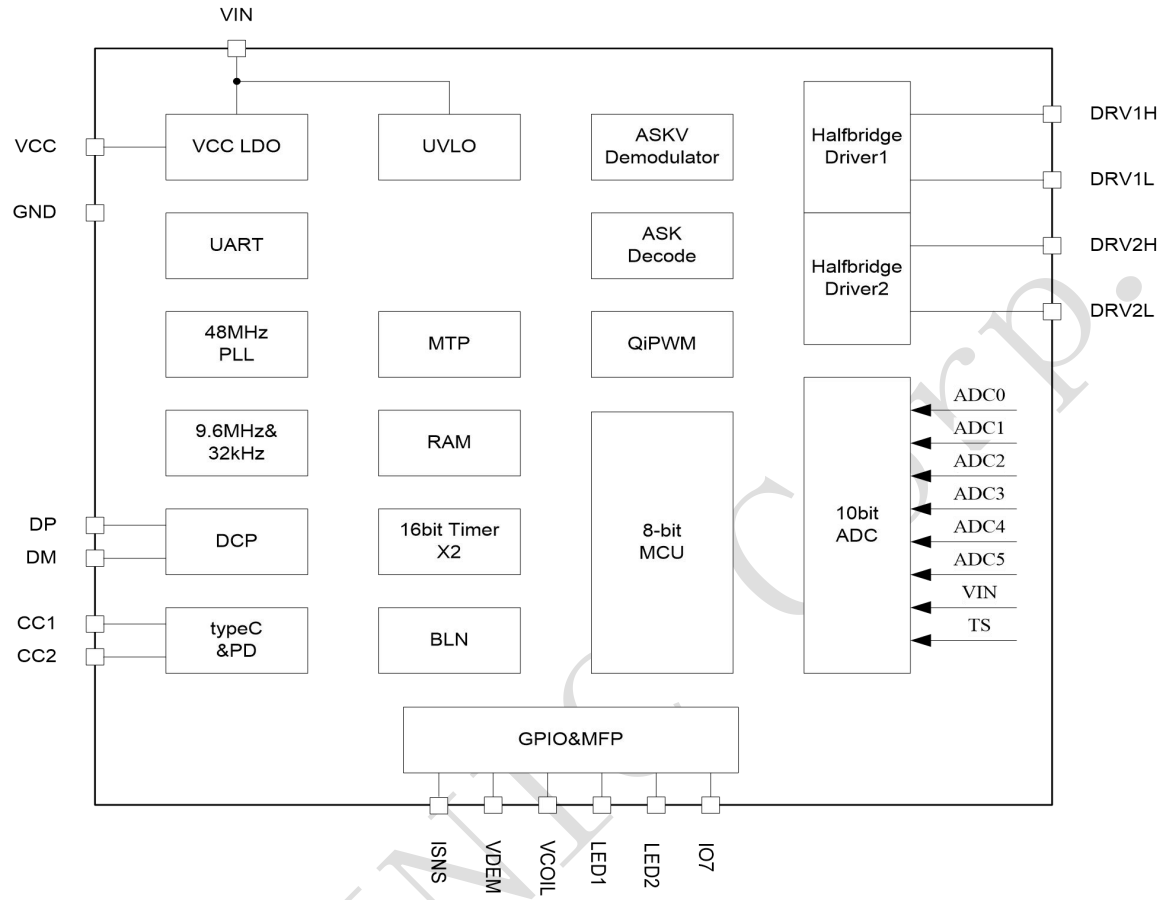


Figure 3 IP6822 Functional Block Diagram

8 Absolute Maximum Ratings

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

Parameters	Symbol	Min	Max	Unit
Input Voltage	VIN,DRV1H,DRV2H	-0.3	15	V
	CC1,CC2	-0.3	8	V
	DP,DM	-0.3	8	V
	LED1/LED2	-0.3	8	V
	VCOIL	-0.3	8	V
	VDEM	-0.3	8	V
	ISNS	-0.3	8	V
	GPIO7	-0.3	8	V
Junction Temperature Range	T_J	-40	125	℃
Storage Temperature Range	T_{stg}	-55	150	℃
Package Thermal Resistance（JunctionTemperature to environment）	θ_{JA}	40		℃/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
VIN Supply voltage	VIN	4	5/9/12	13	V
GPIO input voltage	GPIO7	GND-0.3	-	V_{CC}+0.3	V
	LED1/LED2	GND-0.3	-	V_{CC}+0.3	V
	VCOIL	GND-0.3	-	V_{CC}+0.3	V
	VDEM	GND-0.3	-	V_{CC}+0.3	V
	ISNS	GND-0.3	-	V_{CC}+0.3	V
Working environment temperature	T_A	-20	-	85	℃

*Beyond these operating conditions, the device operating characteristics are not guaranteed.

10 Electrical Characteristics

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

Parameters	Symbol	Test conditions	Min	Typ	Max	Unit
VIN						
V_{IN} operating voltage range	V_{IN}		4	-	13	V
V_{IN} standby current	I_{Q_VIN}	VIN=5V		10	15	mA

V_{IN} sleep current	I_{SLEEP_VIN}	VIN=3~5V	30	-	50	uA
System						
VCC voltage	VCC	VIN = 5V		4.8		V
VCC load capacity I_{VCC}	I_{VCC}	VCC maximum load current			50	mA
GPIO logic high level	V_{IH}	GPIO7		0.7*VCC		V
		LED1/LED2		0.7*VCC		V
		VCOIL		0.7*VCC		V
		VDEM		0.7*VCC		V
		ISNS		0.7*VCC		V
GPIO logic low level	V_{IL}	GPIO7		0.3*VCC		V
		LED1/LED2		0.3*VCC		V
		VCOIL		0.3*VCC		V
		VDEM		0.3*VCC		V
		ISNS		0.3*VCC		V
Thermal shutdown junction temperature	T_{OTP}	Rise in temperature	130	140	150	℃
Thermal shutdown hysteresis	ΔT_{OTP}	Thermal shutdown recovery hysteresis	30	40	50	℃

11 Function Description

11.1 H Bridge Drive

The IP6822 has two built-in symmetrical half-bridge driver modules and an external N+PMOS H-bridge. The dead time and drive strength of the driver modules can be software configured to different gears. During EMI EMC testing, the EMI margin can be improved by configuring a lower drive capability, thus saving external RC devices.

The IP6822 uses 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.

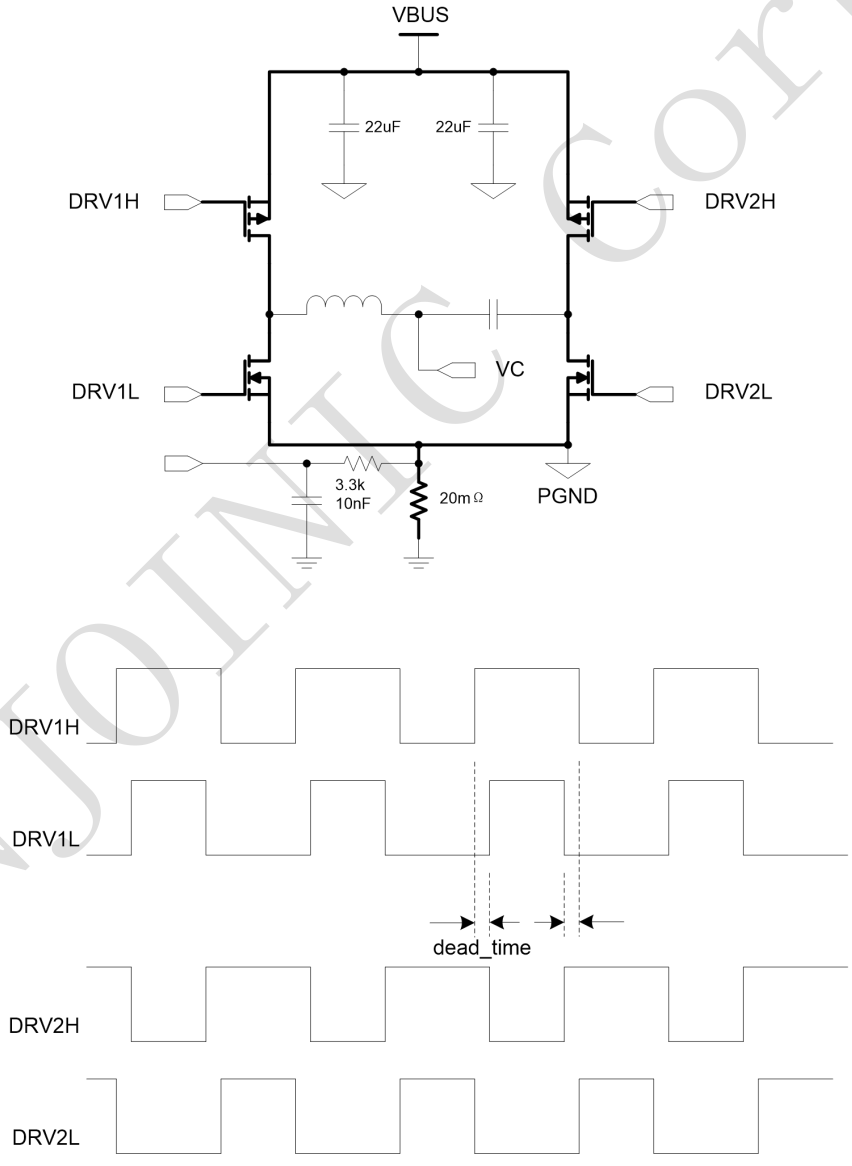


Figure 4 H-bridge drive schematic

11.2 ASK communication demodulation/FSK modulation

The IP6822 has a built-in ASK demodulation module. For the ASK modulated signal from the receiving device, the IP6822 collects the coil voltage and current for ASK signal demodulation and decoding respectively. The system implements the QI wireless charging protocol based on the ASK decoded data.

IP6822 has built-in FSK modulation function, through FSK modulation, IP6822 can send information to the receiving device to realize PPDE, EPP, MPP and other protocols.

11.3 Input Fast Charging

IP6822 built-in USB PD protocol, apply voltage to the PD adapter through CC1, CC2 pins.

IP6822 built-in DP/DM type adapter fast charging protocol, apply voltage to the adapter through DP, DM pins.

11.4 NTC temperature protection

The IP6822's LED1 pin is time-multiplexed to achieve the LED indicator and NTC detection function. The recommended parameters of NTC resistor are B=3950,100k.

IP6822 NTC detection pin can output 20uA constant current source, external 100k NTC resistor, 20uA constant current source in the NTC resistor to form a voltage, the IC internal ADC detection of this voltage to achieve temperature protection. If the NTC function is not used, the pin is connected to a 100K resistor to ground.

When users customize the NTC temperature protection threshold, proceed as follows:

1、Consult the NTC resistor data sheet 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 detection voltage for protection threshold value is V_NTC = R_NTC * 20uA (mV);

3、Configure the upper computer software with the parameters provided by the original manufacturer to configure V_NTC into the firmware, and the new temperature protection threshold will take effect;

4、The NTC protection threshold in the standard firmware is set to 60°C (480mV), which protects when the NTC voltage is detected to be lower than 480mV. The NTC recovery threshold is set to 50°C (700mV), which resumes charging when the NTC voltage is detected to be higher than 700mV.

11.5 Charging Indicator

IP6822 built-in indicator model algorithm, support user-defined charging indicator (need to use the PC upper computer provided by the original factory), import the firmware to the upper computer software, configure the indicator effect on the software interface, and export the new firmware to get the desired indicator effect. Only LED2 supports breathing light, LED1 does not support breathing light configuration. The standard firmware indicator status is as follows：

Charging status	LED1	LED2
Power-on	Alternating flashes, three times in total	
Standby	Off	Off
Charging	On	Off
FOD	Off	Flashing
Overheating	Off	Flashing
Overvoltage/undervoltage	Off	Flashing
Full charged	Off	On

11.6 Firmware Upgrade Instructions

IP6822 integrates MTP ROM, supports multiple firmware upgrades, and the firmware download interface is DP/DM pins. The firmware download interface is DP/DM pin. To download the firmware, use the burner provided by the original manufacturer.

12 Typical Application Schematic

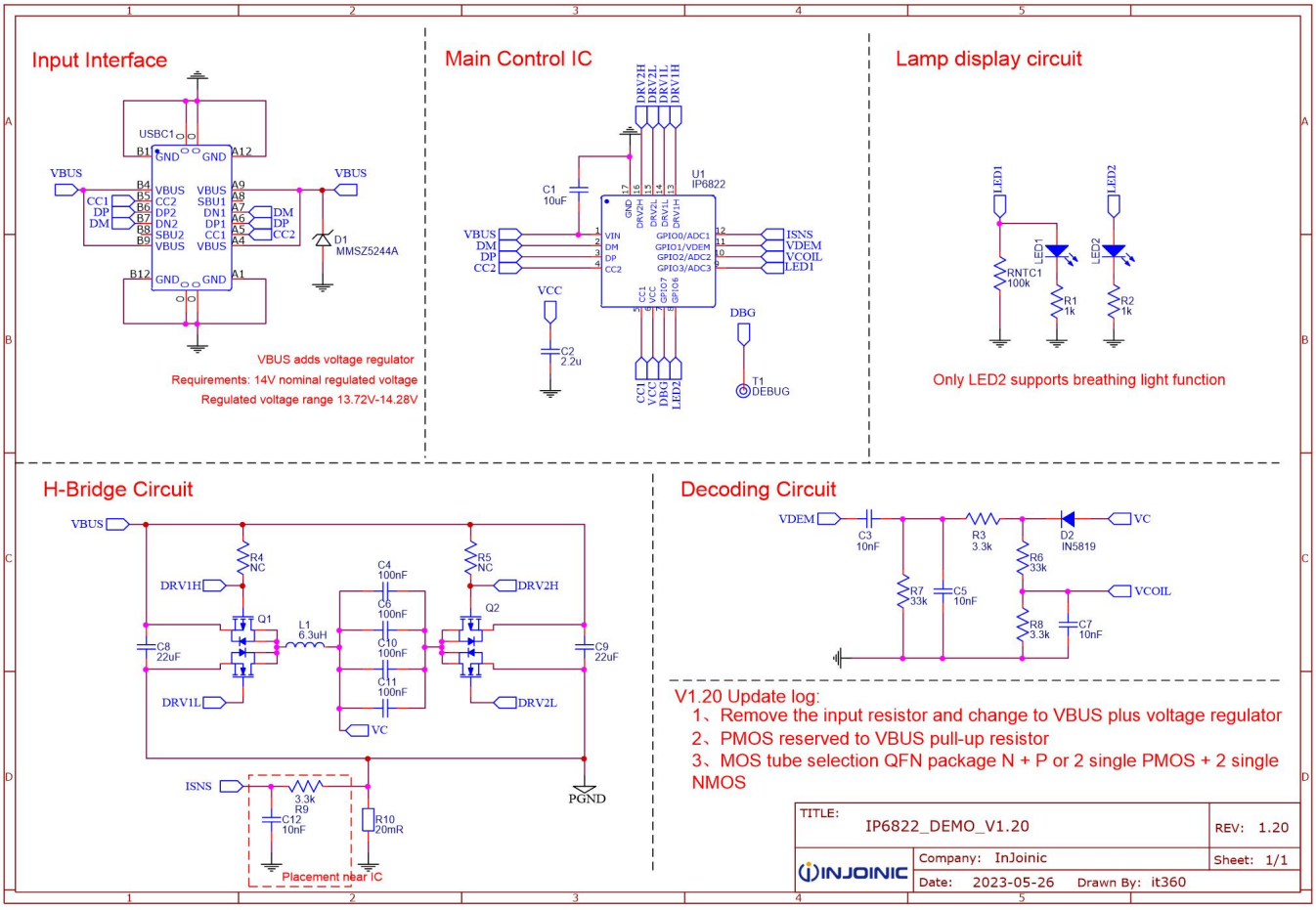
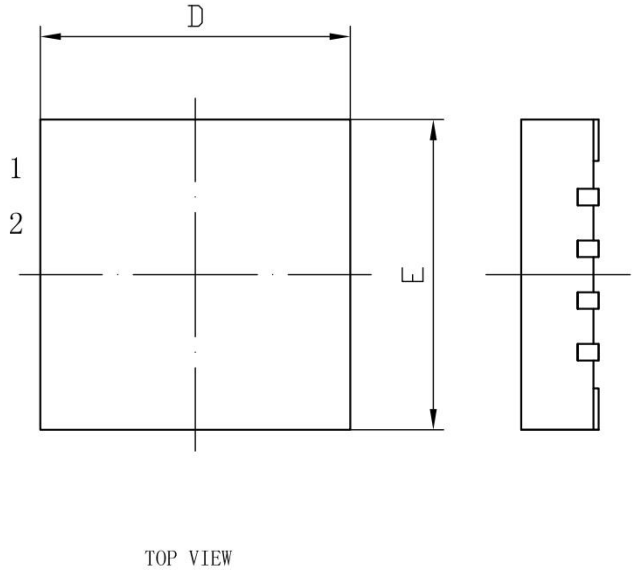


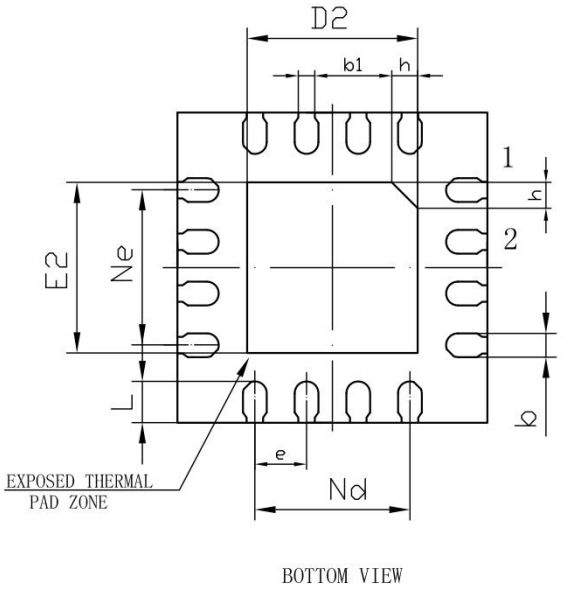
Figure 5 Typical Application Schematic

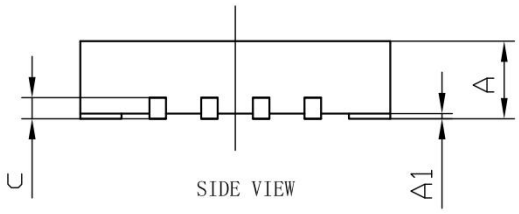
13 BOM

No.	Part Name	Component Bit No.	Description&Specification	Qty
1	IP6822	U1	WQFN-16_L3.0-W3.0-P0.50-TL-EP1.6	1
2	SAMTF20V3NP	Q1,Q2	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	IN5819	D1	SOD-123_L2.7-W1.6-LS3.7-R-RD	1
9	6.3uH	L1	Wireless power transfer coil	1
10	LED	LED1	LED0603_RED	1
11	LED	LED2	LED0603_GREEN	1
12	4.7R	R1	R0603	1
13	1k	R2,R3	R0603	2
14	3.3k	R4,R6,R9	R0603	3
15	20mR	R5	R1206	1
16	33k	R7,R8	R0603	2
17	100k	RNTC1	R0603	1
18	TYPE-C-31-M-12	USBC1	USB-C_SMD-TYPE-C-31-M-12	1

14 Package







SYMBOL	MILLIMETER		
	MIN	NOM	MAX
A	0.70	0.75	0.80
A1	0	0.02	0.05
b	0.18	0.25	0.30
b1	0.16REF		
c	0.18	0.20	0.25
D	2.90	3.00	3.10
D2	1.55	1.65	1.75
e	0.50BSC		
Ne	1.50BSC		
Nd	1.50BSC		
E	2.90	3.00	3.10
E2	1.55	1.65	1.75
L	0.35	0.40	0.45
h	0.20	0.25	0.30

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