

bq500212A

Schematic and Materials Application Package

Reference Design



Literature Number: SLUUAP8B
August 2013–Revised February 2015

bq500212A Schematic and Materials Application Package

Johns, Bill

Introduction

This reference design provides wireless power developers with the schematic and list of materials required to prototype their first practical wireless power transmitter system using the bq500212A. The WPC compatible example provided offers:

- Best cost savings, reduced to the essentials.
- A full-feature approach intended for lowest standby power.

Link to the datasheet: [bq500212A](#)

Link to the Evaluation Module user's Guide: bq500212AEVM-550

For more information on Texas Instruments Wireless Power product portfolio, including links to FAQ, please visit: www.ti.com/wirelesspower

Description

The bq500212A wireless power transmitter from Texas Instruments is a high performance, easy-to-use controller for the design of wireless power solutions. The single-channel transmitter enables designers to speed the development of their end-applications. See Evaluation Module User's Guide for information regarding layout recommendations and board design.

Features

- Intelligent Control of Wireless Power Transfer
- 5-V Operation Conforms to Wireless Power Consortium (WPC) Type A5 and Type A11 Transmitter Specifications
- Dynamic Power Limiting for USB and Limited Source Operation
- Digital Demodulation Reduces Components
- Comprehensive Charge Status Mode and Fault Indication

Applications Information:

VCC input to bq500212A, V33A and V33D should be well filtered with decoupling capacitors located near Pin 33 & 34. Ground returns for the filter capacitors should have low impedance returns to Pin 36 and Pin 32. Ground Pad for device should be well connected to ground and used as a common ground point for the ground pins.

Several un-used pins should be configured for normal operation, see data sheet for additional information:

Pin 45 --Reserved pull up to 3.3V.

Pin 31 --Reserved connect to ground

Pin 1 -- Peak_Det connect to ground

Pin 48 -- External Reference, connect to ground

Communications Bus is used for FOD calibration of the unit for WPC1.1 certification access to the below pins required:

Pin 11 and 10 -- Data and CLK, should be Pulled up to 3.3V and connected to Test Point, used for Calibration of device.

1 bq500212A Schematic

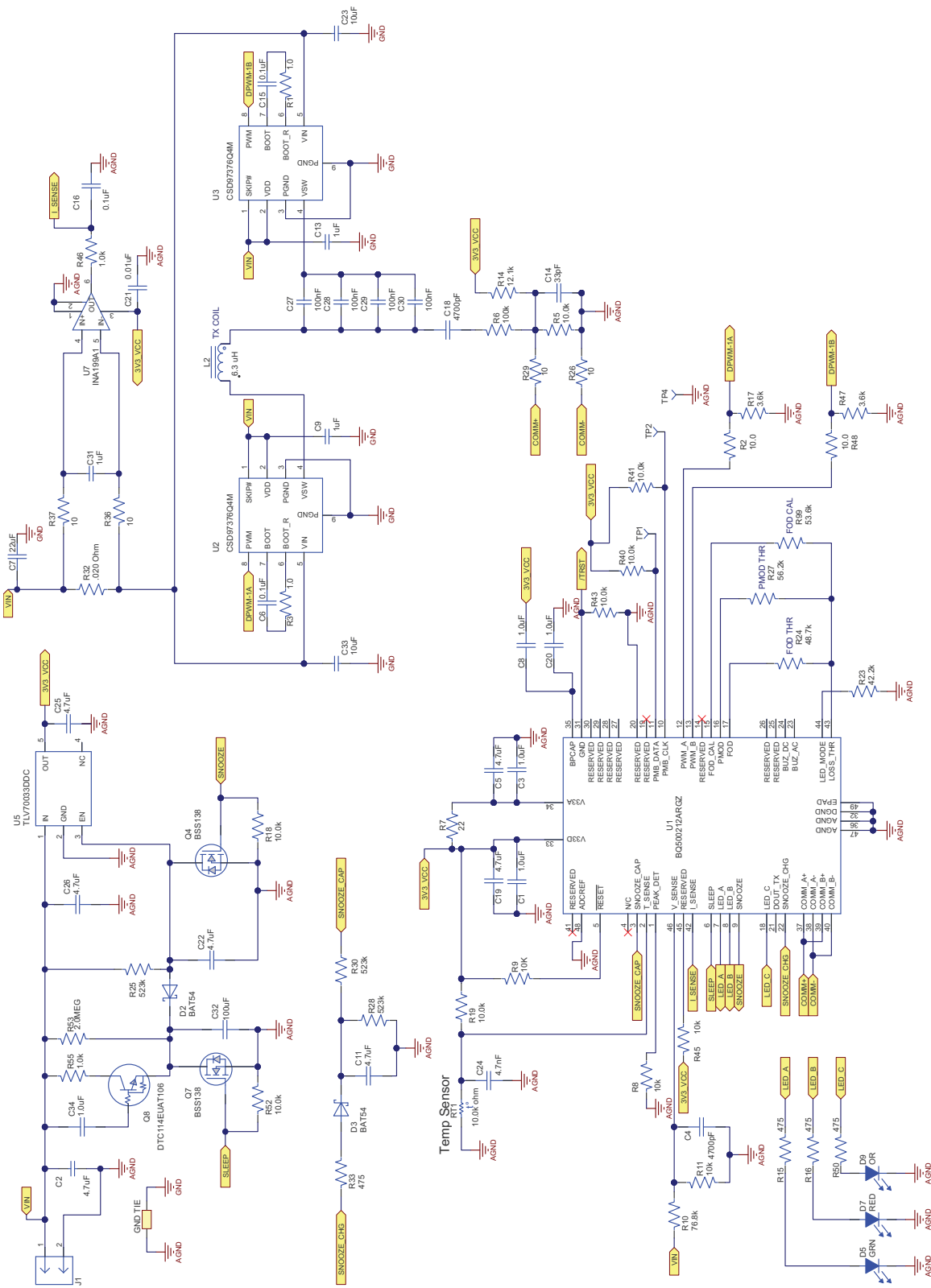


Figure 1. bq500212A Schematic

List of Materials
bq500212A List of Materials⁽¹⁾

Designator	Quantity	Value	Description	Package Reference	Part Number	Manufacturer	Alternate Part Number	Alternate Manufacturer
C1, C3, C8, C20, C34	5	1.0uF	Capacitor, Ceramic, 1UF 16V 10% X7R 0603	0603	C1608X7R1C105K080AC	TDK		
C2	1	4.7uF	CAP, CERM, 4.7uF, 10V, +/-10%, X5R, 0805	0805	0805ZD475KAT2A	AVX		
C4	1	4700pF	Capacitor, Ceramic, 4700PF 50V 5% NP0 0603	0603	C1608C0G1H472J080AA	TDK	445-7400-2-ND	Digi-Key
C5	1	4.7uF	Capacitor, Ceramic, 4.7uF, 10V, X7R, 20%	0603	CGB3B1X5R1A475M055AC	TDK		
C6, C15, C16	3	0.1uF	Capacitor, Ceramic, 0.1UF 50V 10% X7R 0603	0603	C1608X7R1H104K080AA	TDK	C1608X7R1H104K080AA	TDK
C7	1	22uF	Capacitor, Ceramic, 22UF 25V 10% X5R 1210	1210	GRM32ER61E226KE15L	Murata	490-3889-1	Digi-Key
C9, C13, C31	3	1uF	CAP, CERM, 1uF, 16V, +/-10%, X5R, 0603	0603	C0603C105K4PACTU	Kemet		
C11, C25	2	4.7uF	Capacitor, Ceramic, 4.7UF 10V 20% X5R 0603	0603	CGB3B1X5R1A475M055AC	TDK		
C14	1	33pF	Capacitor, Ceramic, 33PF 50V 5% NP0 0603	0603	C1608C0G1H330J080AA	TDK	445-1275-1	Digi-Key
C18	1	4700pF	Capacitor, Ceramic, 4700pF, 50V, X7R, 10%	0603	C1608C0G1H472J080AA	TDK	445-7400-2-ND	Digi-Key
C19, C26	2	4.7uF	Capacitor, Ceramic, 4.7UF 10V 20% X5R 0603	0603	CGB3B1X5R1A475M055AC	TDK		
C21	1	0.01uF	Capacitor, Ceramic, 0.01uF, 50V, X7R, 10%	0603	C1608X7R1H103K080AA	TDK	445-1311-1	Digi-Key
C22	1	4.7uF	Capacitor, Ceramic, 4.7UF 10V 20% X5R 060	0603	CGB3B1X5R1A475M055AC	TDK		
C23, C33	2	10uF	CAP, CERM, 10uF, 10V, +/-10%, X5R, 1210	1210	C1210C106K8PACTU	Kemet		
C24	1	4.7nF	Capacitor, Ceramic, 4.7nF, 50V, X7R, 10%	0603	CGA3E2X7R1H472K080AD	TDK	445-8828-1	Digi-Key
C27, C28, C29, C30	4	100nF	CAP CER 0.1UF 50V 10% NP0 1210	1210 (3225 Metric)	C3225C0G1H104K250AA	TDK Corporation		
C32	1	100uF	Capacitor, Ceramic Chip, 100UF 6.3V 20% X5R 1206	1206	C3216X5R0J107M160AB	TDK	445-6008-1	TDK
D2, D3	2	BAT54	Diode, Schottky, 200-mA, 30-V	SOT23	BAT54	Vishay-Liteon		
D5	1	GRN	Diode. LED 2X1.2MM 568NM GN WTR CLR SMD	0805	APT2012SGC	Kingbright Corp	754-1131-1	Digi-Key
D7	1	RED	Diode. LED 2X1.2MM 640NM RD WTR CLR SMD	0805	APT2012SRCPRV	Kingbright Corp	754-1132-1-ND	Digi-Key
D9	1	OR	Diode. LED 2X1.2MM 601NM OR WTR CLR SMD	0805	APT2012SECK	Kingbright Corp	754-1130-1	Digi-Key
J1	1		Header, Male 2-pin, 100mil spacing,	0.100 inch x 2	PEC02SAAN	Sullins		
L2	1	6.3 uH	TX Coil	55x55 mm	760-308-111	Würth Elektronik		
Q4, Q7	2	BSS138	MOSFET, Nch, 50V, 0.22A, 3.5 Ohm	SOT23	BSS138	Fairchild		
Q8	1	DTC114EUA	Transistor, Digital NPN, 50 V, 100 mA	SOT-323	DTC114EUA	Rohm		
R1, R3	2	1.0	Resistor, Chip, 1.0 OHM 1/10W 5% 0603 SMD	0603	RC0603JR-071RL	Yageo	311-1.0GRCT	Digi-Key
R2, R47	2	10.0	Resistor, Chip, 10 OHM 1/10W 5% 0603 SMD	0603	RC0603JR-0710RL	Yageo	311-10GR	Digi-Key
R5, R18, R19, R40, R41, R43, R52	7	10.0k	RES 10.0K OHM 1/10W 1% 0603 SMD	0603	RC0603FR-0710KL	Yageo		
R6	1	100k	Resistor, Chip, 100K OHM 1/10W 1% 0603 SMD	0603	RC0603FR-07100KL	Yageo	311-100KHRTR	Digi-Key
R7	1	22	Resistor, Chip, 22 OHM 1/8W 5% 0805 SMD	0805	RC0805JR-0722RL	Yageo	311-22ARCT	Digi-Key
R8, R9, R11, R45	4	10k	RES 10.0K OHM 1/10W 1% 0603 SMD	0603	RC0603FR-0710KL	Yageo		
R10	1	76.8k	Resistor, Chip, 76.8K OHM 1/10W 1% 0603 SMD	0603	RC0603FR-0776K8L	Yageo	311-76.8KHRCT	Digi-Key
R14	1	12.1k	Resistor, Chip, 12.1K OHM 1/10W 1% 0603 SMD	0603	RC0603FR-0712K1L	Yageo	311-12.1KHRCT	Digi-Key
R15, R16, R33	3	475	Resistor, Chip, 475 OHM 1/10W 1% 0603 SMD	0603	RC0603FR-07475RL	Yageo	311-475HRCT, 311-475HRC	Digi-Key

⁽¹⁾ Unless otherwise noted in the Alternate PartNumber and/or Alternate Manufacturer columns, all parts may be substituted with equivalents.

bq500212A List of Materials⁽¹⁾ (continued)

Designator	Quantity	Value	Description	Package Reference	Part Number	Manufacturer	Alternate Part Number	Alternate Manufacturer
R17	1	3.6k	Resistor, Chip, 3.60K OHM 1/10W 1% 0603 SMD	0603	RC0603FR-073K6L	Yageo	311-3.60KHR	Digi-Key
R23	1	42.2k	Resistor, Chip, 42.2K OHM 1/10W 1% 0603 SMD	0603	RC0603FR-0742K2L	Yageo	311-42.2KHRCT	Yageo
R24	1	48.7k	Resistor, Chip, 1/16W, 1%	0603	RC0603FR-0748K7L	Yageo	311-48.7KHRCT-ND	Digi-Key
R25, R28, R30	3	523k	Resistor, Chip, 523K OHM 1/10W 1% 0603 SMD	0603	RC0603FR-07523KL	Yageo	311-523KHRCT	Digi-Key
R26, R29, R36, R37	4	10	Resistor, Chip, 10 OHM 1/10W 5% 0603 SMD	0603	RC0603JR-0710RL	Yageo	311-10GR, 311-10GRCT, 311-10GRCT, 311-10GRCT	Digi-Key
R27	1	56.2k	Resistor, Chip, 56.2K OHM 1/10W 1%	0603	RC0603FR-0756K2L	Yageo		
R32	1	.020 Ohm	Resistor, Chip, 0.02 OHM 1/2W 1% 0805 SMD	0805	ERJ-6BWFR020V	Panasonic Electronic Components		
R46, R55	2	1.0k	Resistor, Chip, 1.00K OHM 1/10W 1% 0603 SMD	0603	RC0603FR-071KL	Yageo	311-1.00KH	Digi-Key
R48	1	3.6k	Resistor, Chip, 3.60K OHM 1/10W 1% 0603 SMD	0603	RC0603FR-073K6L	Yageo	311-3.60KHRCT	Digi-Key
R50	1	475	Resistor, Chip, 475 OHM 1/10W 1% 0603 SMD	0603	RC0603FR-07475RL	Yageo	311-475HRCT	Digi-Key
R53	1	2.0MEG	Resistor, Chip, 2.00M OHM 1/10W 1% 0603 SMD	0603	RC0603FR-072ML	Yageo	311-2.00MHRCT	Digi-Key
R99	1	53.6k	Resistor, Chip, 53.6K OHM 1/10W 1%	0603	RC0603FR-0753K6L	Yageo		
RT1	1	10.0k ohm	Thermistor NTC, 10.0k ohm, 1%, 0603	0603	NTCG163JF103F	TDK		
TP1, TP2, TP4	3		Test Point, White, Thru Hole	0.125 x 0.125 inch	5012	Keystone		
U1	1	BQ500212ARGZ	IC, Qi Compliant Wireless Power Transmitter Manager	VQFN	BQ500212ARGZ	TI		None
U2, U3	2	CSD97376Q4M	IC, Synchronous Buck NexFET Power Stage	QFN	CSD97376Q4M	TI		None
U5	1	TLV70033DDC	IC REG LDO 3.3V 200mA SOT-23-5	SOT	TLV70033DDC	TI		Digi-Key
U7	1	INA199A1	IC, Current Monitor, High or Low Side Measurement, Bi-Directional Zero-Drift Series	SC-70	INA199A1DCKR	TI		None

Revision History

Changes from A Revision (January 2014) to B Revision	Page
• Changed Figure 1 to correct an error at U7 and part numbers on U2 and U3	3

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

Revision History

Changes from Original (August 2013) to A Revision	Page
• Changed Figure 1	3
• Changed Figure 1	4

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

IMPORTANT NOTICE

Texas Instruments Incorporated and its subsidiaries (TI) reserve the right to make corrections, enhancements, improvements and other changes to its semiconductor products and services per JESD46, latest issue, and to discontinue any product or service per JESD48, latest issue. Buyers should obtain the latest relevant information before placing orders and should verify that such information is current and complete. All semiconductor products (also referred to herein as "components") are sold subject to TI's terms and conditions of sale supplied at the time of order acknowledgment.

TI warrants performance of its components to the specifications applicable at the time of sale, in accordance with the warranty in TI's terms and conditions of sale of semiconductor products. Testing and other quality control techniques are used to the extent TI deems necessary to support this warranty. Except where mandated by applicable law, testing of all parameters of each component is not necessarily performed.

TI assumes no liability for applications assistance or the design of Buyers' products. Buyers are responsible for their products and applications using TI components. To minimize the risks associated with Buyers' products and applications, Buyers should provide adequate design and operating safeguards.

TI does not warrant or represent that any license, either express or implied, is granted under any patent right, copyright, mask work right, or other intellectual property right relating to any combination, machine, or process in which TI components or services are used. Information published by TI regarding third-party products or services does not constitute a license to use such products or services or a warranty or endorsement thereof. Use of such information may require a license from a third party under the patents or other intellectual property of the third party, or a license from TI under the patents or other intellectual property of TI.

Reproduction of significant portions of TI information in TI data books or data sheets is permissible only if reproduction is without alteration and is accompanied by all associated warranties, conditions, limitations, and notices. TI is not responsible or liable for such altered documentation. Information of third parties may be subject to additional restrictions.

Resale of TI components or services with statements different from or beyond the parameters stated by TI for that component or service voids all express and any implied warranties for the associated TI component or service and is an unfair and deceptive business practice. TI is not responsible or liable for any such statements.

Buyer acknowledges and agrees that it is solely responsible for compliance with all legal, regulatory and safety-related requirements concerning its products, and any use of TI components in its applications, notwithstanding any applications-related information or support that may be provided by TI. Buyer represents and agrees that it has all the necessary expertise to create and implement safeguards which anticipate dangerous consequences of failures, monitor failures and their consequences, lessen the likelihood of failures that might cause harm and take appropriate remedial actions. Buyer will fully indemnify TI and its representatives against any damages arising out of the use of any TI components in safety-critical applications.

In some cases, TI components may be promoted specifically to facilitate safety-related applications. With such components, TI's goal is to help enable customers to design and create their own end-product solutions that meet applicable functional safety standards and requirements. Nonetheless, such components are subject to these terms.

No TI components are authorized for use in FDA Class III (or similar life-critical medical equipment) unless authorized officers of the parties have executed a special agreement specifically governing such use.

Only those TI components which TI has specifically designated as military grade or "enhanced plastic" are designed and intended for use in military/aerospace applications or environments. Buyer acknowledges and agrees that any military or aerospace use of TI components which have **not** been so designated is solely at the Buyer's risk, and that Buyer is solely responsible for compliance with all legal and regulatory requirements in connection with such use.

TI has specifically designated certain components as meeting ISO/TS16949 requirements, mainly for automotive use. In any case of use of non-designated products, TI will not be responsible for any failure to meet ISO/TS16949.

Products

Audio	www.ti.com/audio
Amplifiers	amplifier.ti.com
Data Converters	dataconverter.ti.com
DLP® Products	www.dlp.com
DSP	dsp.ti.com
Clocks and Timers	www.ti.com/clocks
Interface	interface.ti.com
Logic	logic.ti.com
Power Mgmt	power.ti.com
Microcontrollers	microcontroller.ti.com
RFID	www.ti-rfid.com
OMAP Applications Processors	www.ti.com/omap
Wireless Connectivity	www.ti.com/wirelessconnectivity

Applications

Automotive and Transportation	www.ti.com/automotive
Communications and Telecom	www.ti.com/communications
Computers and Peripherals	www.ti.com/computers
Consumer Electronics	www.ti.com/consumer-apps
Energy and Lighting	www.ti.com/energy
Industrial	www.ti.com/industrial
Medical	www.ti.com/medical
Security	www.ti.com/security
Space, Avionics and Defense	www.ti.com/space-avionics-defense
Video and Imaging	www.ti.com/video

TI E2E Community

e2e.ti.com