

3W Qi V1.3-Compliant Wireless Power Receiver and Power Supply

Features

- Integrated Wireless Power Supply Receiver Solution
 - High Efficiency Full Synchronous Rectifier.
 - WPC Qi V1.3 Compliant communication Control
 - Single IC Required Between RX Coil and Output
- WPC Qi V1.3 FOD Function
 - High Accurate Current Sense
 - Easy to debug for certification by Resistance
- Current limit by external programming resistor
- Dynamic Rectifier VRECT
 - Improve the Load Transient Response
- Optimize the dynamic efficiency for full load output
- Rectifier Overvoltage Clamp ($V_{OVP}=18V$)
- Support 18-V Maximum Input
- Over Temperature, Over Voltage and Over Current Protection
- LED Output Indication
- Charging Complete and Fault Host Control
- VOUT with High Voltage Protection and Reverse current prevention
- QFN 3mm*3mm 16Pin Pack
- Specially optimized for small power and small or irregular coil applications

Applications

- Wearable product
- Hand-held Device
- Portable Products (Audio, Media, Headsets)

Description

- CP2022 is a single-chip, advanced, flexible, secondary-side device for wireless power transfer in portable applications capable of providing up to 3W. It has high integration, high efficiency, low power consumption.
- CP2022 receiver the power that uses the near field electromagnetic induction principle, the power transfer is through coupling between the transmitter coil (primary) and receiver coil (secondary), Global feedback is established from the secondary to the primary to control the power transfer process using the Qi V1.3 protocol.
- CP2022 integrated a low resistance synchronous rectifier (AC to DC), low-dropout regulator (LDO), digital control, and accurate voltage and current loops to improve the high efficiency and decrease the power dissipation.
- CP2022 also integrated a digital controller that comply with the WPC V1.3 standard, it can calculate the amount of power received by the mobile device, the controller then communicates this information to the transmitter to allow the transmitter to determine if a foreign object is present within the magnetic interface and introduces a higher level of safety within magnetic field. This foreign object detection (FOD) method is part of requirement under the WPC V1.3 specification.
- CP2022 Output stage is LDO, the output voltage is adjusted dynamically according to the output current to achieve the best transient and efficiency.
- CP2022 Output voltage and current can be flexibly configured according to the application case.

Application Schematics

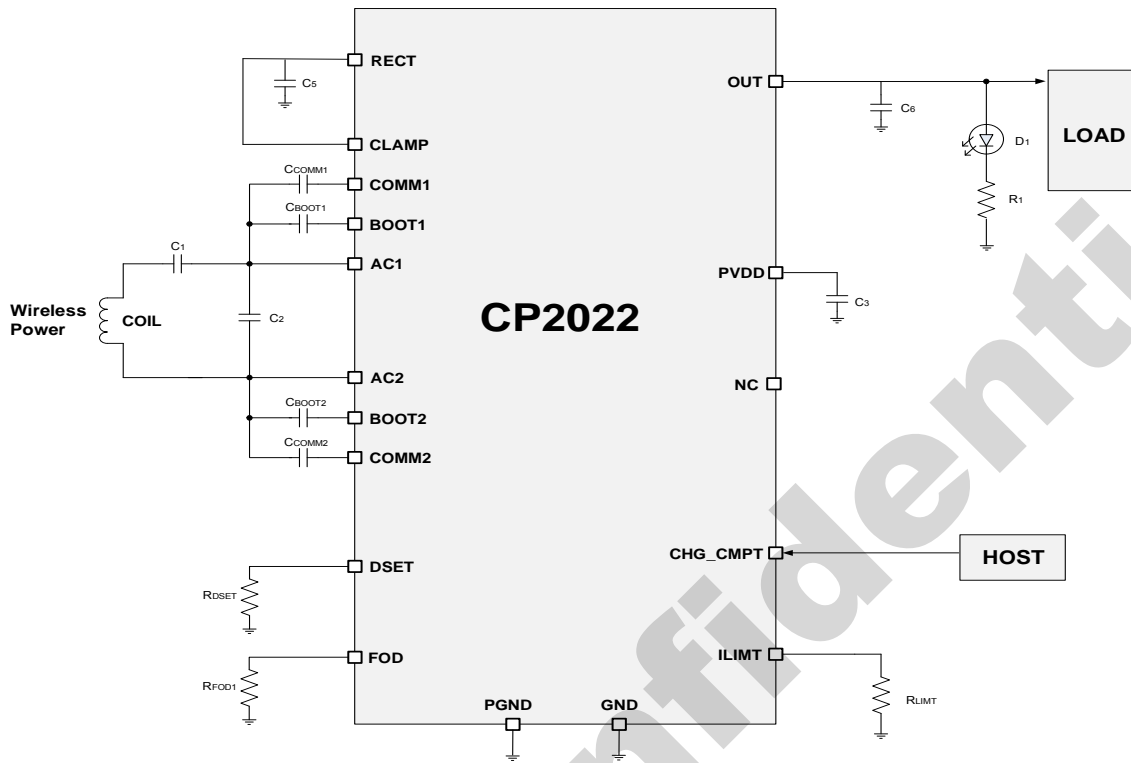


Figure 1. CP2022 application schematics

Package and Pin Description

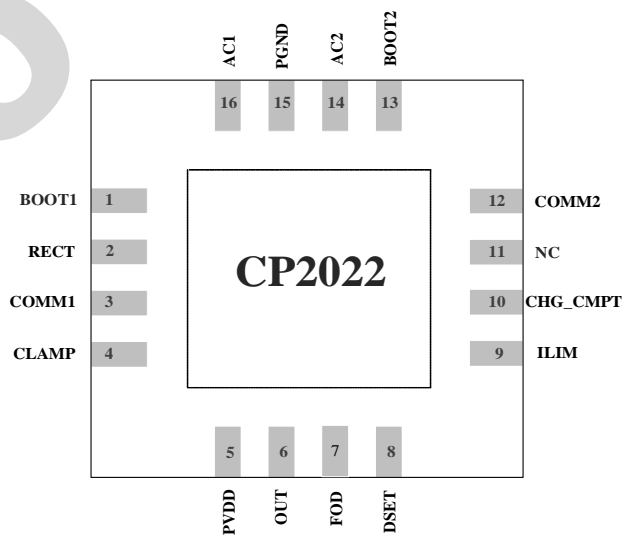


Figure 2. 16 Pin QFN Top View

Pin Description

Pin Name	RHL	I/O	Description
AC1	16	I	AC input from receiver coil.
AC2	14	I	
BOOT1	1	O	Bootstrap capacitors for driving the high side FETs of the synchronous rectifier. Connect a 10nF capacitor from BOOT1 to AC1 and BOOT2 to AC2.
BOOT2	13	O	
RECT	2	O	Filter capacitor for the inter rectifier. Connect to PGND with 22μF capacitor.
OUT	6	O	Power output, delivers power to the load.
COMM1	3	O	Open drain output used to communication with TX coil by varying reflected impedance. Connect through a capacitor to either AC1 or AC2 for capacitive load modulation.
COMM2	12	O	
CLAMP	4	O	Open drain FETs which are utilized for over voltage AC clamp protection
PGND	15		Power ground.
ILIM	9	I/O	Programming pin for the over current limit. Connect external resistor to GND. Sizing the R_{LIM} with the following equation: $R_{LIM} = I_{LIM} * K_{MAX}$ (kΩ), I_{LIM} is the Maximum output current.
FOD	7	I	Input for receiver power measurement.
DSET	8	I	Internal set pin. Connect external resistor(100kΩ) to GND
PVDD	5	O	5V power output. Connect to GND with 1μF capacitor
CHG_CMPT	10	I	Charging completing indication PIN, a logic high input for RX power down.
NC	11		NC

Absolute Maximum Ratings

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

Item(V/I)	Pin Name	Min	Max	Unit
Input Voltage	AC1/2	-0.8	18	V
	RECT, COMM1/2, CLAMP	-0.3	18	V
	BOOT1/2	-0.3	26	V
	FOD, ILIM, CHG_CMPT, DSET, OUT	-0.3	7	V
Input Current	AC1/2		1	A
Output Current	OUT		750	mA
Sink Current	COMM1/2, CLAMP		500	mA
ESD	HBM		2	kV
	CDM		500	V

- 1: All voltages are with respect to the VSS terminal, unless otherwise noted.
- 2: Stresses beyond those listed under Absolute Maximum Ratings may cause permanent damage to the device. These are stress ratings only and functional operation of the device at these or any other condition beyond those indicated under Recommended Operating Conditions is not implied. Exposure to absolute maximum rated conditions for extended periods may affect device reliability.

Thermal Information

Symbol	Description	Value	A
θ_{JA}	Thermal Resistance Junction to Ambient	35	°C/W
θ_{JC}	Thermal Resistance Junction to Case	30	°C/W
θ_{JB}	Thermal Resistance Junction to Board	2.4	°C/W
T_J	Operating Junction Temperature	0 to +125	°C
T_A	Ambient Operating Temperature	0 to +85	°C
T_{STG}	Storage Temperature	-55 to +150	°C
T_{LEAD}	Lead Temperature (soldering, 10s)	300	°C

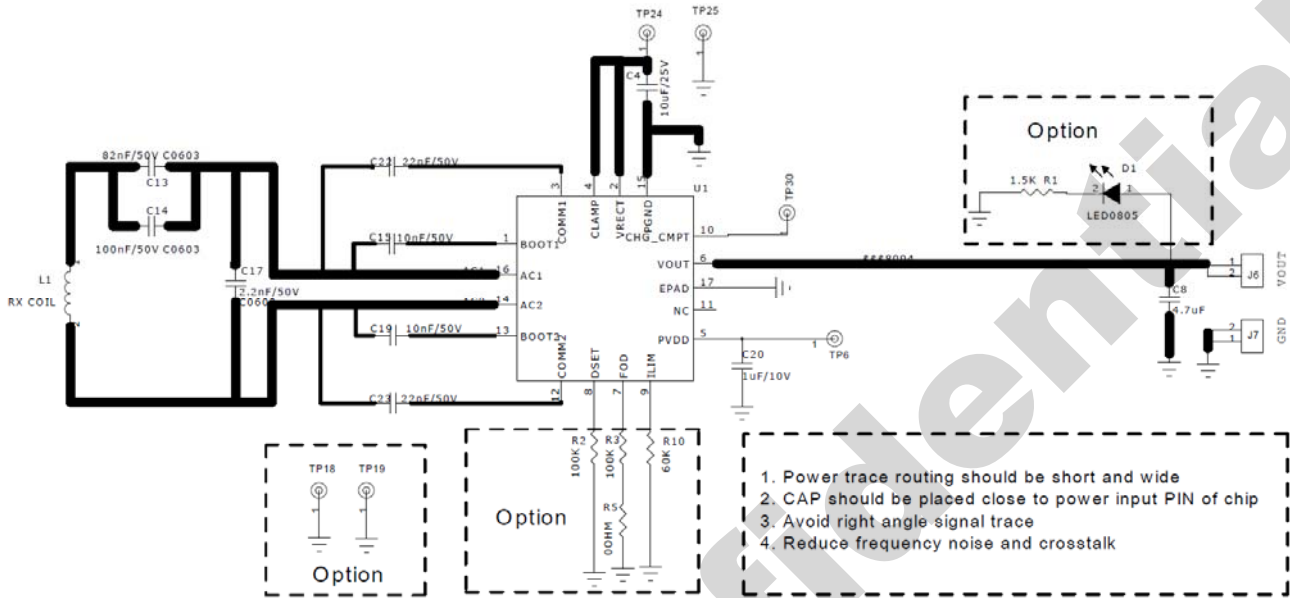
Electrical Characteristics

Over operating free-air temperature range, 0 to 85°C

Parameter		Test Condition	Min	Typ	Max	Unit
RECT						
$V_{RECT-UV}$	V_{RECT} Under Voltage lock-out	$V_{RECT}: 0V \rightarrow 2.9V$	2.5		2.7	V
	Hysteresis on UV			0.25		
$V_{RECT-CLAMP}$	V_{RECT} Over Voltage lock-out	$V_{RECT}: 5V \rightarrow 20V$		18		V
	Hysteresis on OV			2		
$V_{RECT-REG}$	Dynamic V_{RECTV} Threshold1	$I_{LOAD} < 0.2 * I_{MAX}$		$V_{OUT} + 1$		V
	Dynamic V_{RECTV} Threshold3	$0.2 * I_{MAX} < I_{LOAD} < 0.4 * I_{MAX}$		$V_{OUT} + 0.5$		
	Dynamic V_{RECTV} Threshold4	$I_{LOAD} > 0.4 * I_{MAX}$		$V_{OUT} + 0.2$		
$I_{LOAD-HYS}$	I_{LOAD} Hysteresis for dynamic V_{RECT} as a% of I_{MAX}			4		%
$V_{RECT-DPM}$	Rectifier under voltage protection, restrict I_{OUT} at $V_{RECT-DPM}$		3.0		4.5	V
Quiescent Current						
I_{RECT}	Active IC quiescent current consumption at V_{RECT}	$I_{LOAD} = 0$		8	10	mA
		$I_{LOAD} = 200mA$		2	3	
I_Q	Quiescent current at the OUT when wireless power is disable	OUT=4.2V		10	15	μA
ILIM Short Current						
I_{OUT-CL}	Maximum output current limit	Maximum I_{LOAD} that will be delivered for 1ms when I_{LIM} is Short			0.6	A

Parameter		Test Condition	Min	Typ	Max	Unit
OUTPUT						
I _{OUT}	Output Current(I _{LIM} set by R _{LIM})		5		600	mA
K _{IMAX}	Current programming factor for the hardware protection	$R_{LIM} = I_{LIM} * K_{IMAX}$	197.5	200	202.5	kΩ/A
ACC _{ILIM}	Current limit accuracy	V _{OUT} =3.8V, I _{LOAD} =0.75A, 0°C-85°C	-7		7	%
V _{OUT}	5V Output Voltage		4.9	5	5.1	V
Rectifier						
I _{LOAD-FULL}	I _{OUT} at which the synchronous rectifier enters half-synchronous mode	I _{LOAD} : 0mA→200mA		20		%
	Hysteresis			6		
Thermal Protection						
T _{J-OFF}	Thermal shutdown temperature			155		°C
	Thermal shutdown hysteresis			40		

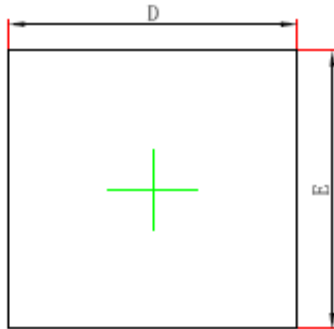
Typical Application Schematics



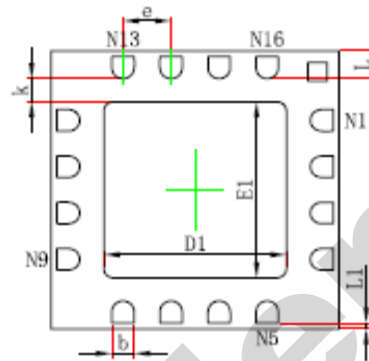
Note: Detailed application circuits please refer to the last updated schematic file. L1 coil should be selected with respect to the requested transferred power.

Package Information

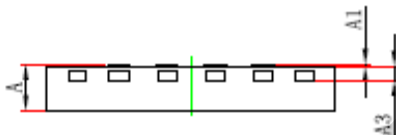
QFNWB3x3-16L (P0.50T0.60) Package Outline Dimensions



Top View



Bottom View



Side View

Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	0.450/0.500/0.550	0.550/0.600/0.650	0.018/0.020/0.022	0.022/0.024/0.026
A1	0.000	0.050	0.000	0.002
A3	0.152REF.		0.006REF.	
D	2.924	3.076	0.115	0.121
E	2.924	3.076	0.115	0.121
D1	1.800	2.000	0.071	0.079
E1	1.800	2.000	0.071	0.079
k	0.200MIN.		0.008MIN.	
b	0.230	0.330	0.009	0.013
e	0.500TYP.		0.020TYP.	
L	0.250	0.350	0.010	0.014
L1	0.013	0.113	0.000	0.004

Revision History

Date	Revision #	Description	Page
2022.12	1.0	Original	

Ordering Information

Part Number	Package	PINs	SPQ	Description
CP2022	QFN	16	5000	3W Fast charging and BPP

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