26-V, 500-kHz Synchronous Buck Controller Demo Board

DESCRIPTION

The demo board shows how SiP12201A works as a central control unit in a high efficiency, high current dc-to-dc buck converter.

This board incorporates the SiP12201A buck controller IC, the Si7392DP high-side and Si7892DP low-side N-Channel power MOSFETs that SiP12201A drives, a place for an optional 3 A Schottky diode, the output L-C filter, input power supply with decoupling capacitors, and required compensation components.

This Board can be used as an evaluation vehicle for this SiP12201A buck controller IC.

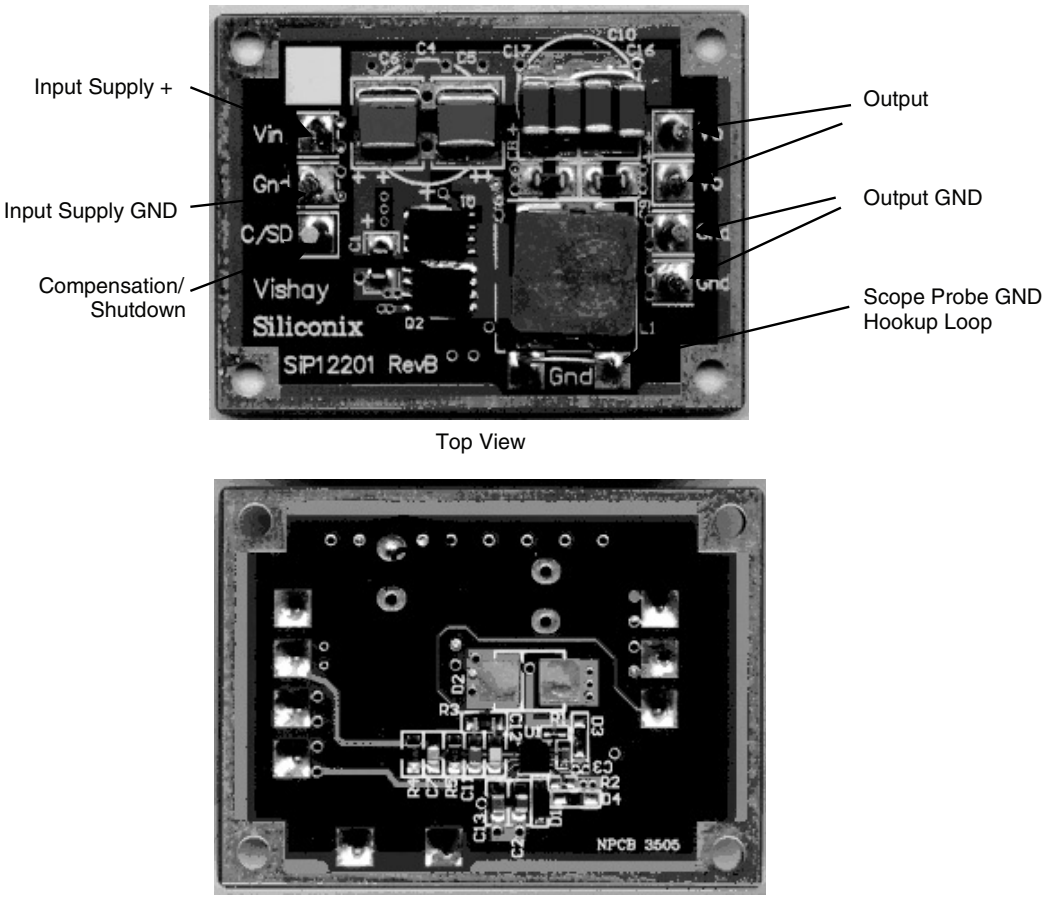
FEATURES

- SiP12201A demo board includes the required components to evaluate the IC performance in a system
- Easy hook-up to demonstrate system performance using this IC
- 4 layer PCB capable of operating up to 10 A with forced air-cooling

APPLICATIONS

- High current, high efficiency, high frequency dc-to-dc synchronous buck converters
- Bus converters
- Point of load converter
- Computer, telecoms, set-top boxes

DEMONSTRATION BOARD PHOTO AND HOOK UP



Top View

Bottom View

Figure 1.

SCHEMATIC DIAGRAM

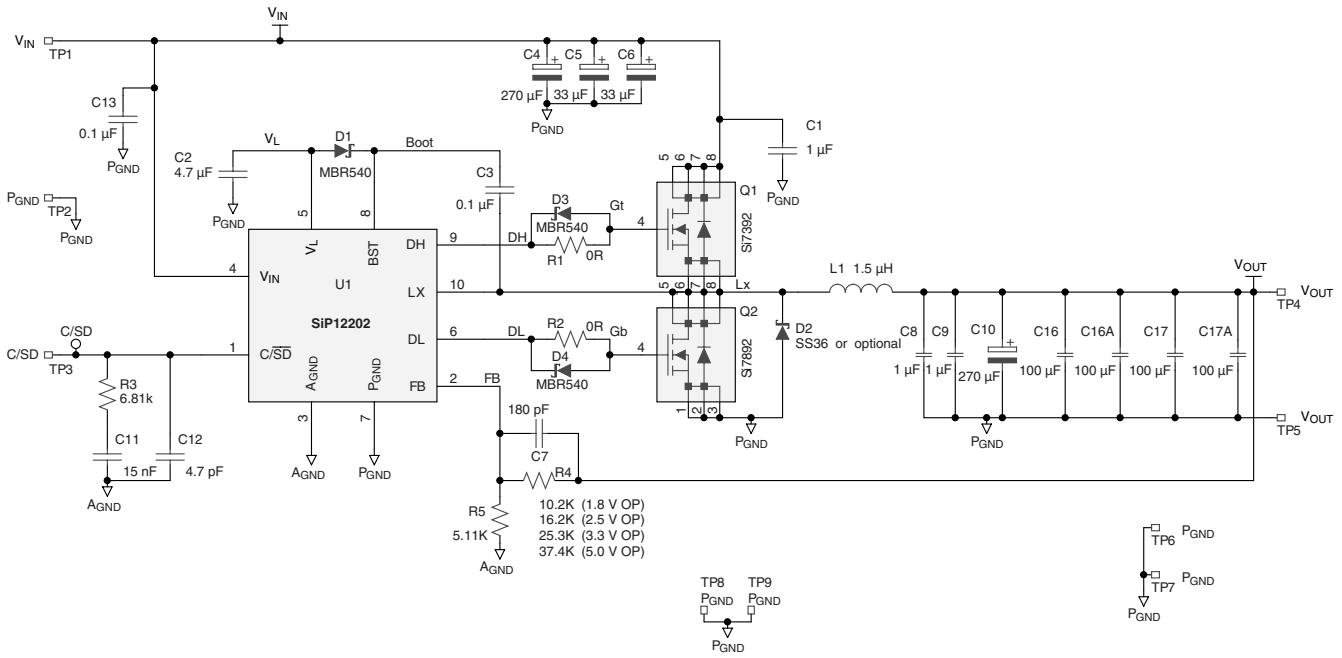


Figure 2.

BILL OF MATERIAL						
Item	**Qty**	**Designator**	**Part Type**	**Description**	**Footprint**	**Manufacturer**
1	1	R3	CRCW0803091RF	Resistor, 1%, 3.09 kΩ	0805	VISHAY/DALE
2	1	R4	CRCW08052322RF	Resistor, 1%, 23.2 kΩ (3.3 V)	0805	VISHAY/DALE
3	1	R5	CRCW08055111RF	Resistor, 1%, 5.11 kΩ	0805	VISHAY/DALE
4	3	C1, C8, C9	VJ1206V105MXAC	CAP, CER, 1 µF, 50 V, 20 %	1206	VISHAY/VITRAMON
5	1	C2	GRM43ER71E475MA01L	CAP, CER, 4.7 µF, 25 V, 20 %	1812	MURATA
6	1	C3	VJ0603Y104MXAC	CAP, CER, 0.1 µF, 50 V, 20 %	0603	VISHAY/VITRAMON
7	1	C11	VJ0805Y333KXAC	CAP, CER, 33 nF, 50 V, 10 %	0805	VISHAY/VITRAMON
8	1	C12	VJ0805A8R2DXAC	CAP, CER, 8.2 pF, 50 V, 10 %	0805	VISHAY/VITRAMON
9	1	C13	VJ0805Y104MXAC	CAP, CER, 0.1 µF, 50 V, 20 %	0805	VISHAY/VITRAMON
10	2	C5, C6	594D336X_035R2T	CAP, TAN, 33 µF 35 V	595D_R	VISHAY/SPRAGUE
11	4	C16, C16A, C17, C17A	490-1923-1-ND	CAP, CER, 100 µF, 6.3 V	1812	DIGI-KEY
12	1	L1	IHLP2525CZER1R5M01	1.5 µH Power Inductor	IHLP	VISHAY/DALE
13	1	D1	MBR0540T1	Schottky Diode, 0.5 A, 40 V	SOD-123	ON SEMICONDUCTOR
14	1	D2	SS36	Schottky Diode, 3 A, 60 V	SMC	VISHAY SEMICONDUCTOR
15	1	Q1	Si7392DP	N-FET, 30 V, 25 A	PPak SO8	VISHAY/SILICONIX
16	1	Q2	Si7892DP	N-FET, 30 V, 15 A	PPak SO8	VISHAY/SILICONIX
17	1	U1	SiP12201ADM	POWER IC	MLP33-10	VISHAY/SILICONIX
18	7	TP1-7	6821-000010000080	Test Point - PIN HEADER	TP1	DIGI-KEY
19	1	TP8-9	Bus Wire	GND LOOP	TP1	MULTI-SOURCE
20	1	C7	0805BP181XKMCT	CAP, CER, 180 pF, 10 V, 10 %	0805	VISHAY/VITRAMON
Other Optional Components - Not required or inserted						

BILL OF MATERIAL						
Item	Qty	Designator	Part Type	Description	Footprint	Manufacturer
21	2	R1, R2	10 Ω	Resistor 1 %	0805	VISHAY/DALE
22	2	D3, D4	MBR0540T1	Schottky Diode, 0.5 A, 40 V	SOD-123	ON SEMICONDUCTOR
23	2	C4, C10	94SP277X0016FBP	CAP, OSCON, 270 µF, 16 V	Radial 0.2	VISHAY/SPRAGUE
24	1	R4	CRCW08051622RF	Resistor, 1 %, 16.2 kΩ (2.5 V)	0805	VISHAY/DALE
25	1	R4	CRCW08053742RF	Resistor, 1 %, 37.4 kΩ (5.0 V)	0805	VISHAY/DALE

Demo Board Operation

- To use the demo board, connect a 5 to 18 V power supply to the input supply and GND pins
- A load resistor or electronic load should be connected to the Output and GND pins, in order to simulate typical loaded conditions for this type of circuit

Choice of Components

The purpose of this PC board is to evaluate the SiP12201A IC, therefore there are various optional component choices and configurations possible.

The board is designed to be able to accept electrolytic, Oscon, tantalum or ceramic capacitors as the input and output filters (for C4, C5, C6, C10, C16, C17) thus allowing the circuit designer to substitute his preference of cap according to cost/performance constraints. The footprints have been made especially large and versatile to allow for this.

The MOSFET footprints are designed to be able to accept both SO-8 and PowerPAK devices, and PowerPAK 1212 package size devices can also be used here.

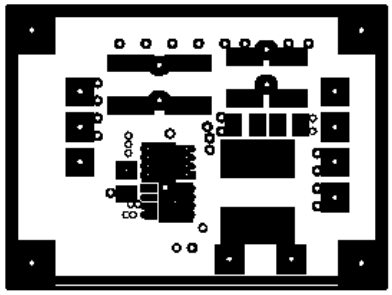
The inductor footprint is designed to allow for a variety of different devices to be able to be inserted here.

D2 has a footprint for an optional 3 A Schottky diode, which can help reduce switching noise, enhance MOSFET intrinsic diode current capability, and slightly improve efficiency.

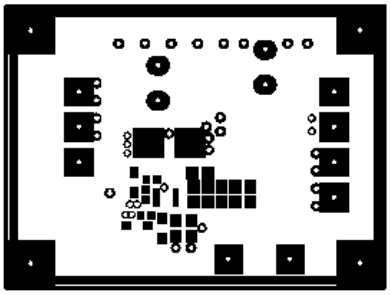
The locations of gate driver tailoring elements R1, D3, R2 and D4 are places, where resistors and diodes may be inserted so that the high- and low-side MOSFETs' turn-on and turn-off times can be adjusted.

The footprint of C7 is included to allow for adding an additional zero in the feedback compensation, for dealing with low ESR output capacitors (such as ceramics)

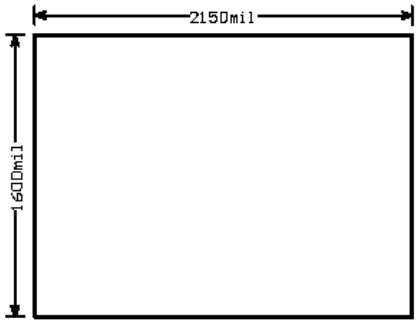
Printed Circuit Board



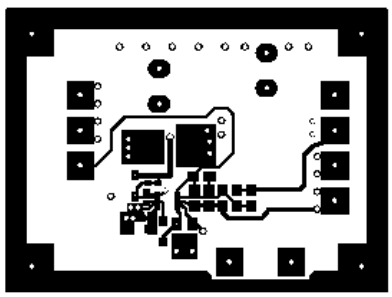
SiP12201 Rev B Top Solder Mask



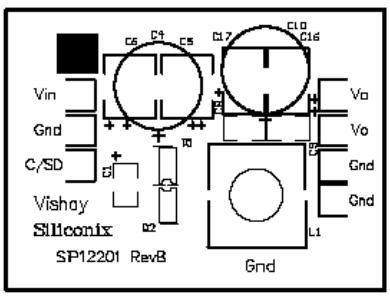
SiP12201 Rev B Bottom Solder Mask



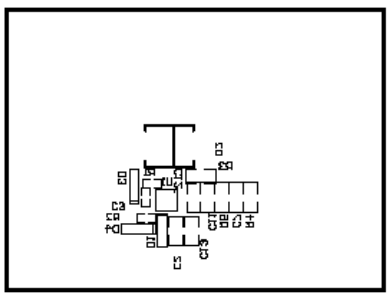
SiP12201 Rev B Mechanical Layer 3



SiP12201 Rev B Bottom Layer



SiP12201 Rev B Top Overlay



SiP12201 Rev B Bottom Overlay

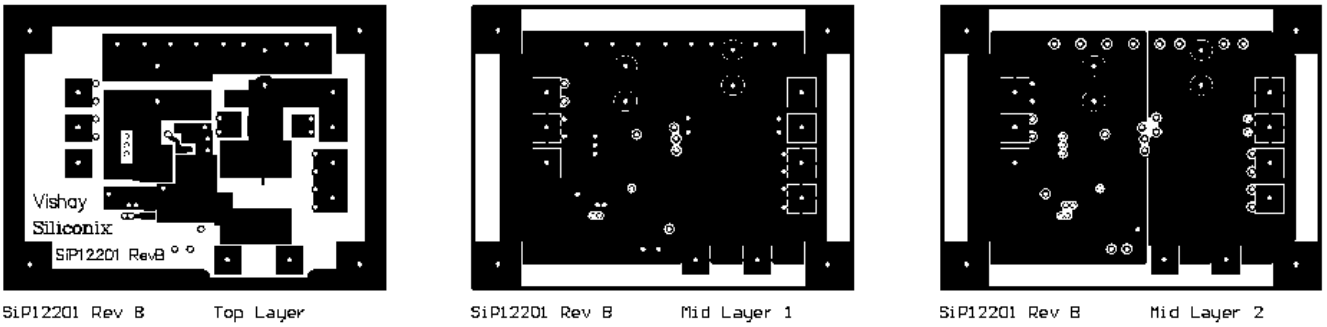
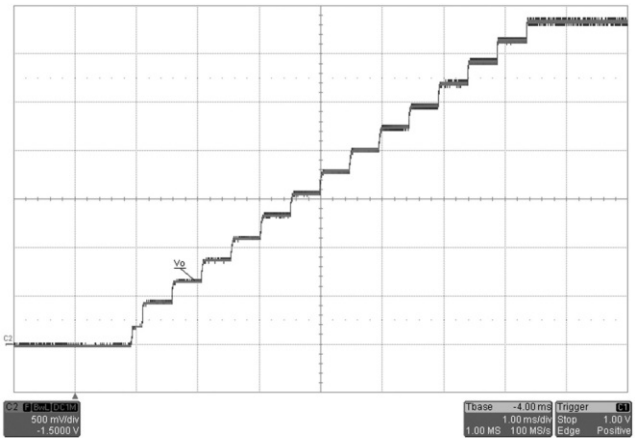


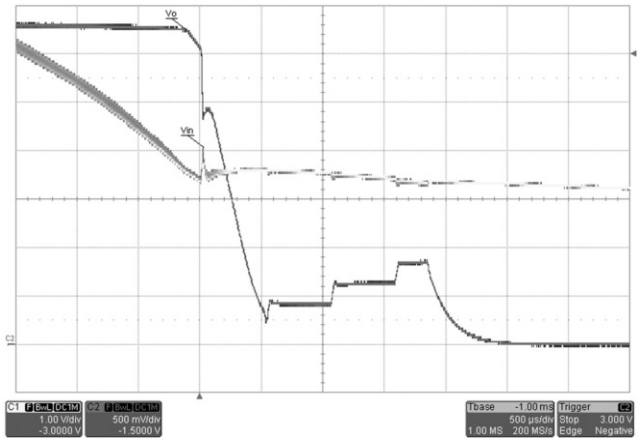
Figure 3.

ORDERING INFORMATION		
Part Number	**Marking**	**Temperature Range**
SiP12201DB		- 40 °C to 85 °C

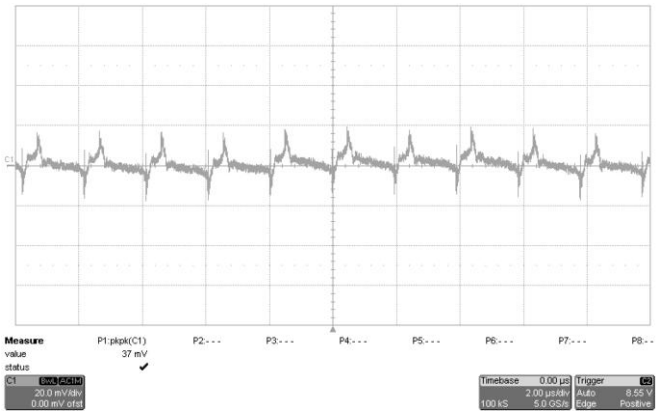
TYPICAL WAVEFORMS



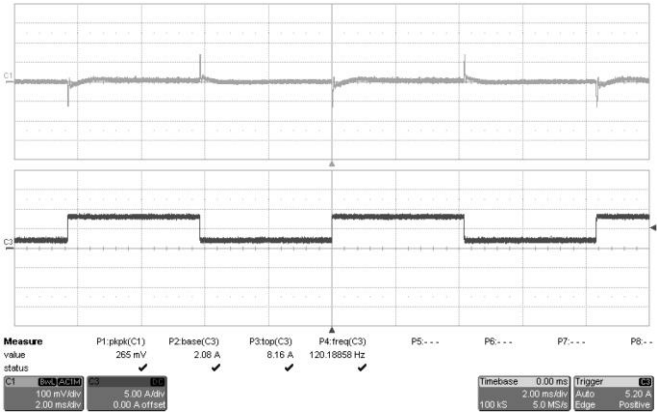
V_{OUT} = 3.3 V at 10 A
V_{OUT} Start Up Waveform



V_{OUT} = 3.3 V at 10 A
V_{OUT} Shut Down Waveform

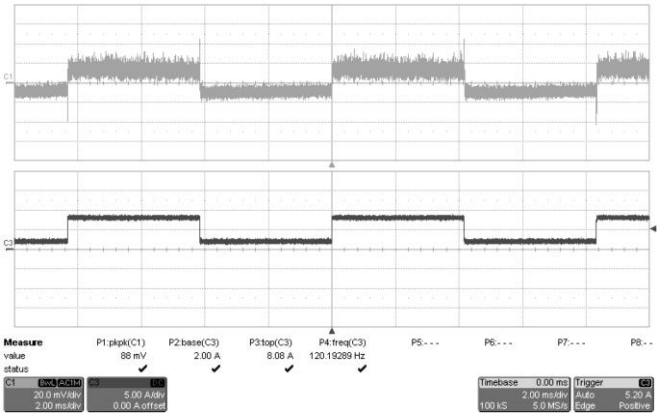


V_{IN} = 15 V, V_{OUT} = 3.3 V at 10 A
Output Ripple Voltage



V_{IN} = 5.5 V, V_{OUT} = 3.3 V at 2 A ↔ 8 A with 2.5 A/µs Slew Rate
Transient Response

TYPICAL WAVEFORMS



V_{IN} = 15 V, V_{OUT} = 3.3 V at 2 A ↔ 8 A
with 2.5 A/µs Slew Rate Transient Response

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