ADP1043A Evaluation Board
Forward Active Clamp

Reference Design **PRD 1168**

FEATURES

Forward Active Clamp with Synchronous rectifier
Voltage Feedback Loop
Dimensions: 58.4mm×61mm×12mm (Half Brick)
Input Voltage Range: -34V to -60V DC
Output Voltage/Current: 18V/6A DC
95% Max. Efficiency
I2C serial interface
Software GUI

PRD 1168 OVERVIEW

The PRD 1168 is designed for evaluating ADP1043A application using forward active clamp topology. The ADP1043A is a secondary side power supply controller IC designed to provide all the functions that are typically needed in an AC-DC or isolated DC-DC application.

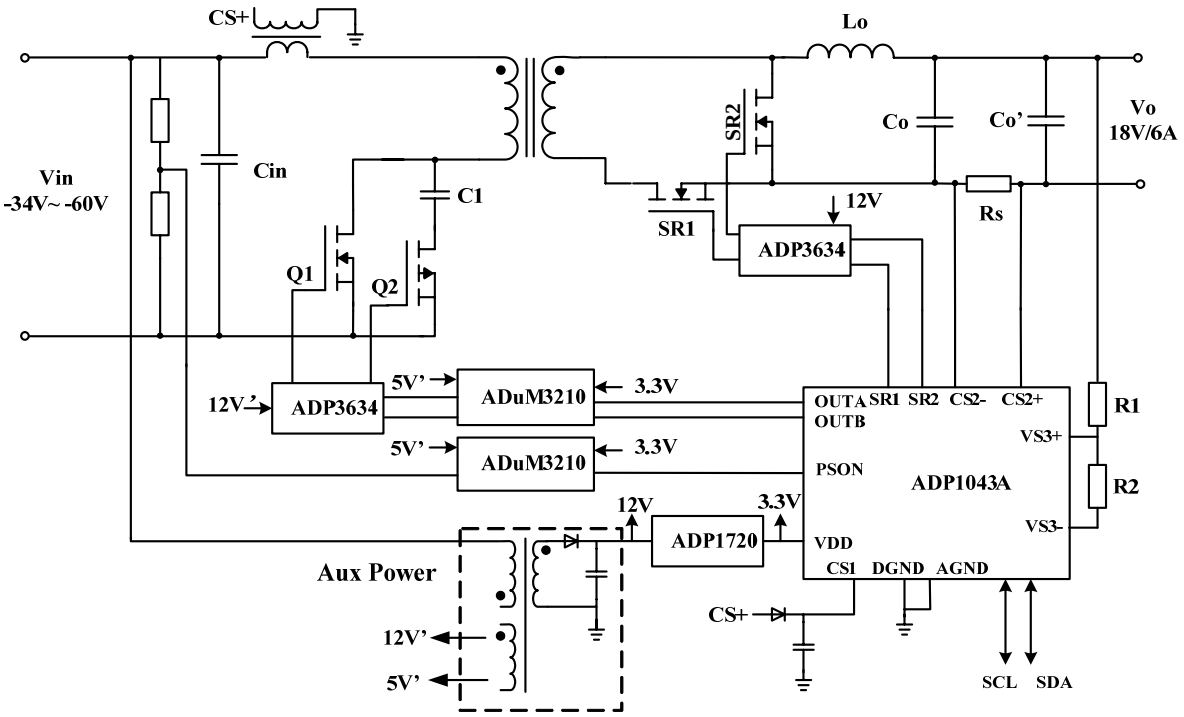
The board output 18V/6A DC from a -34to -60VDC input. The maximum efficiency can reach 95%. It has versatile protection, such as OCP, SCP, OTP etc. And the protection mode also can be programmed through GUI.

Using this board and its accompanying software, the ADP1043A can be interfaced to any PC running Windows 2000, Windows NT, Windows XP or Windows Vista via the computer's USB port.

EVALUATION EQUIPMENT

To evaluate this demo board, a PC, oscilloscope, electronic load and a DC power source are required.

Figure 1 Forward Active Clamp Topology.



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EVALUATION BOARD HARDWARE

SPECIFICATIONS

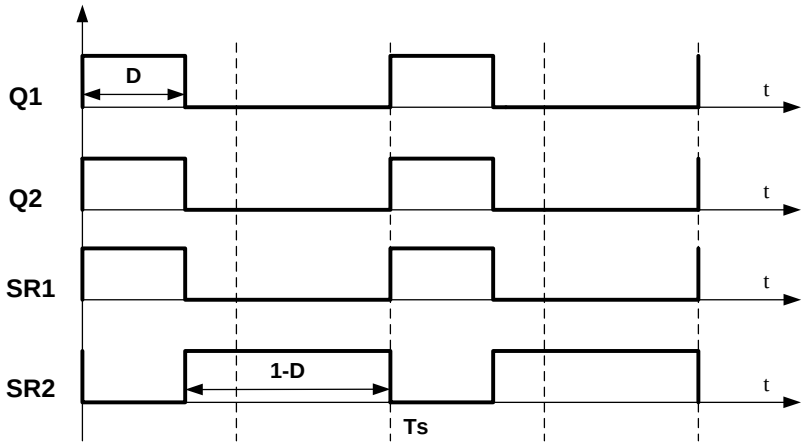
- Nominal input voltage: -48 DC
- Input voltage range: -34~-60V DC
- Nominal output voltage: 18V DC
- Nominal output current: 6A DC
- Switching frequency: 180kHz
- Efficiency: 95% at full load

TOPOLOGY AND OPERATION WAVEFORMS

A typical DC/DC switching power supply is the basis for the eval board. It is a forward active clamp with synchronous rectifier topology, shown as Figure 1. The forward active clamp converter is an isolated converter, which operates with variable duty cycle which can be over 50%, so that a wide range input converter can provide high efficiency under the conditions of regulated output.

The primary side consists of the input terminals, main switch, aux switch (PMOS) and main transformer. The gate driver signal for the switches comes from the ADP1043A, through the iCoupler and the drivers. There is also a current transformer (CT), to transmit the primary side current information to the ADP1043A on the secondary side.

Figure 2 Driver Signal



The secondary side power stage consists of the synchronous rectifiers, inductor, output capacitor and sensing resistor. This provides 18V @ 6A at the output. The ADP1043A is located on the secondary side. The ADP1043A provides the feedback signal that is used to regulate the voltage, limit the current, allow current sharing and shutdown to be implemented. Low side current sensing is used.

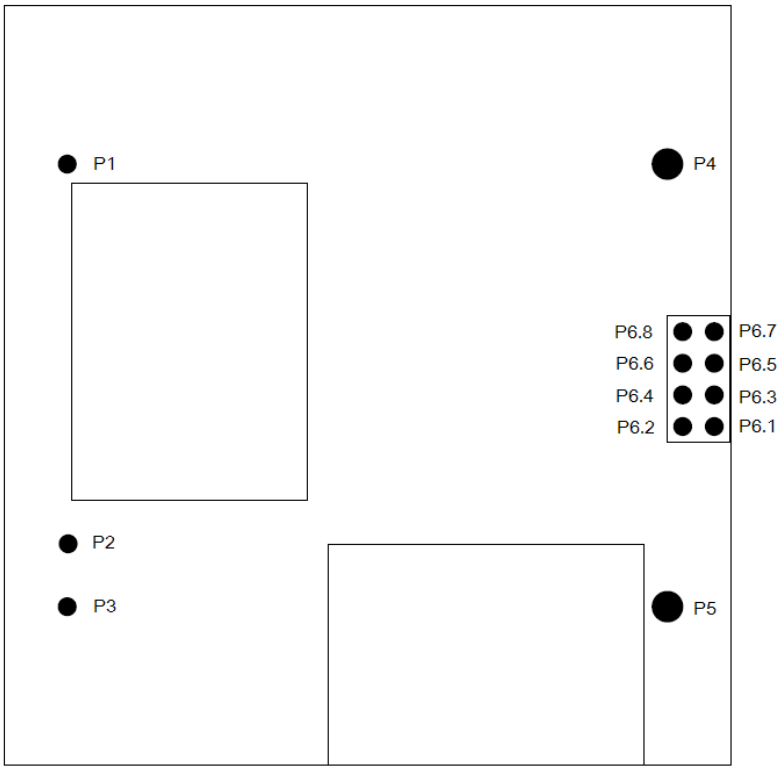
There is a 8pins connector on the board. 4pins of the connector is for I2C. This allows the PC software to communicate with the eval board through the USB port of the PC. The user can readily change register settings on the ADP1043A this way, and also monitor the status registers.

The eval board is designed with a 2mOhm RSENSE resistor. The power supply is designed to support a maximum continuous output of 6 A.

A variable load is required to perform a thorough evaluation. The output voltage is available between P4 and P5. This is also where the load should be connected.

The power supply will be in Continuous Conduction Mode. If the synchronous rectifiers are enabled, the power supply will remain in CCM mode over the full load range.

Figure 3 Pin Connection Diagram (Bottom View)



CONNECTORS

The connections to the eval board are shown in Table 1.

Table 1. Power module pin assignment

Pin	Designation	Eval Board Function
P1	Vin-	Negative Input
P2	On/Off	Remote Control
P3	Vin+	Positive Input
P4	Vo-	Negative Output
P5	Vo+	Positive Output
P6	Interface	Interface

INTERFACE CONNECTOR

The signal pins are P6.1~P6.8 as shown in Table 2. Among them P6.7, P6.5, P6.3 and P6.1 are connected to USB dongle.

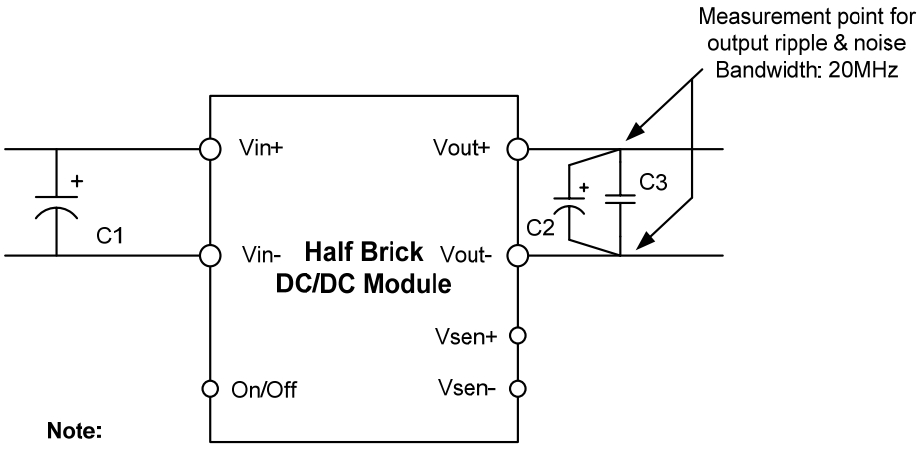
Table 2. Signal pins

Pin	Designation	Pin	Designation
P6.1	GND	P6.5	SCL
P6.2	PGOOD	P6.6	Vsen-
P6.3	SDA	P6.7	5V
P6.4	Vsen+	P6.8	Address

Figure 3 shows the photo of eval board. Figure 4 provides a typical circuit diagram which details the filtering for normal operation and output ripple test

Figure 4 Eval Board Picture(Bottom View)

Figure 5 Test Configuration for the Evaluation Board



Note:

1. C1 100uF/100V
2. C2 470uF/25V
3. C3 MLCC 10uF

TEST RESULTS

Figure 6 Efficiency at nominal output voltage vs. load current for minimum, nominal, and maximum input voltage at 25°C.

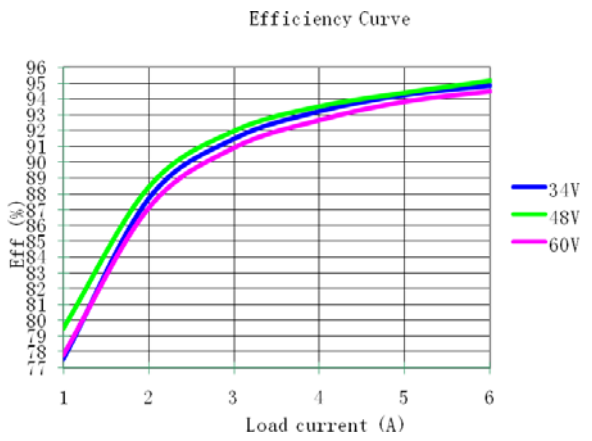


Figure 7 Output voltage response to step-change in load current (25%-75%-25% of Iout(max): dI/dt = 1A/µs). Ch 2: Vout (500mV/div), Ch 4: Iout (2A/div).

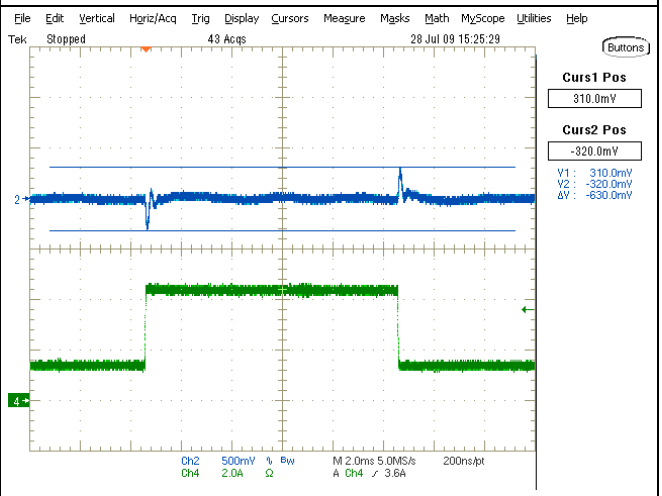


Figure 8 Output voltage ripple at nominal input voltage and no load current . Ch 2: Vout (50mV/div), Bandwidth: 20 MHz.

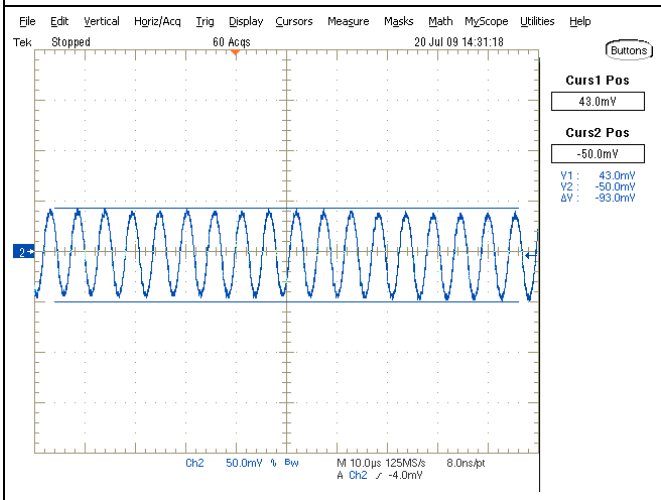


Figure 9 Output voltage ripple at nominal input voltage and nominal load current. Ch 2: Vout (50mV/div), Bandwidth: 20 MHz.

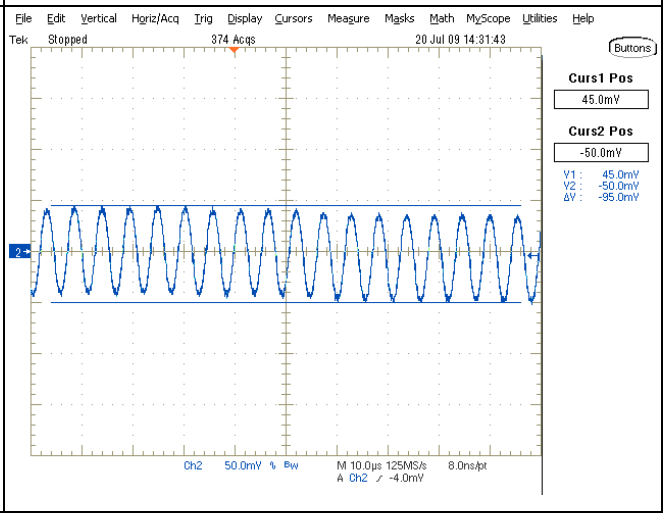


Figure 10 Turn-on transient at nominal input voltage and no load current. Ch 2: Vout (5V/div), Ch 4: Load Current (5A/div).

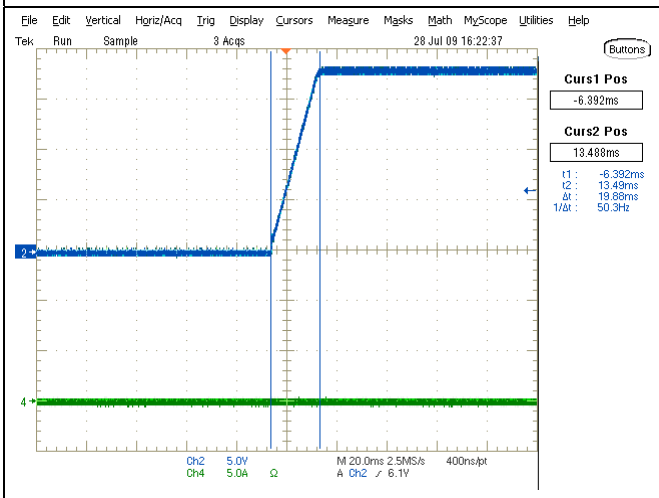


Figure 11 Turn-on transient at nominal input voltage and nominal load current. Ch 2: Vout (5V/div), Ch 4: Load Current (5A/div).

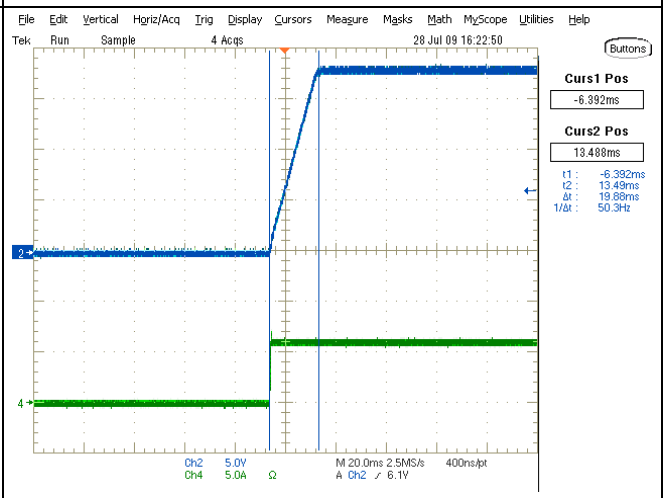


Figure 12 Output over current protection function. Increase load current at nominal input voltage to over current limit. Ch 2: Vout (5V/div), Ch 4: Load Current (5A/div).

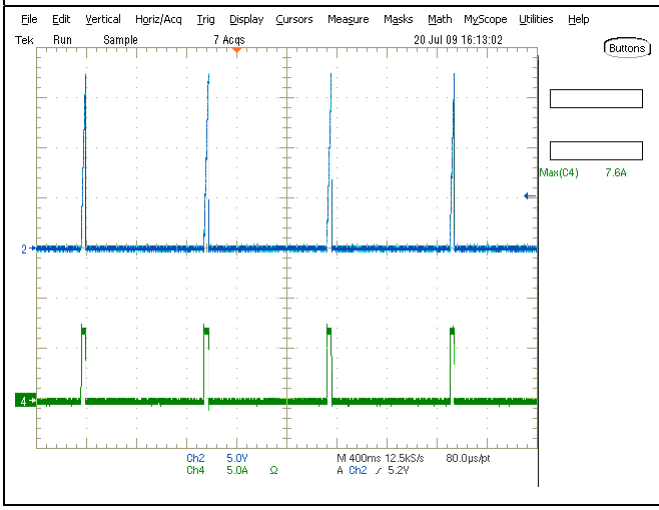
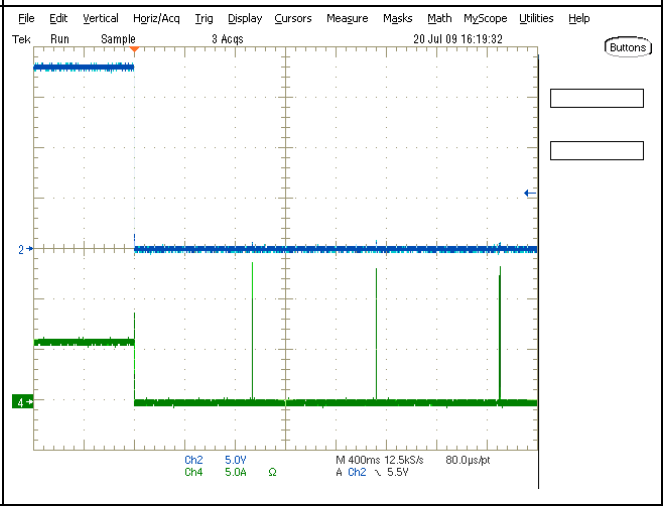


Figure 13 Output short circuit protection function. Turn on at nominal input voltage and rated load current then short circuit. Ch 2: Vout (5V/div), Ch 4: Load Current (5A/div).



GETTING STARTED

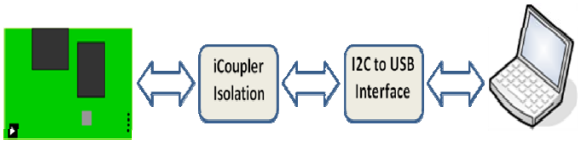
EQUIPMENT

- DC Power Supply 0-60V (Sorensen DLM150-20E)
- Electronic Load capable of 18V/6A (Chroma 63112)
- Oscilloscope (Tektronix TDS5054B)
- PC with ADP1043A GUI installed
- Precision Digital Multi-meters (Agilent 34401A)
- Current Probe for measuring up to 6A DC (Tektronix TCP202)

SETUP

NOTE: DO NOT CONNECT THE USB CABLE TO THE EVAL BOARD UNTIL AFTER THE SOFTWARE HAS BEEN INSTALLED.

Figure 14 Connection with Computer

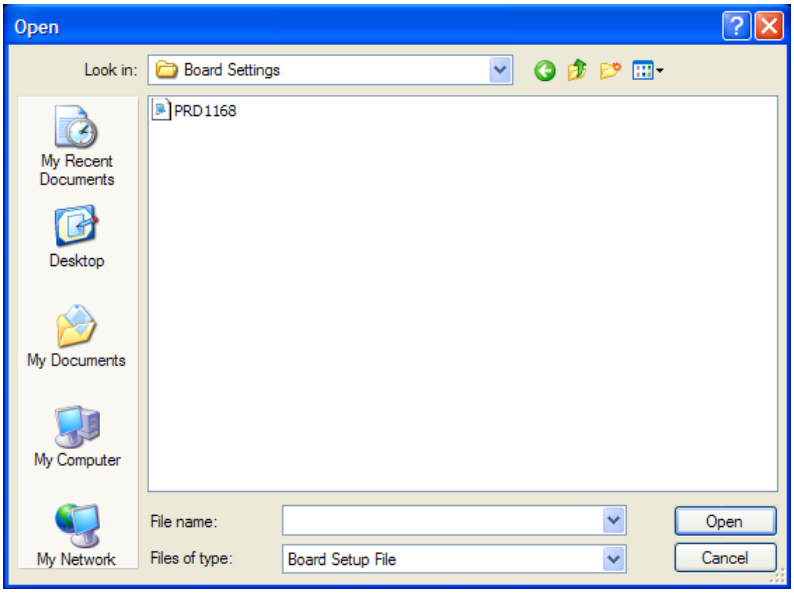


1. Install the ADP1043A software. Refer to the Quick Start Guide that comes on the CD (If already installed, skip to the next step).
2. Connect the evaluation board to the USB port on the computer, using the "USB to I2C interface" dongle. If the dongle driver was not previously installed, run the software from the Start Menu under "Programs/ADI/ADP1043A".
3. The software should report that the ADP1043A has been located on the board. Click Finish to proceed to the Main Software Interface Window.

Figure 15 Getting Started

4. Click on the  icon and "Load Board Setting": select the "PRD1168.43b file". This file contains all the board information including values of shunt and voltage dividers

Figure 16 Load Board Setting



5. The ADP1043A is pre-programmed and calibrated, so there is no programming necessary.
6. Connect an electronic load at the output.
7. For the input voltage source, a DC power supply can be used. The input voltage range is -34V to -60 VDC (-48VDC is recommended). This input voltage is the signal which will be regulated to provide a 18V/6A supply at the output. Set the voltage to -48VDC.
8. The eval board should now up and running, and ready to evaluate. The output should be 18 VDC.

BOARD EVALUATION

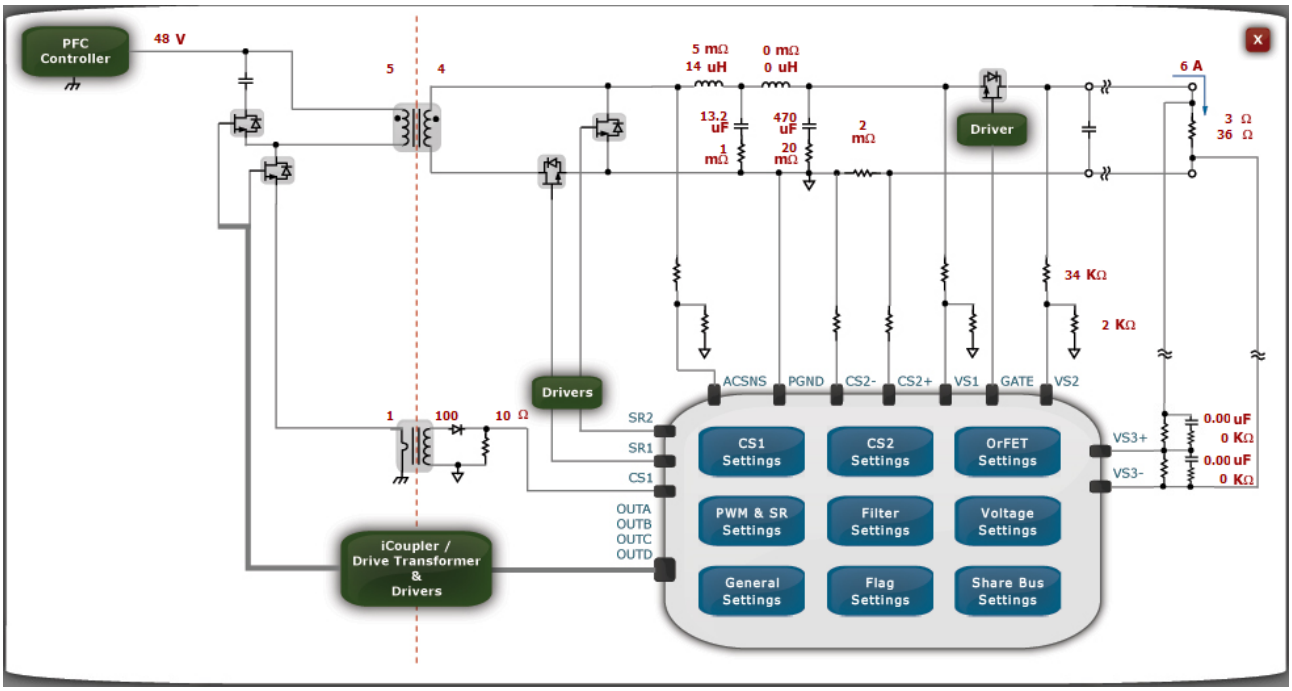
The ADP1043A is optimized for improving the power supply design and evaluation process. The goal of this eval kit is to allow the user to get an insight into the flexibility offered by the extensive programming options offered by the ADP1043A.

The ADP1043A performs many monitoring and housekeeping functions in the power supply. The eval board allows the user to simulate various events that could affect the ADP1043A in a working system. The user can monitor how the ADP1043A handles this event in many ways. One way is to use an oscilloscope and/or multi-meter, and probe the eval board, to see various conditions in the system. The user can also use the software to monitor the conditions of the ADP1043A, and how it has reacted to the event. The following section gives some experiments that the user might typically evaluate.

LINE AND LOAD VOLTAGE REGULATION

Vary the input voltage from -34VDC to -60VDC. The output voltage remains18V. Vary the load current from 0 to 6A. The output voltage remains 18V. The line and load regulation are less than ±1%.

Figure 17 Graphical User Interface



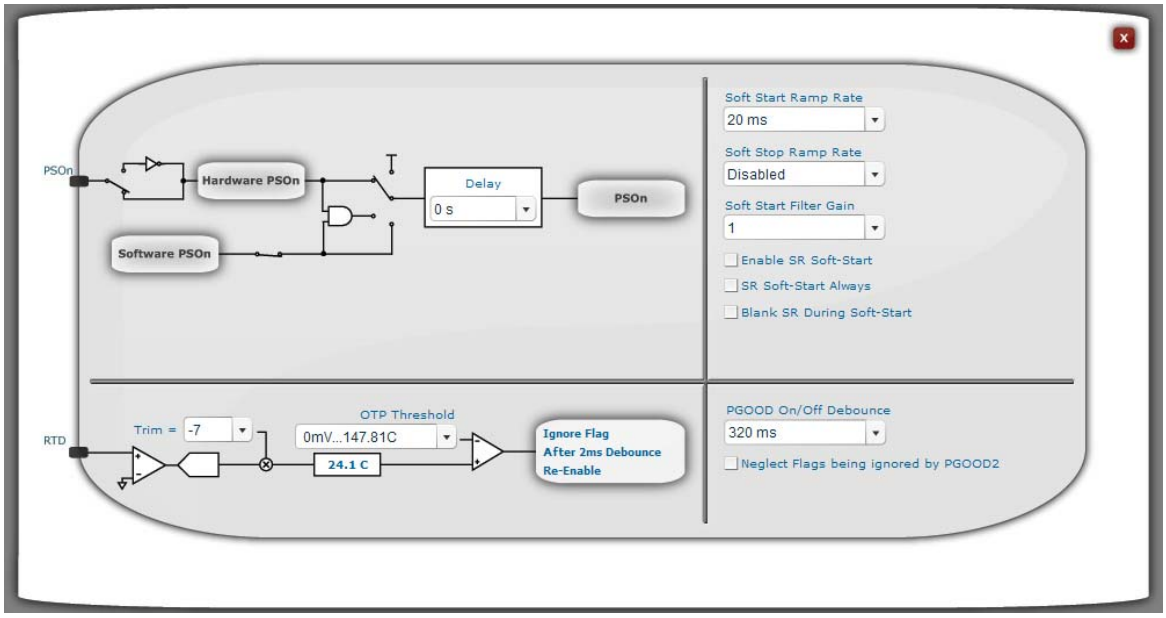
OUTPUT VOLTAGE SETTING

The output voltage setting is programmable. Using the Voltage Setting window in the software, adjust the output voltage (using the o/p trim menu). Monitor the actual output voltage of the power supply using the software or a multi-meter, or looking at the output voltage reading on the electronic load. It should match the programmed value. This will be used to calibrate the power supply in the production environment. By doing this evaluation, the user can see how the ADP1043A can be trimmed digitally to adjust the output voltage.

SOFT START

Once the input voltage is applied it is possible to test the Soft Start of the ADP1043A. The settings are located in the General Settings Window. Please refer to the Software Reference Guide for a detailed explanation of all the controls (EVAL-ADP1043A-GUI-RG).

Figure 18 General Settings Window



Soft Start is enabled and set to 20ms. You can experiment with different times.

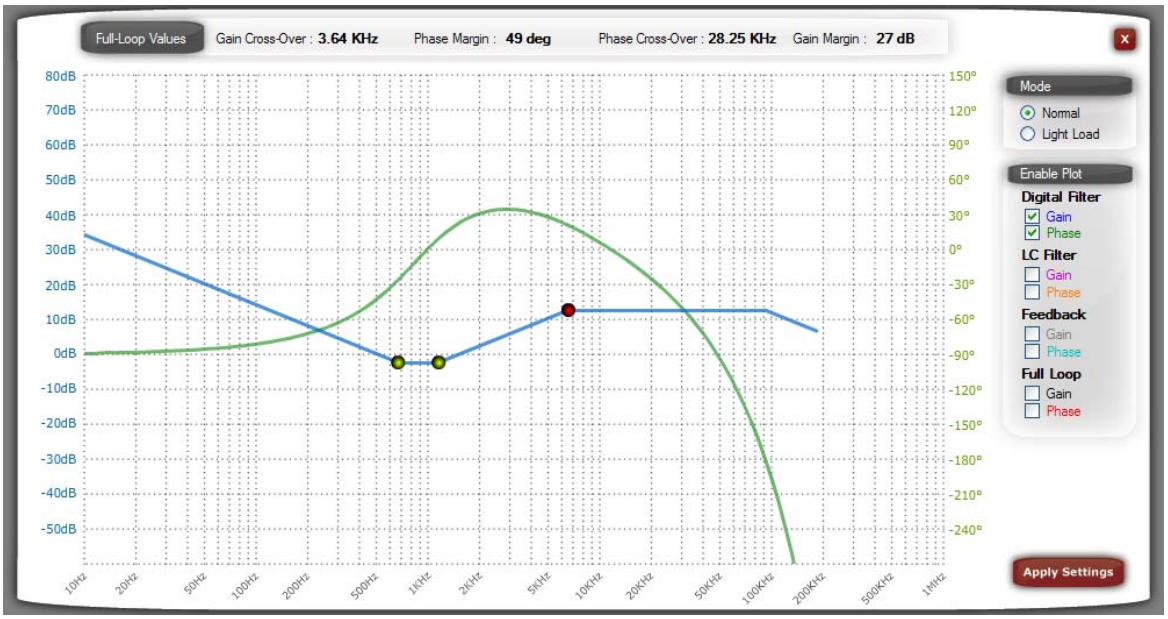
DIGITAL FILTER – TRANSIENT ANALYSIS

The digital filter can be changed using the software. The effect on transient analysis can be evaluated this way. Connect a switching electronic load to the output of the eval board. The load should be set to switch between 25%-75%, changing every 10msecs. Set up an oscilloscope to capture the transient waveform of the power supply output.

Use a differential probe on the scope, connecting it to the eval board output. Turn on the load, and note the waveform response.

Now, vary the digital filter using the software. Click on “Filter Settings” the window shows the filter settings for Normal mode. Click on the curve to move position of poles, zeroes and gains.

Figure 19 Digital Filter Window



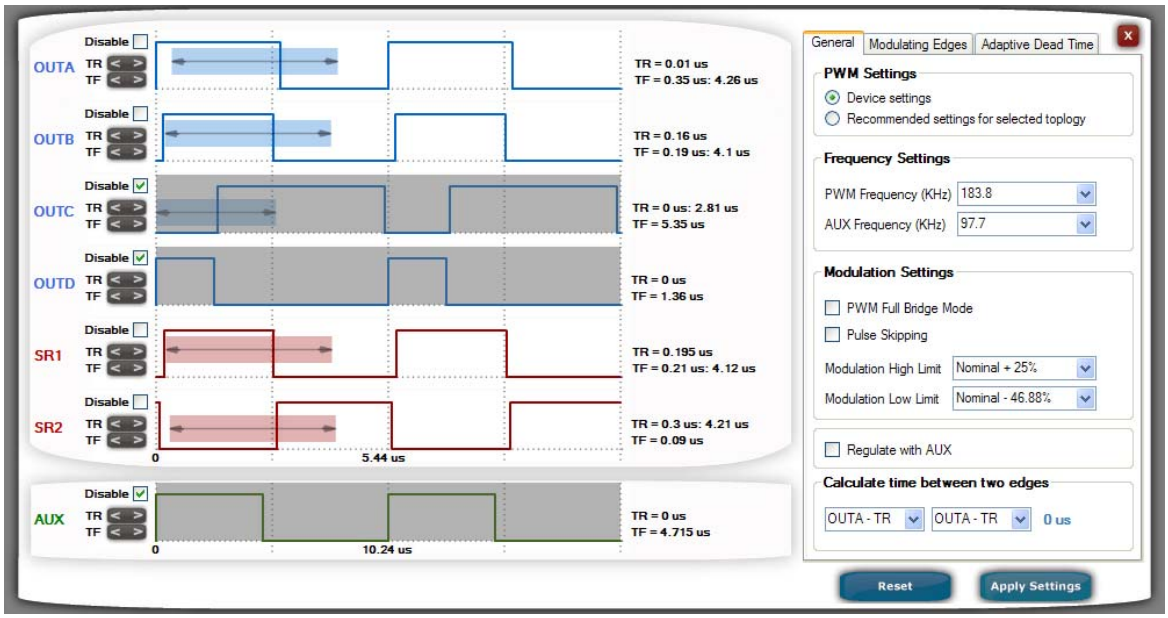
The transient response will change. This evaluation shows the user how the digital filter can easily be programmed to optimize the transient response of the power supply.

PWM – SWITCHING FREQUENCY

The converter switching frequency is programmable. In the “PWM & SR Settings” change the switching frequency.

The minimum and maximum modulation limits can also be modified.

Figure 20 Timing Window



NOTE: It is recommended to evaluate this feature with the power supply turned off. This prevents the chance of damaging the power supply by introducing shoot-through.

LIGHT LOAD OPTIMIZATION

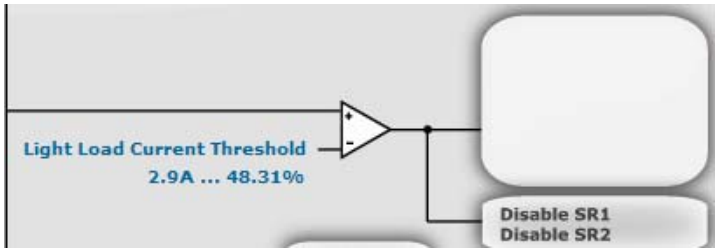
The ADP1043A can be programmed to optimize performance when a output current drops below a certain level.

The threshold for light load mode can be programmed in the digital filter window.

Once the current will drop below this level the sync rectifiers (SR1 and SR2) will be disabled. The “Light Load Mode Settings” will be used. The response time for the ADP1043A to switch from one mode to another is between 10 and 20ms.

The light load mode can be disabled by selecting a Light Load Current Threshold of 0%.

Figure 21 Light Load Current Threshold



PRIMARY SIDE CURRENT SENSE AND SECONDARY SIDE CURRENT SENSE

Current sensing is available for both the primary side current and the secondary side current. Primary side current sensing is performed using the current transformer, T1. Secondary side current sensing uses a low-side sense resistor.

Open the Monitor window in the software. Click on the Flags and Readings tab. Adjust the load current from 0A to 6A. The input current and output current values will change in the software, matching the changes being made at the load.

FLAGS AND FAULT CONFIGURATIONS

Open the Monitor window in the software. Click on the Flags and Readings tab. The window will show all of the fault flags. If a flag is set, then there is a red box next to the flag. If the flag is ok, then there is a green box next to the flag.

Set the load current to 0.3A. The CS2 OCP flag should be green.

Figure 22 Flags

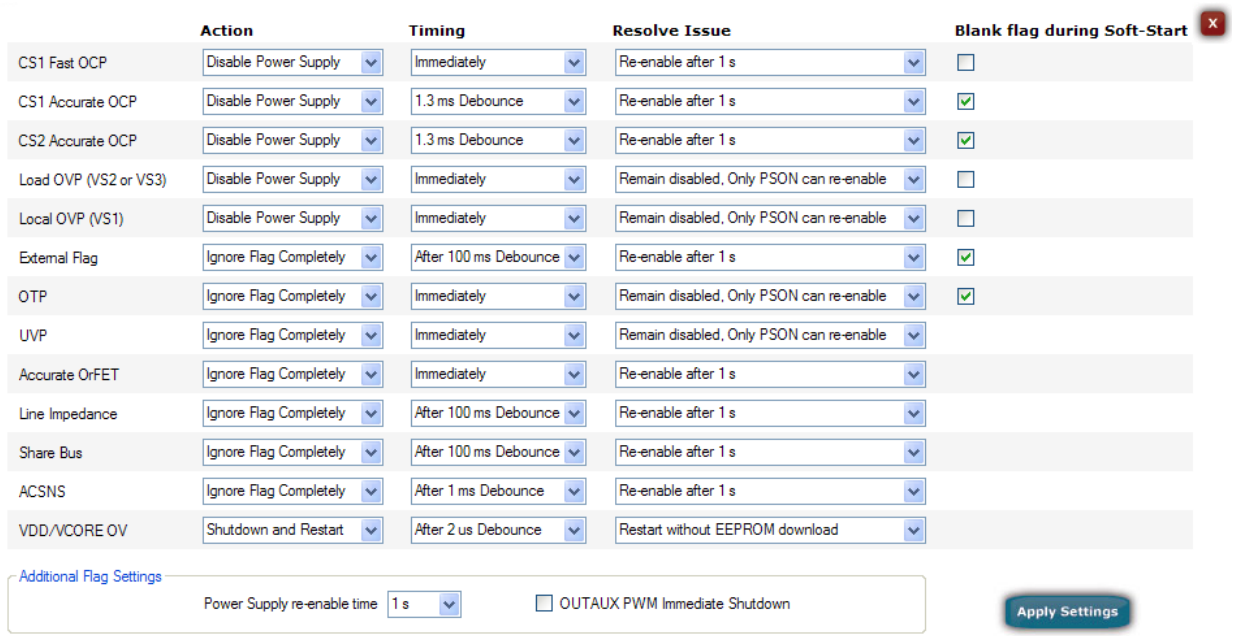
Now change the load to 8A. The CS2 OCP flag should now have turned red, because the CS2 OCP threshold has been reached. The board wills ender in hiccup mode and try and restart.

Set the load back to 2A, and the flag turns green again. This shows how the user can easily monitor the health of the power supply by monitoring the status of the various flags.

Flag and Fault Response Configuration:

The ADP1043A is programmed to respond to the various fault conditions in the Fault Configuration Tab.

Figure 23 Fault Configurations



You can change the resolve issue to “Remain Disabled”. If the over current is applied again the ADP1043A will shut down and remain off until PSON is cycled.

This evaluation shows how it is quite easy to configure the response to a fault condition. Change the load back to 2A, then toggle the PS_ON switch to restart the power supply.

APPENDIX

SCHEMATIC

Figure 24 Main Circuit

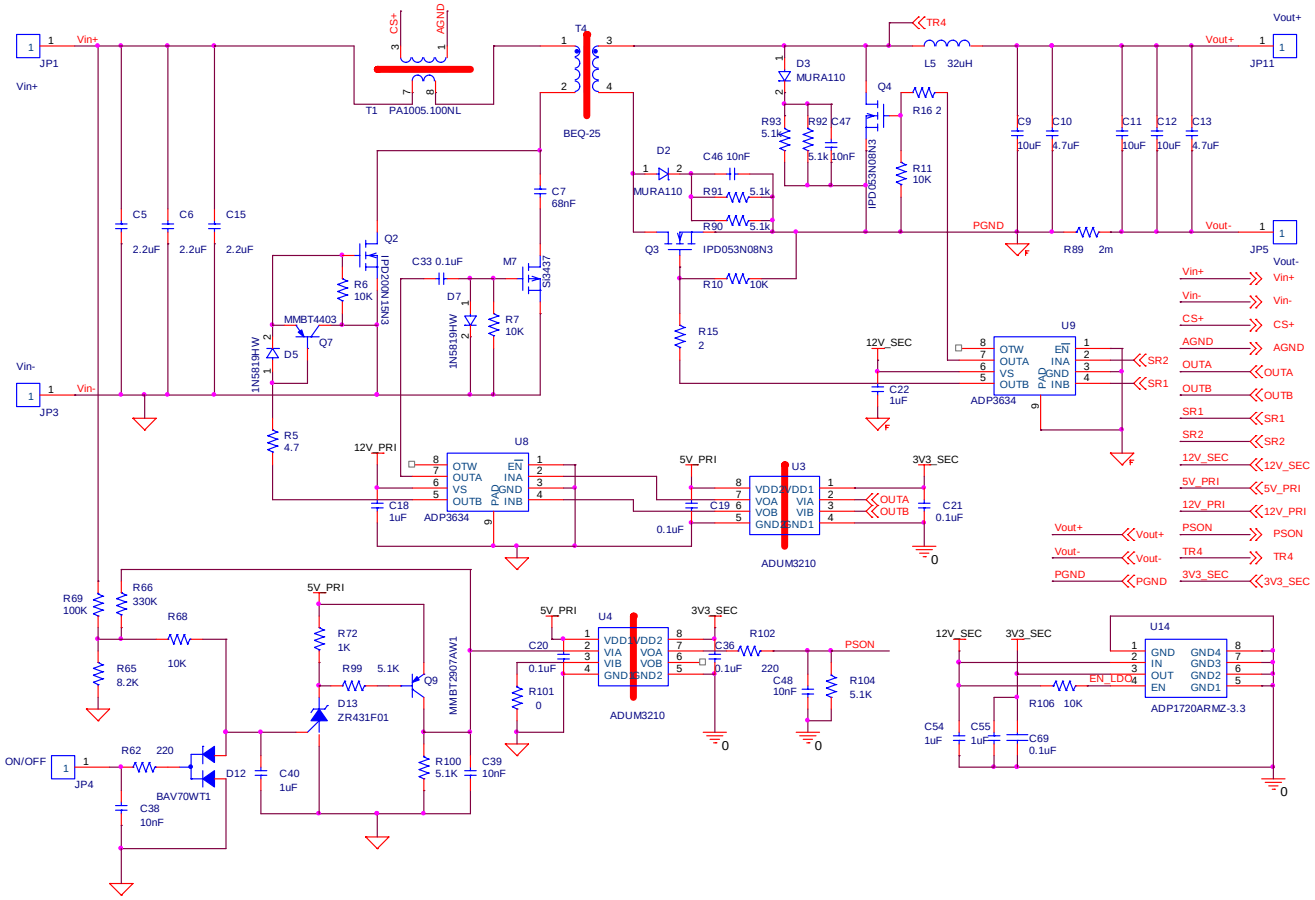


Figure 25 ADP1043A Control Circuit

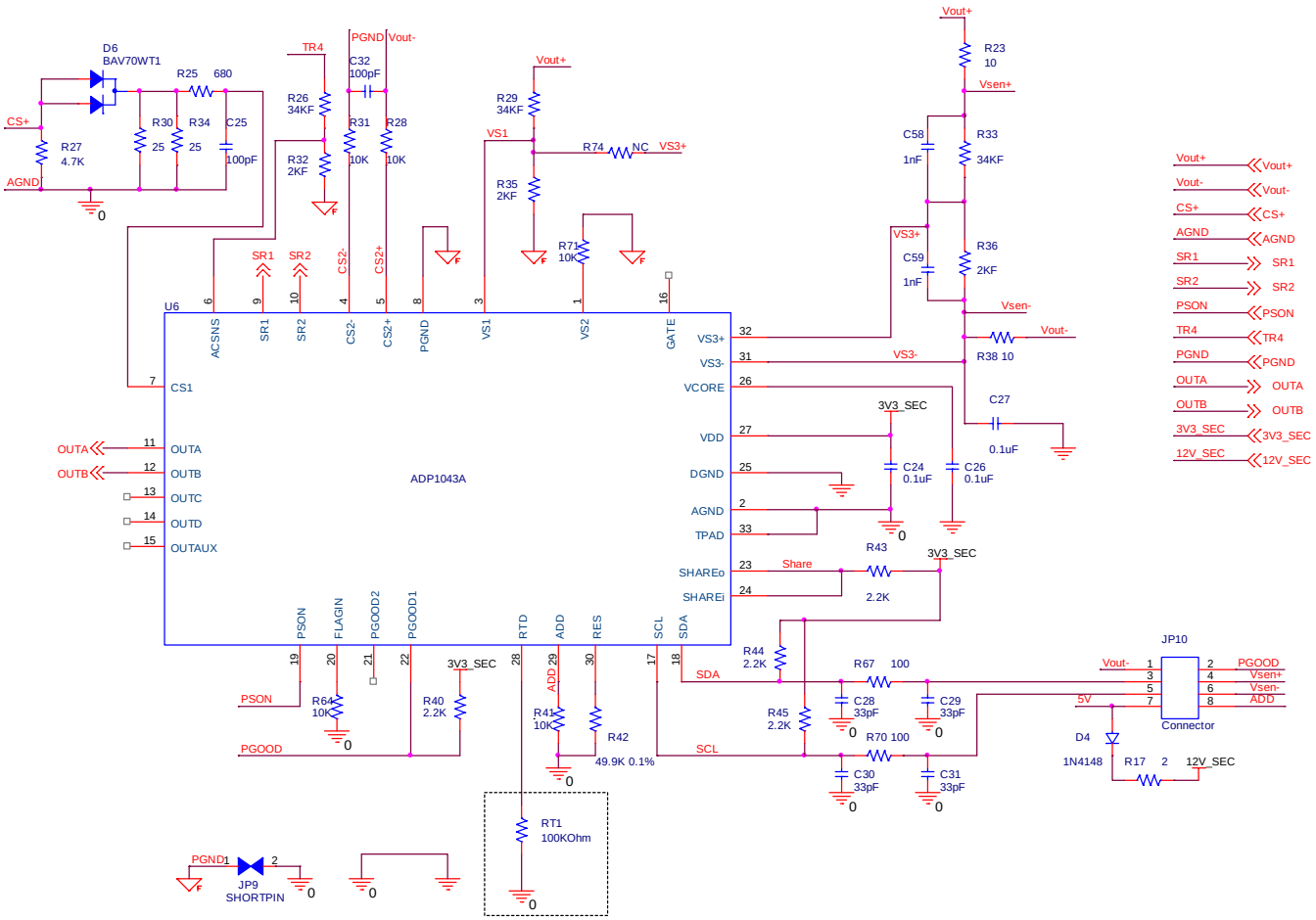
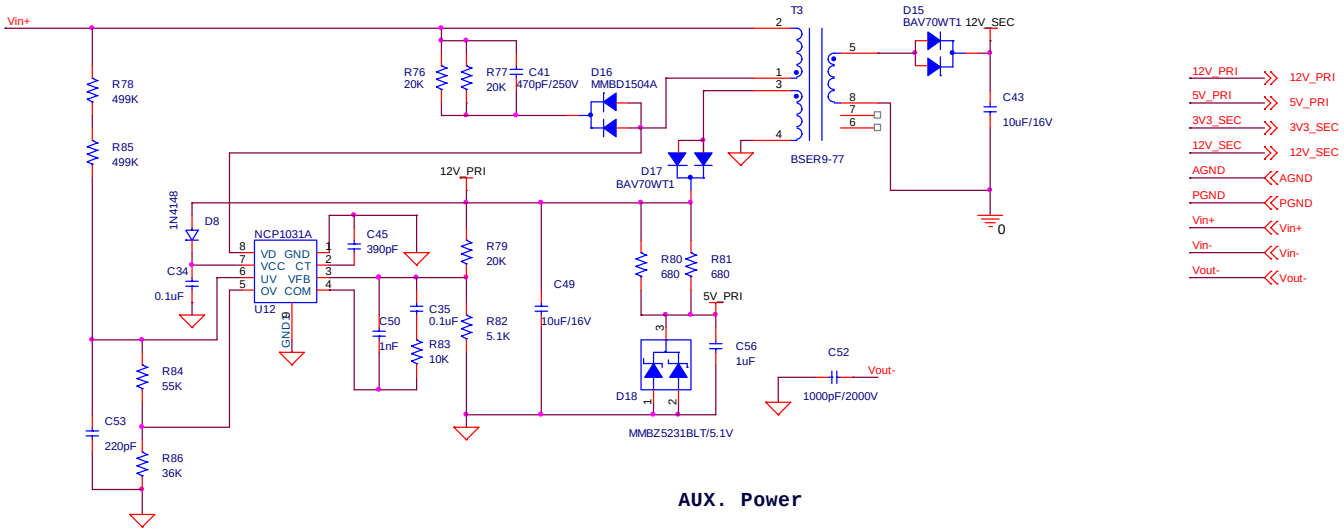


Figure 26 Aux. Power Circuit



BILL OF MATERIALS

Item	Reference	Description	Part Number	Manufacture	Qty
1	C5,C6,C15	CAP 2.2uF/100V X7R 1210	C3225X7R2A225K	TDK	3
2	C7	CAP 68nF/250V X7R 1206	C3216X7R2E683K	TDK	1
3	C9,C11,C12	CAP 10uF/25V X7R 1210	C3225X7R1E106K	TDK	3
4	C10,C13	CAP 4.7uF/25V X7R 1206	C3216X7R1E475K	TDK	2
5	C18,C22,C40,C54 C55,C56	CAP 1uF/16V X7R 0603	C1608X7R1C105K	TDK	6
6	C19,C20,C21,C24,C26, C27,C34,C35,C36,C69	CAP 0.1uF/16V X7R 0402	C1005X7R1C104K	TDK	10
7	C25	CAP 100pF/50V C0G 0402	C1005C0G1H101J	TDK	1
8	C28,C29,C30,C31	CAP 33pF/50V C0G 0402	C1005C0G1H330J	TDK	4
9	C32	CAP 100pF/50V X7R 0402	C1005X7R1H101J	TDK	1
10	C33	CAP 0.1uF/50V X7R 0603	C1608X7R1H104K	TDK	1
11	C38,C39,C48	CAP 10nF/25V X7R 0402	C1005X7R1E103K	TDK	3
12	C41	CAP 470pF/250V COG 0603	C1608C0G2E471J	TDK	1
13	C43,C49	CAP 10uF/16V X7R 1206	C3216X7R1C106K	TDK	2
14	C45	CAP 390pF/50V C0G 0402	C1005C0G1H391J	TDK	1
15	C46,C47	CAP 10nF/250V X7R 0805	C2012X7R2E103K	TDK	2
16	C50,C58,C59	CAP 1nF/50V X7R 0402	C1005X7R1H102K	TDK	3
17	C52	CAP 1000pF/2000V X7R 1808	C4520X7R3D102K	TDK	1
18	C53	CAP 220pF/50V X7R 0402	C1005X7R1H221K	TDK	1
19	D2,D3	Diode 1A 100V	MURA110	On Semi	2
20	D4,D8	Diode 150mA 75V	1N4148	Fairchild	2
21	D5,D7	Diode 1A 40V	1N5819HW	Fairchild	2
22	D6,D12,D15,D17	Diode 200mA 70V	BAV70WT1	Fairchild	4
23	D13	Adjustable from Vref=2.5V 1%	ZR431F01	Zetex	1
24	D16	Diode 200mA 200V	MMBD1504A	Fairchild	1
25	D18	Zener 5.1V	MMBZ5231BLT	On Semi	1
26	JP1,JP3,JP4,JP5 JP9,JP10,JP11	Terminal		Any	1
27	L5	LDC-25-7	INDUCTOR	Jinchuan	1
28	M7	Aux Switch(PMOS)	Si3437	Vishay	1
29	Q2	MOSFET	IPD200N15N3	Infineon	1
30	Q3	MOSFET	IPD053N08N3	Infineon	1
31	Q4	MOSFET	IPD068N10N3	Infineon	1
32	Q7	PNP -600mA -40V	MMBT4403	On Semi	1
33	Q9	PNP -800mA -40V	MMBT2907AWT1	On Semi	1
34	RT1	THERMISTOR 100KOHM 1% 0603		Vishay	1
35	R5	RES 4.7OHM 5% 1/10W 0603		Generic	1
36	R6,R7,R10,R11 R68,R83,R106	RES 10KOHM 5% 1/16W 0402		Generic	7
37	R15,R16	RES 2OHM 5% 1/10W 0603		Generic	2

38	R17	RES 2OHM 5% 1/16W 0402		Generic	1
39	R23,R38	RES 10OHM 5% 1/16W 0402		Generic	2
40	R25	RES 680OHM 5% 1/16W 0402		Generic	1
41	R26,R29,R33	RES 34KOHM 1% 1/16W 0402		Generic	3
42	R27	RES4.7KOHM 5% 1/10W 0603		Generic	1
43	R28,R31,R41,R64,R71	RES 10KOHM 1% 1/16W 0402		Generic	5
44	R30,R34	RES 25OHM 5% 1/10W 0603		Generic	2
45	R32,R35,R36	RES 2KOHM 1% 1/16W 0402		Generic	3
46	R40,R43,R44,R45	RES 2.2KOHM 1% 1/16W 0402		Generic	4
47	R42	RES 49.9KOHM 0.1% 1/16W 0402		Generic	1
48	R62,R102	RES 220OHM 5% 1/16W 0402		Generic	2
49	R65	RES 8.2KOHM 1% 1/16W 0402		Generic	1
50	R66	RES 330KOHM 1% 1/16W 0402		Generic	1
51	R67,R70	RES 100OHM 5% 1/16W 0402		Generic	2
52	R69	RES 100KOHM 5% 1/10W 0603		Generic	1
53	R72	RES 1KOHM 5% 1/16W 0402		Generic	1
54	R74	RES 0OHM 5% 1/16W 0402		Generic	1
55	R76,R77	RES 20KOHM 5% 1/10W 0603		Generic	2
56	R78,R85	RES 499KFOHM 5% 1/10W 0603		Generic	2
57	R79	RES 20KOHM 5% 1/16W 0402		Generic	1
58	R80,R81	RES 680OHM 5% 1/8W 0805		Generic	2
59	R82,R99,R100,R104	RES 5.1KOHM 5% 1/16W 0402		Generic	4
60	R84	RES 55KOHM 5% 1/16W 0402		Generic	1
61	R86	RES 36KOHM 5% 1/16W 0402		Generic	1
62	R89	RES 2m OHM 1% 1/4W 1206		Vishay	1
63	R90,R91,R92,R93	RES 5.1KOHM 1/4W 1206		Generic	4
64	R101	RES 0OHM 5% 1/16W 0402		Generic	1
65	T1	PA1005.100NL 20A 1:100		Pulse	1
66	T3	AUX TRANSFORMER	BSER9-77	Jinchuan	1
67	T4	MAIN TRANSFORMER	BEQ-25	Jinchuan	1
68	U3,U4	iCoupler	ADuM3210	ADI	2
69	U6	Secondary PWM Controller	ADP1043A	ADI	1
70	U8,U9	Dual channel driver IC	ADP3634	ADI	2
71	U12	NCP1031A	NCP1031A	On Semi	1
72	U14	LDO	ADP1720ARMZ-3.3-R7	ADI	1

PCB Layout

Figure 27 Top view of Board

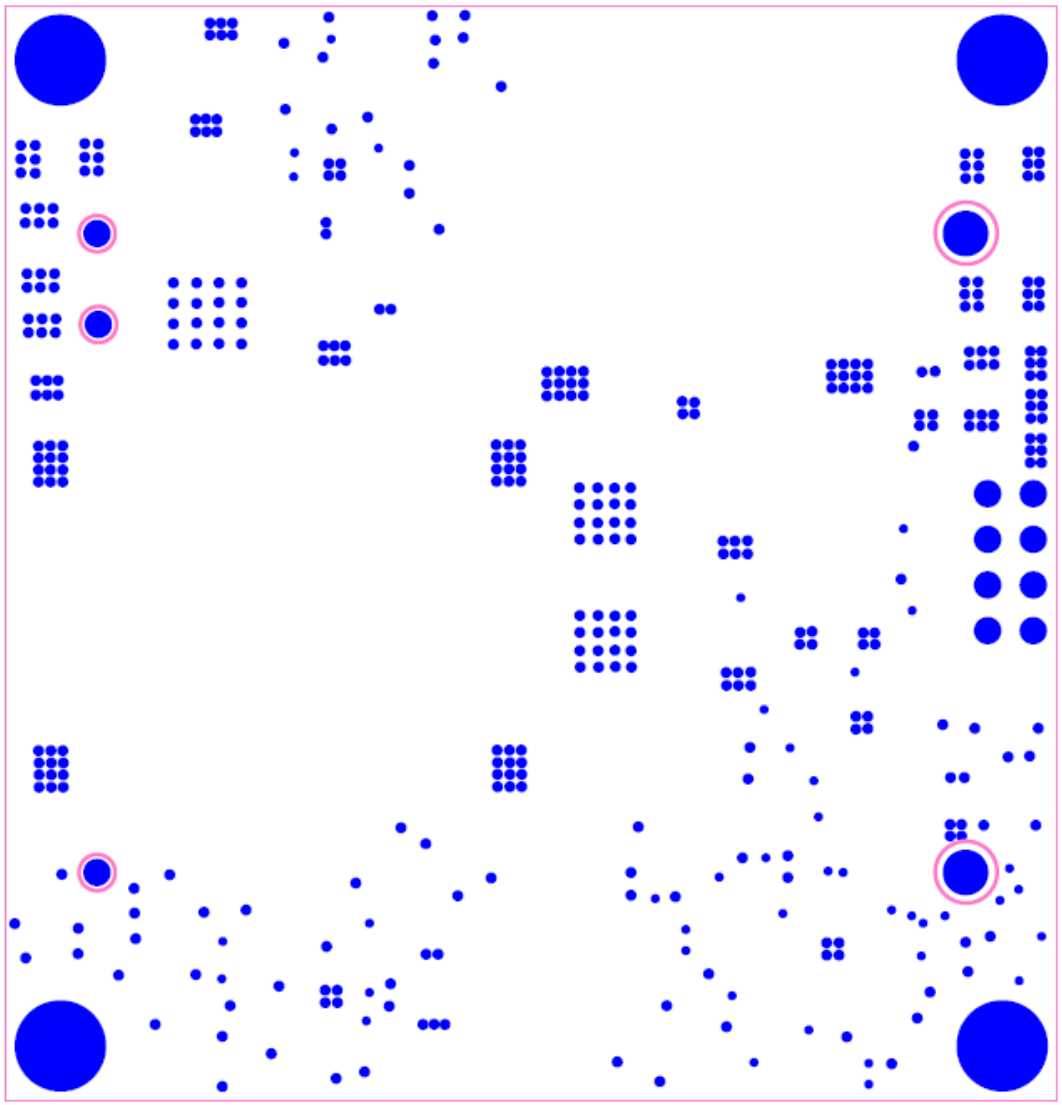
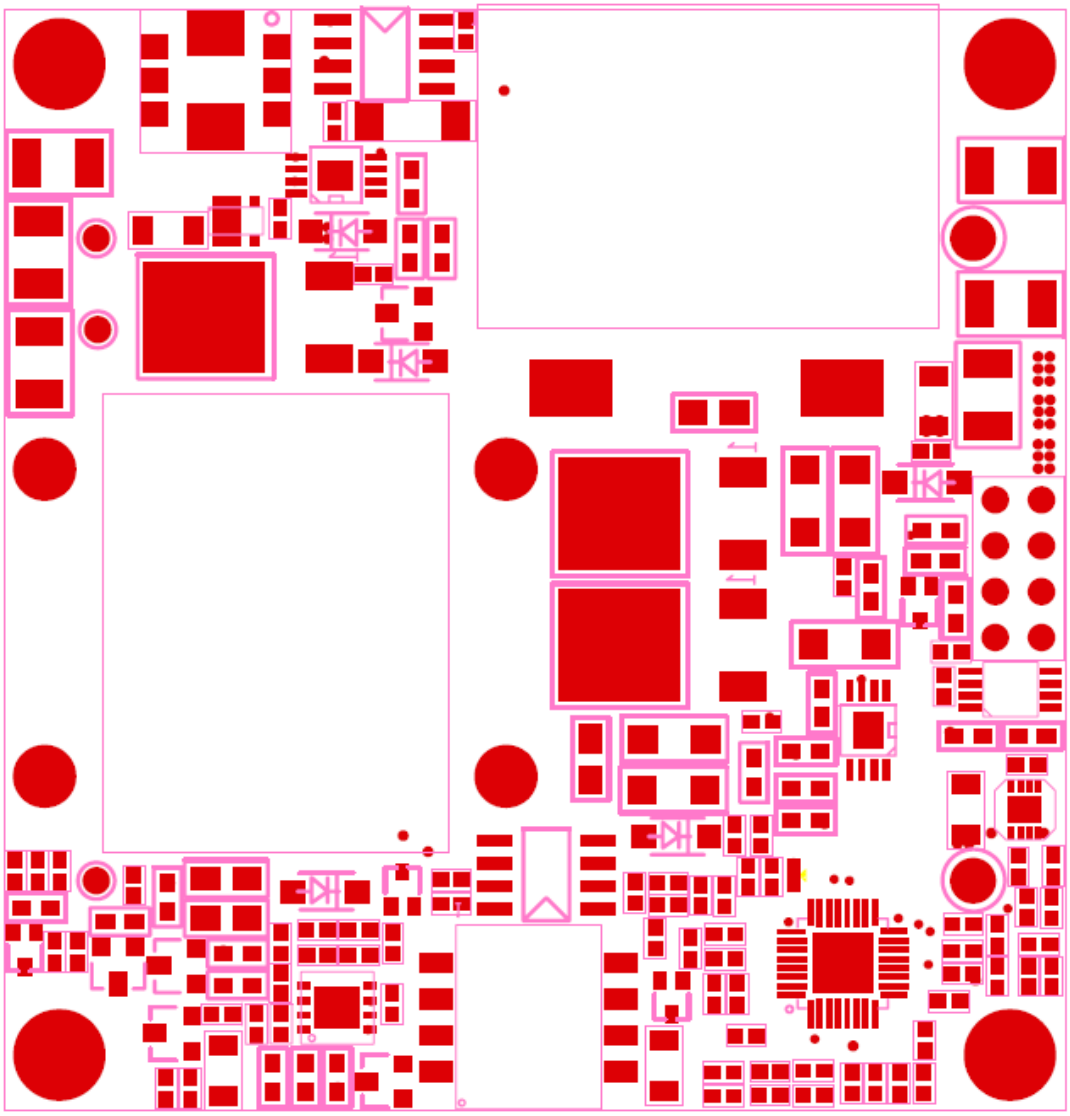


Figure 28 Bottom View of Board



BOARD SETTING

Input Voltage = 48 V

N1 = 5

N2 = 4

R (CS2) = 2.07 mOhm

I (load) = 6 A

R1 = 34 KOhm

R2 = 2 KOhm

C3 = 0.001 uF

C4 = 0.001 uF

N1 (CS1) = 1

N2 (CS1) = 100

R (CS1) = 10 Ohm

ESR (L1) = 5 mOhm

L1 = 14 uH

C1 = 13.2 uF

ESR (C1) = 1 mOhm

ESR (L2) = 0 mOhm

L2 = 0 uH

C2 = 240 uF

ESR (C2) = 35 mOhm

R (Normal-Mode) (Load) = 3 Ohm

R (Light-Load-Mode) (Load) = 36 Ohm

Cap Across R1 & R2 = 0 "(1 = Yes: 0 = No)"

Topology = 4 (0 = Full Bridge: 1 = Half Bridge: 2 = Two Switch Forward: 3 = Interleaved Two Switch Forward: 4 = Active Clamp Forward: 5 = Resonant Mode: 6 = Custom)

Switches / Diodes = 1 (0 = Switches: 1 = Diodes)

High Side / Low Side Sense (CS2) = 0 (1 = High-Side: 0 = Low-Side Sense)

Second LC Stage = 1 (1 = Yes: 0 = No)

CS1 Input Type = 0 (1 = AC: 0 = DC)

R3 = 0 KOhm

R4 = 0 KOhm

PWM Main = 1 (0 = OUTA: 1 = OUTB: 2 = OUTC: 3 = OUTD: 4 = SR1: 5 = SR2: 6 = OUTAUX)

REGISTER SETTING

Reg(0h) = F8h - Fault Register 1

Reg(1h) = 0h - Fault Register 2

Reg(2h) = 4h - Fault Register 3

Reg(3h) = 44h - Fault Register 4

Reg(4h) = F8h - Latched Fault Register 1

Reg(5h) = 0h - Latched Fault Register 2

Reg(6h) = 4h - Latched Fault Register 3

Reg(7h) = 45h - Latched Fault Register 4

Reg(8h) = 33h - Fault Configuration Register 1

Reg(9h) = 3Fh - Fault Configuration Register 2

Reg(Ah) = F0h - Fault Configuration Register 3

Reg(Bh) = 0h - Fault Configuration Register 4

Reg(Ch) = 0h - Fault Configuration Register 5

Reg(Dh) = 0h - Fault Configuration Register 6

Reg(Eh) = 81h - Flag Configuration

Reg(Fh) = 66h - Soft-Start Flag Blank

Reg(10h) = 0h - First Flag ID

Reg(11h) = FFh - Reserved

Reg(12h) = 0h - VS1 Value

Reg(13h) = 0h - CS1 Value

Reg(14h) = 0h - CS1 x VS1 Value

Reg(15h) = 0h - VS1 Voltage Value

Reg(16h) = 0h - VS2 Voltage Value

Reg(17h) = 148h - VS3 Voltage Value

Reg(18h) = 0h - CS2 Value

Reg(19h) = 0h - CS2 x VS3 Value

Reg(1Ah) = 4DE0h - RTD Temperature Value

Reg(1Bh) = FFh - Reserved

Reg(1Ch) = FFh - Reserved

Reg(1Dh) = 0h - Share Bus Value

Reg(1Eh) = C0h - Modulation Value

Reg(1Fh) = FFh - Line Impedance Value

Reg(20h) = FFh - Reserved

Reg(21h) = 87h - CS1 Gain Trim

Reg(22h) = 2Ah - CS1 OCP Limit

Reg(23h) = 3Bh - CS2 Gain Trim

Reg(24h) = 10h - CS2 Offset Trim

Reg(25h) = 0h - CS2 Digital Trim

Reg(26h) = 3Ah - CS2 OCP Limit

Reg(27h) = 0h - CS1 and CS2 OCP Setting

Reg(28h) = 0h - VS Balance Gain Setting

Reg(29h) = 0h - Share Bus Bandwidth

Reg(2Ah) = 30h - Share Bus Setting

Reg(2Bh) = 1Bh - Temperature Trim

Reg(2Ch) = 62h - PSON/Soft Start Setting

Reg(2Dh) = 0h - Pin Polarity Setting

Reg(2Eh) = 12h - Modulation Limit

Reg(2Fh) = 0h - OTP Threshold

Reg(30h) = C0h - OrFET

Reg(31h) = A4h - VS3 Voltage Setting

Reg(32h) = 0h - VS1 Overvoltage Limit

Reg(33h) = Ah - VS3 Overvoltage Limit

Reg(34h) = 0h - VS1 Undervoltage Limit

Reg(35h) = 0h - Line Impedance Limit

Reg(36h) = 7h - Load Line Impedance

Reg(37h) = FFh - Reserved

Reg(38h) = CAh - VS1 Trim

Reg(39h) = 9h - VS2 Trim

Reg(3Ah) = CFh - VS3 Trim

Reg(3Bh) = 0h - Light Load Disable Setting

Reg(3Ch) = 5h - Silicon Revision ID

Reg(3Dh) = 41h - Manufacturer ID

Reg(3Eh) = 43h - Device ID

Reg(3Fh) = 10h - OUTAUX Switching Frequency Setting

Reg(40h) = 1Fh - PWM Switching Frequency Setting

Reg(41h) = 0h - PWM 1 Positive Edge Timing

Reg(42h) = 20h - PWM 1 Positive Edge Setting

Reg(43h) = 24h - PWM 1 Negative Edge Timing

Reg(44h) = 48h - PWM 1 Negative Edge Setting

Reg(45h) = 2h - PWM 2 Positive Edge Timing

Reg(46h) = 0h - PWM 2 Positive Edge Setting

Reg(47h) = 22h - PWM 2 Negative Edge Timing

Reg(48h) = 48h - PWM 2 Negative Edge Setting

Reg(49h) = 12h - PWM 3 Positive Edge Timing

Reg(4Ah) = 28h - PWM 3 Positive Edge Setting

Reg(4Bh) = 42h - PWM 3 Negative Edge Timing

Reg(4Ch) = E0h - PWM 3 Negative Edge Setting

Reg(4Dh) = 0h - PWM 4 Positive Edge Timing

Reg(4Eh) = 0h - PWM 4 Positive Edge Setting

Reg(4Fh) = 11h - PWM 4 Negative Edge Timing

Reg(50h) = 0h - PWM 4 Negative Edge Setting

Reg(51h) = 2h - SR 1 Positive Edge Timing

Reg(52h) = 70h - SR 1 Positive Edge Setting

Reg(53h) = 22h - SR 1 Negative Edge Timing

Reg(54h) = 88h - SR 1 Negative Edge Setting

Reg(55h) = 23h - SR 2 Positive Edge Timing

Reg(56h) = A8h - SR 2 Positive Edge Setting

Reg(57h) = 1h - SR 2 Negative Edge Timing

Reg(58h) = 20h - SR 2 Negative Edge Setting

Reg(59h) = 0h - PWM AUX Positive Edge Timing

Reg(5Ah) = 0h - PWM AUX Positive Edge Setting

Reg(5Bh) = 3Ah - PWM AUX Negative Edge Timing

Reg(5Ch) = F0h - PWM AUX Negative Edge Setting

Reg(5Dh) = 98h - PWM and SR Pin Disable Setting

Reg(5Eh) = 0h - Password Lock

Reg(5Fh) = 0h - Soft-Start Digital Filter LF Gain Setting

Reg(60h) = 7h - Normal Mode Digital Filter LF Gain Setting

Reg(61h) = F8h - Normal Mode Digital Filter Zero Setting

Reg(62h) = F7h - Normal Mode Digital Filter Pole Setting

Reg(63h) = 11h - Normal Mode Digital Filter HF Gain Setting

Reg(64h) = Eh - Light Load Digital Filter LF Gain Setting

Reg(65h) = D6h - Light Load Digital Filter Zero Setting

Reg(66h) = D5h - Light Load Digital Filter Pole Setting

Reg(67h) = 12h - Light Load Digital Filter HF Gain Setting

Reg(68h) = 0h - Dead Time Threshold

Reg(69h) = 0h - Dead Time 1

Reg(6Ah) = 0h - Dead Time 2

Reg(6Bh) = 0h - Dead Time 3

Reg(6Ch) = 0h - Dead Time 4

Reg(6Dh) = 0h - Dead Time 5

Reg(6Eh) = 0h - Dead Time 6

Reg(6Fh) = 0h - Dead Time 7

Reg(70h) = 14h -

Reg(71h) = Bh -

Reg(72h) = 53h -

Reg(73h) = 9h -

Reg(74h) = 0h -

Reg(75h) = FFh -

Reg(76h) = FFh -

Reg(77h) = 0h -

Reg(78h) = 0h -

Reg(79h) = 1Bh -

Reg(7Ah) = 2h -

Reg(7Bh) = FFh - Factory Default Settings

Reg(7Ch) = 1h - EEPROM X Address

Reg(7Dh) = 35h - EEPROM Y Address

Reg(7Eh) = 35h - EEPROM Register

Reg(7Fh) = FFh -

Reg(80h) = 35h -

Reg(81h) = 35h -

Reg(82h) = 35h -

NOTES