DATA SHEET

# GPMD8102A

## Qi Compliant Wireless Power Receiver

APR. 05, 2017

Version 1.0

# Table of Contents

**PAGE**

## 1. GENERAL DESCRIPTION

GPMQ8102A is a single-chip, advanced, flexible, secondary-side device for wireless power transfer in portable applications capable of providing up to 4 W. It has high integration, high efficiency, low power consumption.

GPMQ8102A 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 V1.2.2 protocol.

GPMQ8102A 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.

GPMQ8102A also integrated a digital controller that comply with the WPC V1.2.2 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 WPV V1.2.2 specification.

GPMQ8102A Output stage is LDO, the output voltage is adjusted dynamically according to the output current to achieve the best transient and efficiency.

GPMQ8102A supports $I^2C$ internal register configuration, The output voltage and current can be flexibly configured according to the application case.

## 2. FEATURES

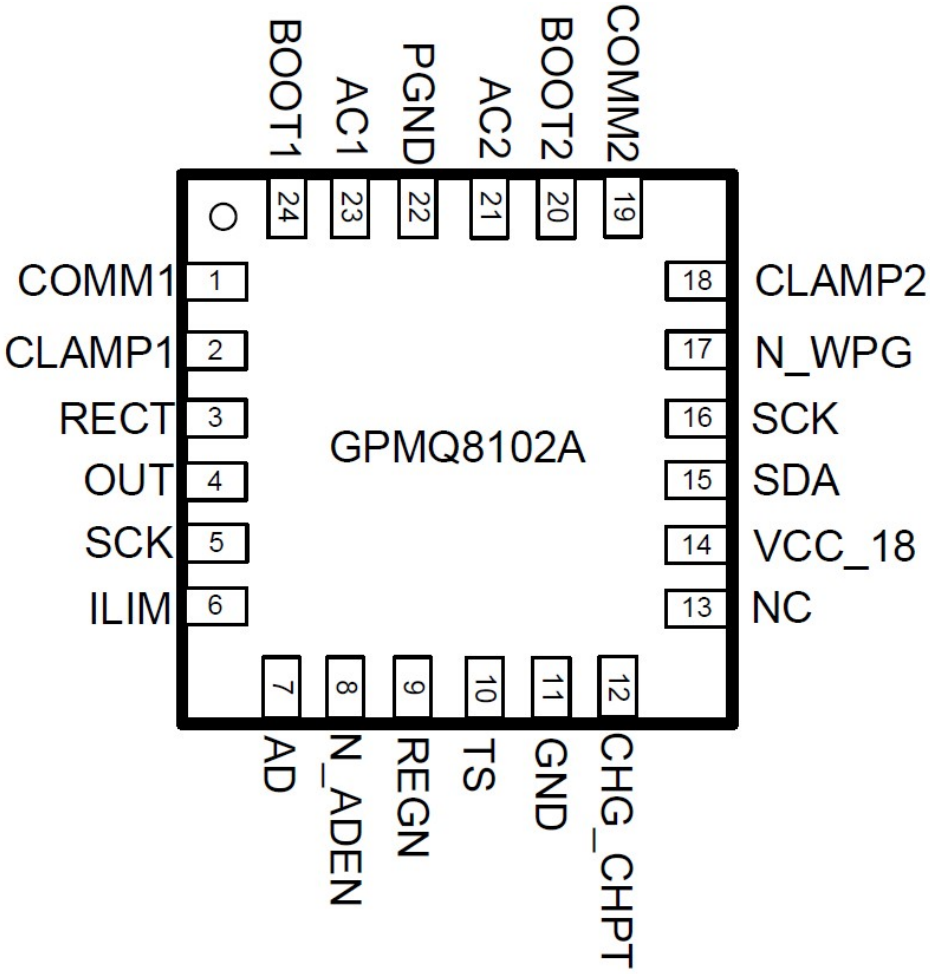
- Integrated Wireless Power Supply Receiver Solution
  - High Efficiency Full Synchronous Rectifier
  - Output Voltage Conditioning
  - WPC Qi V1.2.2 Compliant communication
  - Control
  - Single IC Required Between RX Coil and Output
- WPC Qi V1.2.2 FOD Function
- Support $I^2C$ Internal Register Configuration
  - Output Current -$V_{RECT}$
  - Output Current - $I_{OUT}$
- Dynamic Rectifier $V_{RECT}$
  - Improve the Load Transient Response
  - Optimize the dynamic efficiency for full load output
- Rectifier Overvoltage Clamp ($V_{OVP}$=15V)
- Support 20 V Maximum Input
- Over Temperature, Over Voltage and Over Current Protection
- Open Drain LED Output Indication
- Multifunction NTC and Temperature Monitoring, Charge Complete and Fault Host Control
- Compatible with Adapter and USB Input Application
- QFN 4mm*4mm 24Pin Packaeg

## 3. SIGNAL DESCRIPTIONS

### 3.1. PIN Description

| Pin Name | RHL | I/O | Description |
|---|---|---|---|
| AC1 | 23 | I | AC input from receiver coil. |
| AC2 | 21 | I | |
| BOOT1 | 24 | 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 | 20 | O | |
| RECT | 3 | O | Filter capacitor for the inter rectifier. Connect to PGND with 22uF capacitor. |
| OUT | 4 | O | Power output, delivers power to the load. |
| COMM1 | 1 | 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 | 19 | O | |
| CLAMP1 | 2 | O | Open drain FETs which are utilized for over voltage AC clamp protection |
| CLAMP2 | 18 | O | |
| AD | 7 | I | Adapter or USB input. |
| N_ADEN | 8 | O | Push-pull driver for external PFET connecting AD and OUT. This voltage tracks approximately 4V below AD when effective voltage is present at AD pin. Float this pin if unused. |
| PGND | 22 | | Power ground. |
| GND | 11 | | Analog ground。 |
| ILIM | 6 | I/O | Programming pin for the over current limit. Connect external resistor to GND. Sizing the RILIM with the following equation: RILIM=1.2K/IMAX, IMAX is the Maximum output current. |
| FOD | 5 | I | Input for receiver power measurement. |
| TS | 10 | I | Temperature Sense (TS) functionality. If an NTC function is not desired, connect to PGND with a 10-kΩ resistor, See Temperature Sense Resistor Network (TS) for more details. |
| VCC18 | 14 | O | 1.8V power output. Connect to GND with 1uF capacitor |
| REGN | 9 | O | 5V power output. Connect to GND with 1uF capacitor. |
| SDA | 15 | I/O | $I^2C$ data pin. |
| SCL | 16 | O | $I^2C$ clock pin. |
| N_WPG | 17 | O | Active when output current is being delivered to the load, Open Drain output, OUT pin connects to the pin with a resistor and a LED. |
| CHG_CMPT | 12 | I | Charging indicator from load system. |
| NC | 13 | | NC |

### 3.2. PIN Map




24 Pin QFN Top View

## 4. ELECTRICAL SPECIFICATIONS

### 4.1. Absolute Maximum Ratings

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

| Item(V/I) | Pin Name | Min | Max | Unit |
|---|---|---|---|---|
| Input Voltage | AC1,AC2 | -0.8 | 20 | V |
| | RECT, COMM1,COMM2, OUT, CLAMP1, CLAMP2, N_WPG | -0.3 | 20 | V |
| | BOOT1, BOOT2 | -0.3 | 26 | V |
| | AD, N_ADEN | -0.3 | 20 | V |
| | FOD, ILIM, TS, CHG_CMPT, SDA, SCL | -0.3 | 7 | V |
| Input Current | AC1,AC2 | | 1.5 | A |
| Output Current | OUT | | 1 | A |
| Sink Current | COMM1, COMM 2, CLAMP1, CLAMP2 | | 500 | mA |
| | N_WPG | | 15 | 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.

### 4.2. Thermal Information

| Symbol | Description | Value | A |
|---|---|---|---|
| $\theta_{JA}$ | Thermal Resistance Junction to Ambient | 35 | ℃/W |
| $\theta_{JC}$ | Thermal Resistance Junction to Case | 30 | ℃/W |
| $\theta_{JB}$ | Thermal Resistance Junction to Board | 2.4 | ℃/W |
| TJ | Operating Junction Temperature | 0 to +125 | ℃ |
| TA | Ambient Operating Temperature | 0 to +85 | ℃ |
| TSTG | Storage Temperature | -55 to +150 | ℃ |
| TLEAD | Lead Temperature (soldering, 10s) | 300 | ℃ |

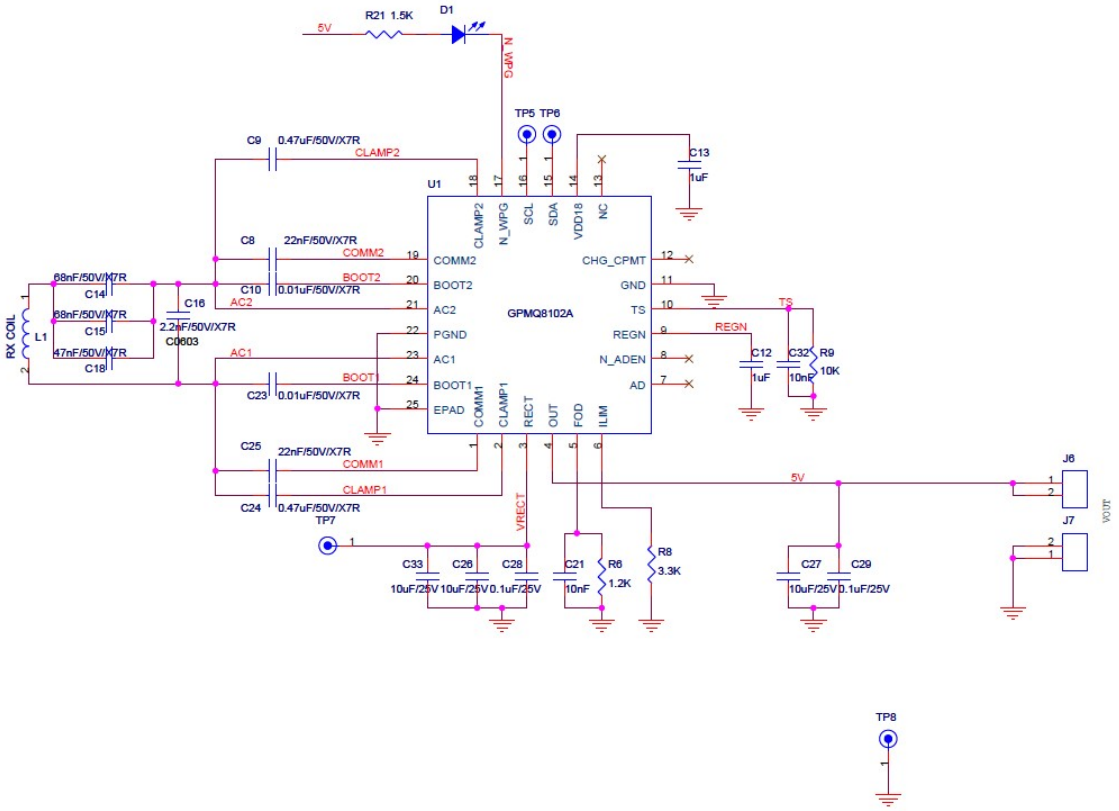
### 4.3. Electrical Characteristics

Over operating free-air temperature range, -40 to 85°C

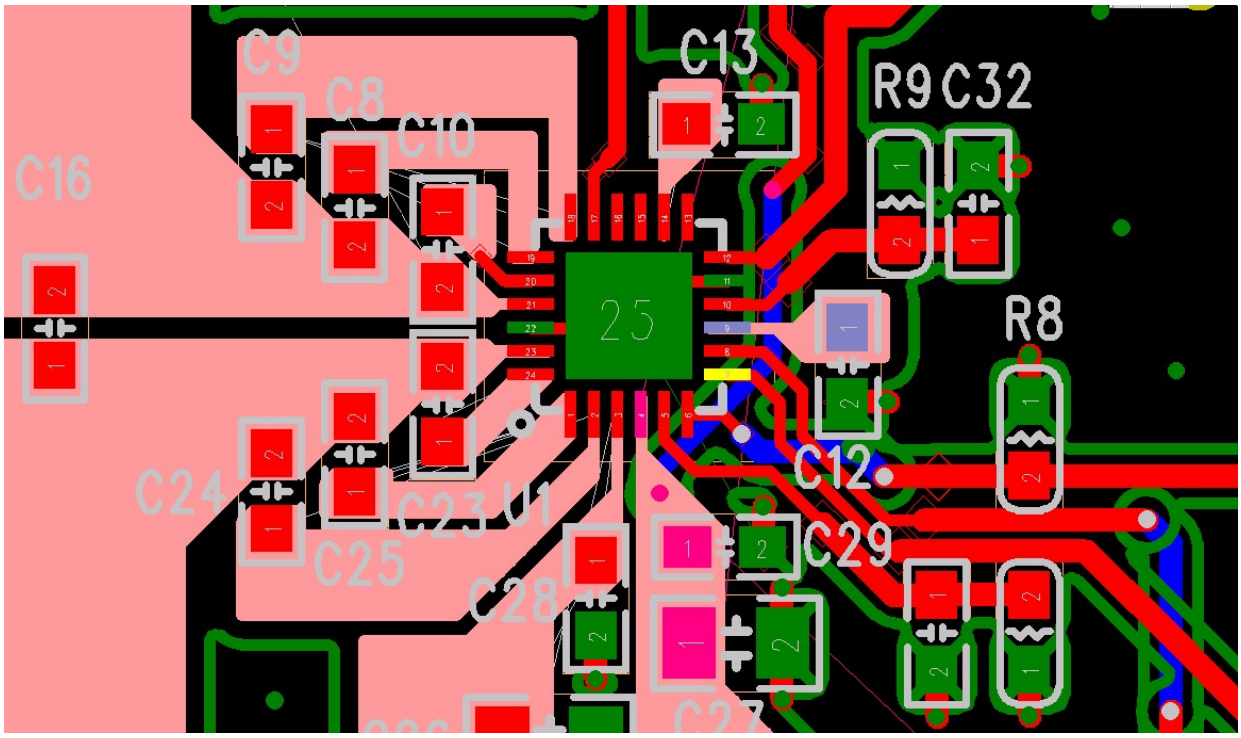
| Parameter | | Test Condition | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| **RECT** | | | | | | |
| $V_{RECT-UV}$ | $V_{RECT}$ Under Voltage lock-out | $V_{RECT}$: 0V→3.3V | 2.9 | 3 | 3.1 | V |
| | Hysteresis on UV | | | 0.25 | | |
| $V_{RECT-CLAMP}$ | $V_{RECT}$ Over Voltage lock-out | $V_{RECT}$: 5V→16V | 14.l5 | 15 | 15.5 | V |
| | Hysteresis on OV | | | 6 | | |
| $V_{RECT-REG}$ | Dynamic $V_{RECTV}$ Threshold1 | $I_{LOAD}$ < 0.1 X $I_{MAX}$ | | $Vol_{OUT}$+2 | | V |
| | Dynamic $V_{RECTV}$ Threshold2 | 0.1 X $I_{MAX}$ < $I_{LOAD}$ < 0.2 X $I_{MAX}$ | | $V_{OUT}$+1.5 | | |
| | Dynamic $V_{RECTV}$ Threshold3 | 0.2 X $I_{MAX}$ < $I_{LOAD}$ < 0.4 X $I_{MAX}$ | | $V_{OUT}$+0.5 | | |
| | Dynamic $V_{RECTV}$ Threshold4 | $I_{LOAD}$ > 0.4 X $I_{MAX}$ | | $V_{OUT}$+0.2 | | |
| $I_{LOAD-HYS}$ | ILOAD Hysteresis for dynamic $V_{RECT}$ as a% of $I_{MAX}$ | | | 4% | | |
| $V_{RECT-DPM}$ | Rectifier under voltage protection, restrict $I_{OUT}$ at | | 3.2 | 3.3 | 3.4 | V |

| Parameter | | Test Condition | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| | $V_{RECT-DPM}$ | | | | | |
| **Quiescent Current** | | | | | | |
| $I_{RECT}$ | Active IC quiescent current consumption at $V_{RECT}$ | $I_{LOAD}$=0 | | 8 | 10 | mA |
| | | $I_{LOAD}$=300mA | | 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 | | | 1.5 | A |
| **OUTPUT** | | | | | | |
| $K_{IMAX}$ | Current programming factor for the hardware protection | $K_{IMAX} = R_{LIM} \times I_{MAX}$ | 1100 | 1200 | 1300 | AΩ |
| $ACC_{ILIM}$ | Current limit accuracy | $V_{OUT}$=3.8V， $I_{LOAD}$=0.8A，-20°C-125°C | -7 | | 7 | % |
| **TS** | | | | | | |
| $V_{TS}$ | Internal TS Bias voltage | $I_{TS}$ < 100uA | 2 | 2.2 | 2.4 | V |
| $V_{COLD}$ | Rising threshold | $V_{TS}$: 50%→60% | 56.5 | 58.7 | 60.8 | %$V_{TS}$ |
| | Falling hysteresis | | | 2 | | |
| $V_{HOT}$ | Falling threshold | $V_{TS}$: 20%→15% | 18.5 | 19.6 | 20.7 | |
| | Rising hysteresis | | | 3 | | |
| $R_{TS}$ | $V_{TS}$ output impedance | | 18 | 20 | 22 | kΩ |
| $t_{DB-TS}$ | Deglitch time for TS comparators | | | 10 | | ms |
| **Rectifier** | | | | | | |
| $I_{LOAD-FULL}$ | IOUT at which the synchronous rectifier enters half-synchronous mode | $I_{LOAD}$: 0mA→200mA | 105 | 125 | 155 | mA |
| | Hysteresis | | | 25 | | |
| $R_{ON}$ | Impendence of rectifier FET | | | 100 | | mΩ |
| **Thermal Protection** | | | | | | |
| $T_{J-OFF}$ | Thermal shutdown temperature | | | 155 | | °C |
| | Thermal shutdown hysteresis | | | 40 | | |

## 5. APPLICATION CIRCUIT



## 6. LAYOUT EXAMPLES



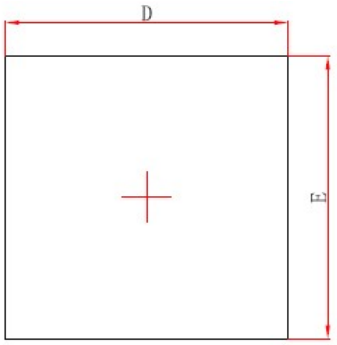

Top layer view

## 7. PACKAGE / ORDERING INFORMATION

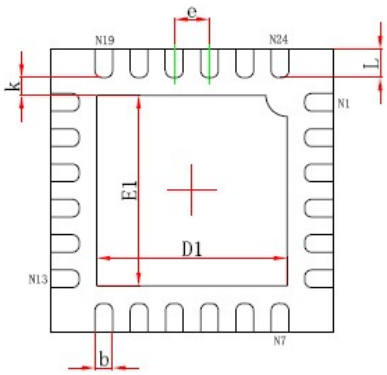
### 7.1. Ordering Information

| Product Number | Package Type |
|---|---|
| GPMQ8102A | QFN24 |
| | |

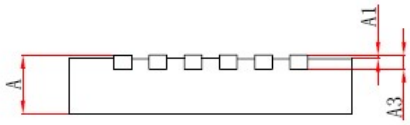
### 7.2. Package Information




Top View




Bottom View




Side View

| Symbol | Dimensions In Millimeters | | Dimensions In Inches | |
|---|---|---|---|---|
| | Min. | Max. | Min. | Max. |
| A | 0.700/0.800 | 0.800/0.900 | 0.028/0.031 | 0.031/0.035 |
| A1 | 0.000 | 0.050 | 0.000 | 0.002 |
| A3 | 0.203REF. | | 0.008REF. | |
| D | 3.924 | 4.076 | 0.154 | 0.160 |
| E | 3.924 | 4.076 | 0.154 | 0.160 |
| D1 | 2.600 | 2.800 | 0.102 | 0.110 |
| E1 | 2.600 | 2.800 | 0.102 | 0.110 |
| k | 0.200MIN. | | 0.008MIN. | |
| b | 0.200 | 0.300 | 0.008 | 0.012 |
| e | 0.500TYP. | | 0.020TYP. | |
| L | 0.324 | 0.476 | 0.013 | 0.019 |

## 8. DISCLAIMER

The information appearing in this publication is believed to be accurate.

Integrated circuits sold by Generalplus Technology are covered by the warranty and patent indemnification provisions stipulated in the terms of sale only. GENERALPLUS makes no warranty, express, statutory implied or by description regarding the information in this publication or regarding the freedom of the described chip(s) from patent infringement. FURTHERMORE, GENERALPLUS MAKES NO WARRANTY OF MERCHANTABILITY OR FITNESS FOR ANY PURPOSE. GENERALPLUS reserves the right to halt production or alter the specifications and prices at any time without notice. Accordingly, the reader is cautioned to verify that the data sheets and other information in this publication are current before placing orders. Products described herein are intended for use in normal commercial applications. Applications involving unusual environmental or reliability requirements, e.g. military equipment or medical life support equipment, are specifically not recommended without additional processing by GENERALPLUS for such applications. Please note that application circuits illustrated in this document are for reference purposes only.

## 9. REVISION HISTORY

| Date | Revision # | Description | Page |
|---|---|---|---|
| APR. 05, 2017 | 1.0 | Original | |