General Description

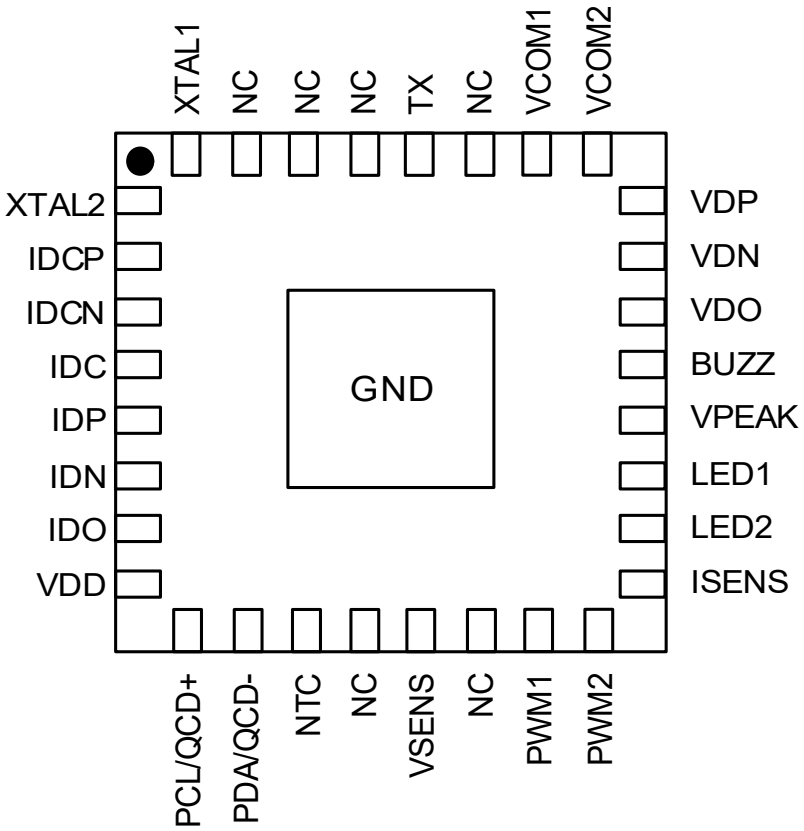
WE9117 is a specially designed, Qi-compliant controller for magnetic inductive wireless power transmitter. The system-on-chip integrates power controller, on-chip voltage and current demodulation, foreign object detection (FOD), over temperature protection, over current protection, input brown-out protection, etc.

It can cooperate with QC adapters and provide fast charge for Samsung and Huawei with charging power up to 10W. It can also provide 7.5W for compatible iPhones.

Features:

- Minimal external components
- Suitable for standard A11 transmitter coil
- Support standard 5W output, Samsung fast charging 10W, Huawei fast charging 10W and iPhone 7.5W
- Reliable foreign object protection
- Reliable and robust communication even with system load variation
- OCP/OTP/input low voltage protection
- 4mmX4mm QFN-32 Package

Pinout:



Pin description:

No.	Name	Description
1	XTAL2	External crystal oscillator input
2	IDCP	Input current sensing positive input
3	IDCN	Input current sensing negative input
4	IDC	Input current sensing output
5	IDP	Current communication data positive input
6	IDN	Current communication data negative input

7	IDO	Current communication data output
8	VDD	Power supply
9	PCL/ QCD+	Program clock input/ Quick charge positive enable output
10	PDA/ QCD-	Program data input/ Quick charge negative enable output
11	NTC	Temperature sense input
12	NC	No connect
13	VSENS	Input voltage sense
14	NC	No connect
15	PWM1	PWM output for half bridge
16	PWM2	PWM output for another half bridge
17	ISENS	Input current sense
18	LED2	LED2 display output
19	LED1	LED1 display output
20	VPEAK	Peak voltage detection of the LC tank
21	BUZZ	Buzzer output
22	VDO	Voltage communication data output
23	VDN	Voltage communication data negative input
24	VDP	Voltage communication data positive input
25	VCOM2	Current communication data input
26	VCOM1	Voltage communication data input

27	NC	No connect
28	TX	Debug pin
29	NC	No connect
30	NC	No connect
31	NC	No connect
32	XTAL1	External crystal oscillator input
0	GND	System ground

Absolute Rating

VDD ---------- 6V

All pins ---------- VDD+0.3V

Operating temperature ---------- -40℃-+85℃

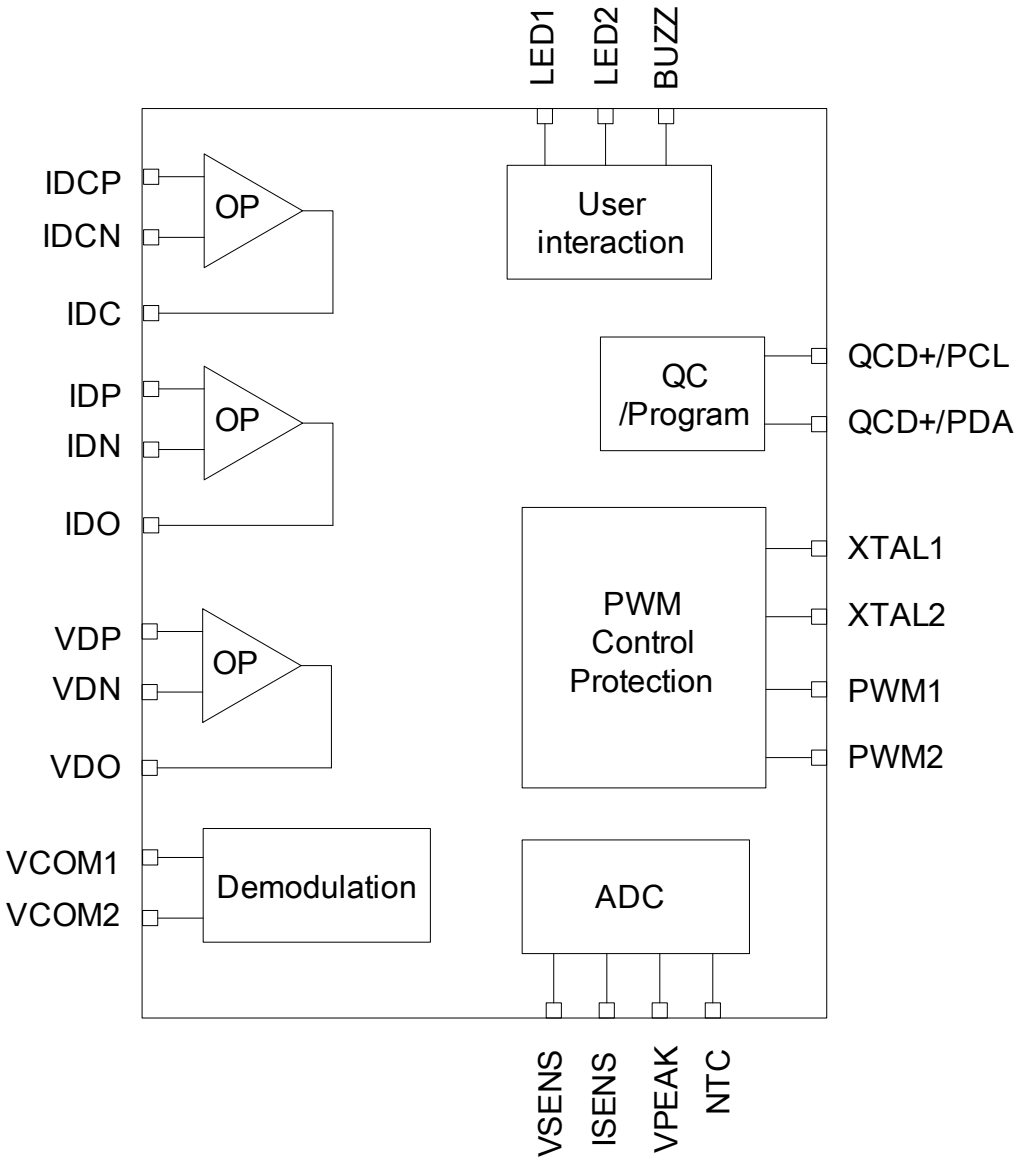
Storage temperature ---------- -40℃-+125℃

Electrical Characteristics

VCC=5V, Ta=25 (unless otherwise noted)

Parameter	Description	Min	Typical	Max	Unit
VDD	Power supply voltage	2.2	5	5.5	V
Iactive	Active input current		2		mA
V_{LOW}	Input low voltage detection		4.3		V
Driver Capability					
I_{LED1}	Output current for LED1		20		mA
I_{LED1}	Output current for LED2		20		mA
Internal gain and Thresholds					
G_{IIN}	Gain for input current sensing		1		
I_{OCP}	Over current threshold		2.2		A
G_{VIN}	Gain for input voltage sensing		1/6		
V_{NTC}	OTP trigger threshold.		2		V

Block Diagram



Detail Descriptions:

WE9117 is a system-on-chip wireless transmitter complying with WPC Qi standard. In order to transfer power over a distance, WE9117 drives a full bridge inverter connected with a LC resonant circuit. The operating frequency is around 110k to 175kHz and the resonant frequency of the LC tank is typically designed at 100kHz. With a pulsating input voltage driving the LC tank, AC current is circulating in the LC tank and magnetic field is generated around the transmitter coil. When the receiver is put inside the magnetic field, voltage can be generated at receiver output. Communication is necessary for the wireless transmitter to control the receiver output voltage. WE9117 integrates sophisticated on-chip voltage and current demodulations. With minimal external components, WE9117 is very robust at communication. Foreign object detection (FOD) is critical for safe wireless charging. WE9117 considers all potential hazardous conditions and is sensitive with FOD protection.

Input Power Limit

When the input power goes higher than the capability of the adapter, the input voltage will drop. WE9117 monitors the input voltage and controls the power transferred to the receiver side. When the input voltage drops below 4.3V, WE9117 stops the switching frequency from dropping or stops the duty cycle from increasing in order to limit the output power.

Over current protection and Over temperature protection

Input current is monitored by WE9117 using ISENS pin. The sensed current is used for FOD protection and also for over current protection. When the sensed current is higher than 2.2A, WE9117 goes into OCP mode and stops switching. If the receiver is removed for more than 1s, OCP mode can be reset. Temperature is also sensed using and external NTC resistor. When the sensed

temperature runs higher than 65℃, OTP is triggered and WE9117 stops switching. When the temperature drops below 55℃, OTP is reset.

Communication and demodulation

Communication between receiver side and transmitter side is critical for wireless charging. To transfer information, especially received voltage and power to the transmitter, receiver side modulates its resonant tank at a particular pattern. At the transmitter side, LC tank voltage will change accordingly and the input current will also change. The envelop of LC tank voltage is pre-processed before sent to WE9117. WE9117 inner opAmp amplifies the envelop signal, and internal logic demodulates voltage and power information from the receiver side. Moreover, the input current is processed and demodulated by WE9117 as well.

FSK modulations

To initiate Samsung and Huawei fast charging, transmitter should transfer modulation information to receiver side. WE9117 includes integrated frequency shift keying modulation circuit and modulates the switching frequency between two adjacent switching frequencies.

User Interaction

WE9117 gives 2 LED indications and one buzzer output.

	Idle	Charging	Charge Complete	FOD
LED1(G)	OFF	OFF	ON	OFF
LED2(R)	OFF	ON	OFF	Blink

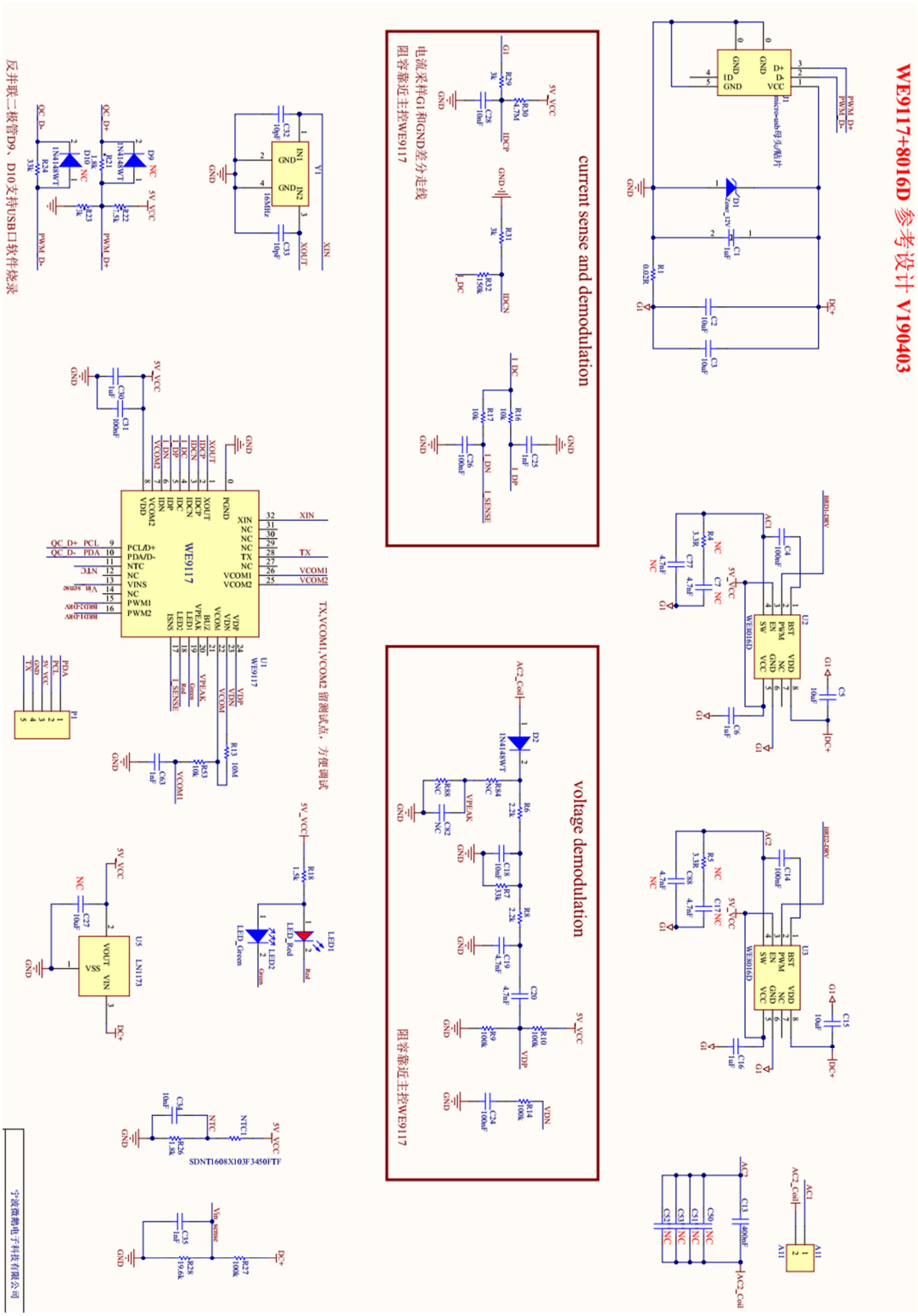
Foreign object detection

For the wireless power transfer system, foreign object can intrude into the charging area and cause much loss. Received power is reported to the transmitter through inband communication. WE9117 calculates the input power by sensing input current and input voltage. Then it compares the reported power and the input power together with other transmitter parameters to decide whether there is foreign object exist. To ensure accurate FOD function, standard A11 transmitter coil should be used.

Layout guidelines

Careful PCB layout is critical to system operation. Make routing loop as small as possible, especially the power loop of the full bridge, to minimize EMI noises. Put a decoupling capacitor WE9117 VDD pin as close as possible. To keep power ground plane low impedance, use as much cooper as possible and adequate number of vias. The external components for tank voltage peak detection and input current should be put to WE9117 as closed as possible.

Reference design schematic



Reference layout