Application Note: 48V-BMS-AN01 – General Description

48V-BMS

AN01 – General Description

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Revision History

Revision	Date	Owner	Description
1.0	06.10.2015	gheh	Initial release

1 General Description

This document describes the 48V BMS Board.

The 48V-BMS is a demonstrator solution for monitoring and safely operating a 48V battery stack such as the ones used in modern car supply nets and in many other mobility applications like e-bikes and scooters.

The board incorporates:

- A cell supervision and balancing portion for up to 14 series connected cells
- Pack current and voltage monitoring via a copper shunt on the + terminal of the battery
- A N-mosFET disconnect switch on the + side of the battery
- A CAN communication interface for status messaging

The board is meant to be used in conjunction with the USB Interface Board and the 48V-PC GUI however you can connect the CAN Interface to any other CAN compatible device and evaluate the status messages there.

1.1 Kit Content

The kit consists of the dual layer PCB 48V-BMS and an eSATA Cable which is used to connect to the USB-Interface Board board.

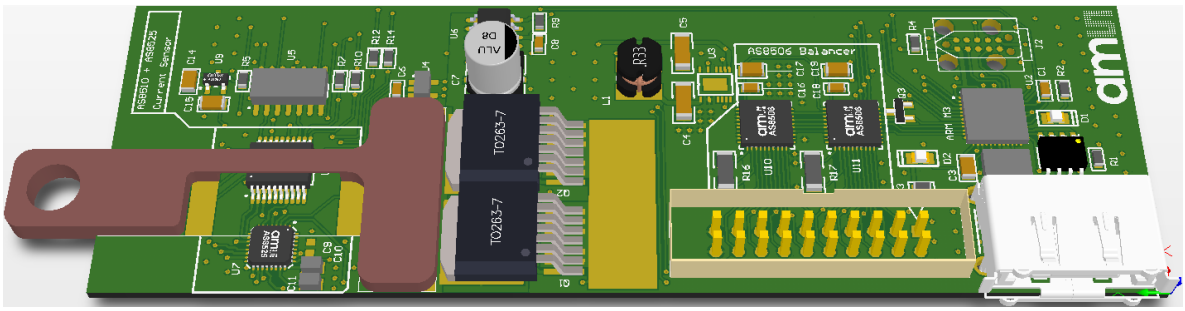


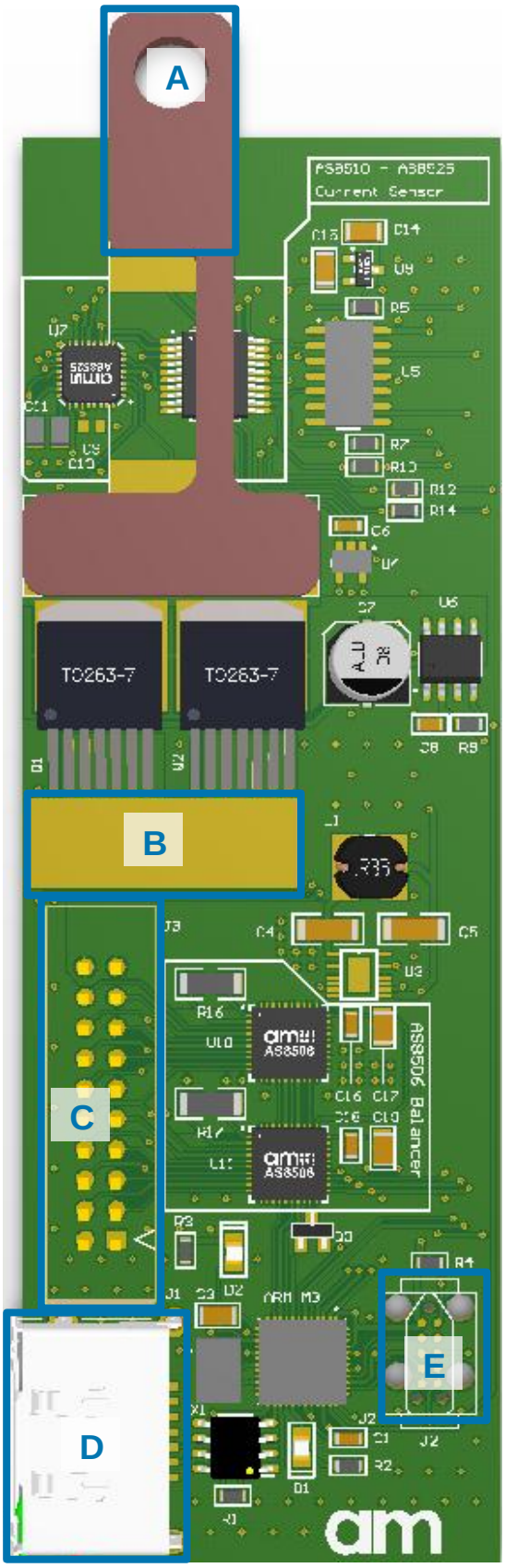
Figure 1: 48V-BMS Board

2 Getting Started

To operate this Board you should at first download and install the 48V-BMS GUI from here:

http://ams.com/eng/Support/Demoboards/Power-Management/Battery-Stack-Monitor-Balancer/AS85xx-Ref-Design-48V

Once the software is installed you can connect the USB Interface Board to the 48V-BMS via the provided eSATA cable and afterwards connect the USB Interface Board to the PC via the USB cable.



3 Hardware Description

The 48V-BMS board is powered via the cell connector J3. A dc-dc converter steps down the input voltage to 5V which is used to power most of the circuitry. Current is routed through connectors A & B. They form a high current sensing path on the + side of the load circuit. Current is measured through the small voltage drop across the thin strip of copper on top of the AS8510 sensing chip. The copper resistance change is compensated in software. Balancing is done passively via two AS8506 chips using discharge resistors.

Figure 2: PCB Top Side Diagram

Table 1: Connection Diagram

Label	Name	Designator	Info
A	+Terminal		+ Connection to battery
B	+ Switched Terminal		+ Connection to load
C	Cell Connector	J3	Connection for cell measurement and balance
D	CAN	J1	Standard CAN Interface
E	JTAG/SWD	J2	Tag-connect Adapter for programming

4 Configuration

4.1 Cell connection

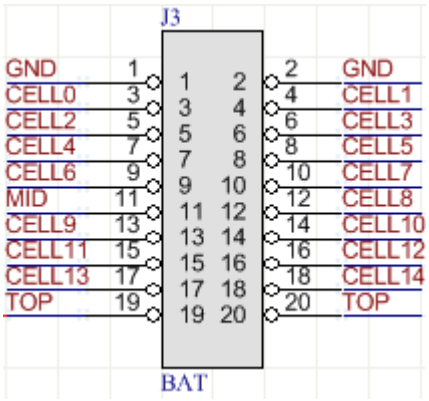


Figure 3: Battery Connector

Cells should be connected according to the pinout of the Battery plug. There are 3 GND (2xGND + Cell0) 2 Mid-Stack (Cell7 + MID) and 3 VPP (Cell14 + 2xTOP) connections respectively which shall be tied together directly at the battery.

4.2 Current path connection

The high current path runs through connectors A & B. The maximum current that the board can handle in this configuration is 100A. The trip current limit can be set via Software and is set to 60A by default.

5 Software

The Software Comprises of 4 different Tabs with different functionality which will be subsequently explained. When the software is started it will automatically connect to the USB Interface Board and start listening for incoming CAN Messages. A Green USB and CAN Signal in the bottom right Corner indicate a successful connection to the USB Board.

5.1 Main Tab

Figure 4: GUI Main Tab

This is the default window. It displays all measured battery parameters including cell voltages, pack voltage before and after the FET switch, temperature and total Current. It also display info messages like when the balancing is active or if any of the min/max parameters has been reached and the FET switch has been turned off for safety protection.

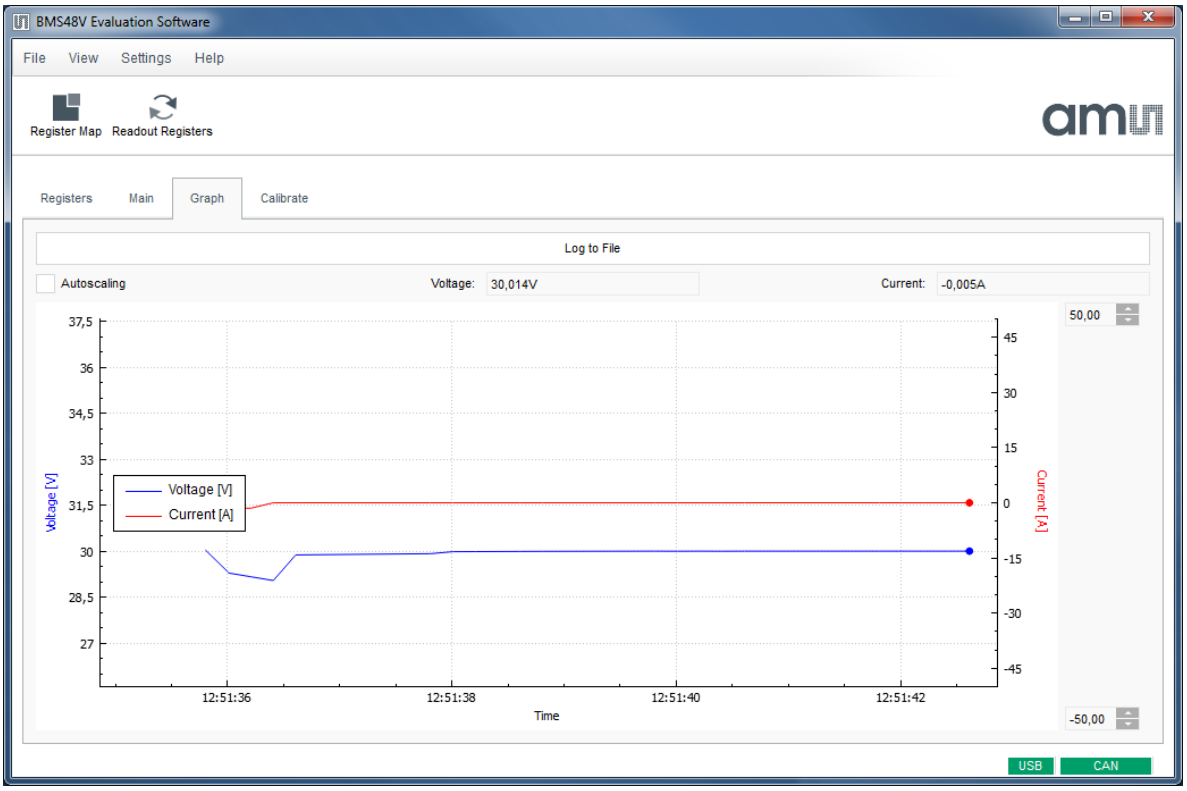


Figure 5: GUI Graph Tab

The graph tab gives a graphical representation of the measured pack current & voltage and allows you to log these measurements to a file.

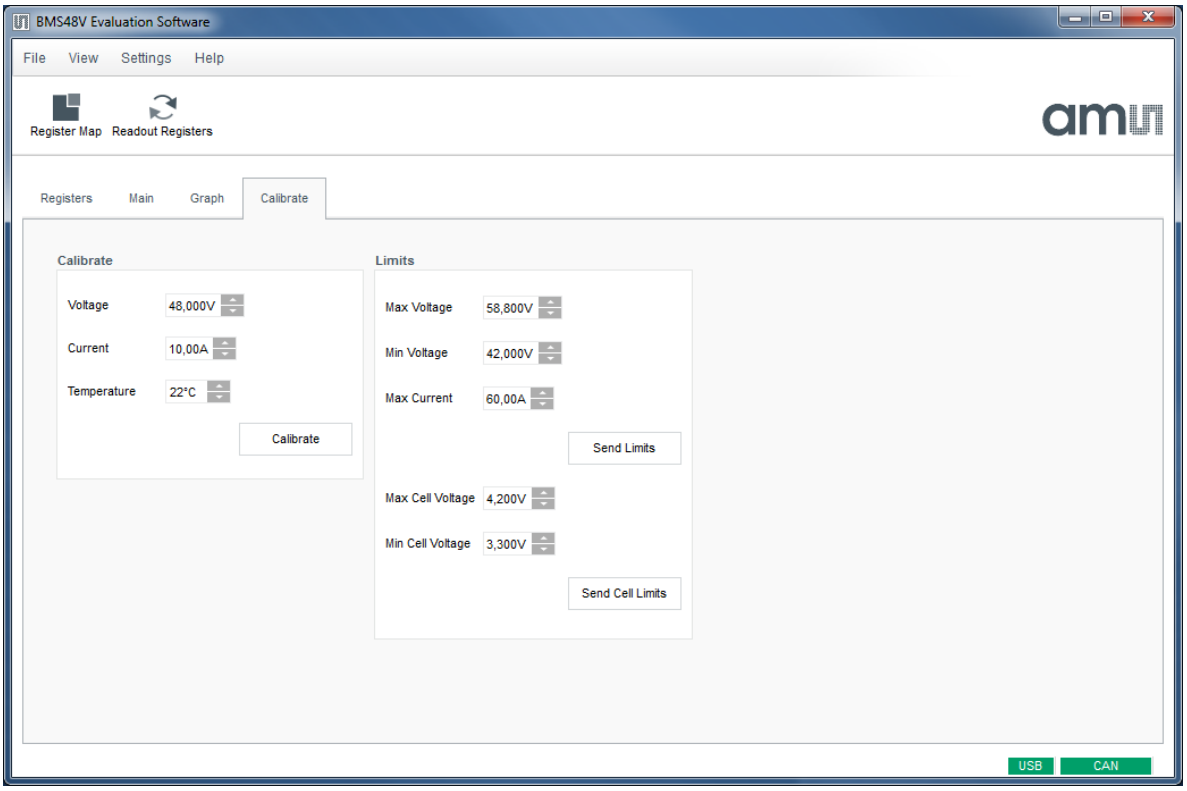
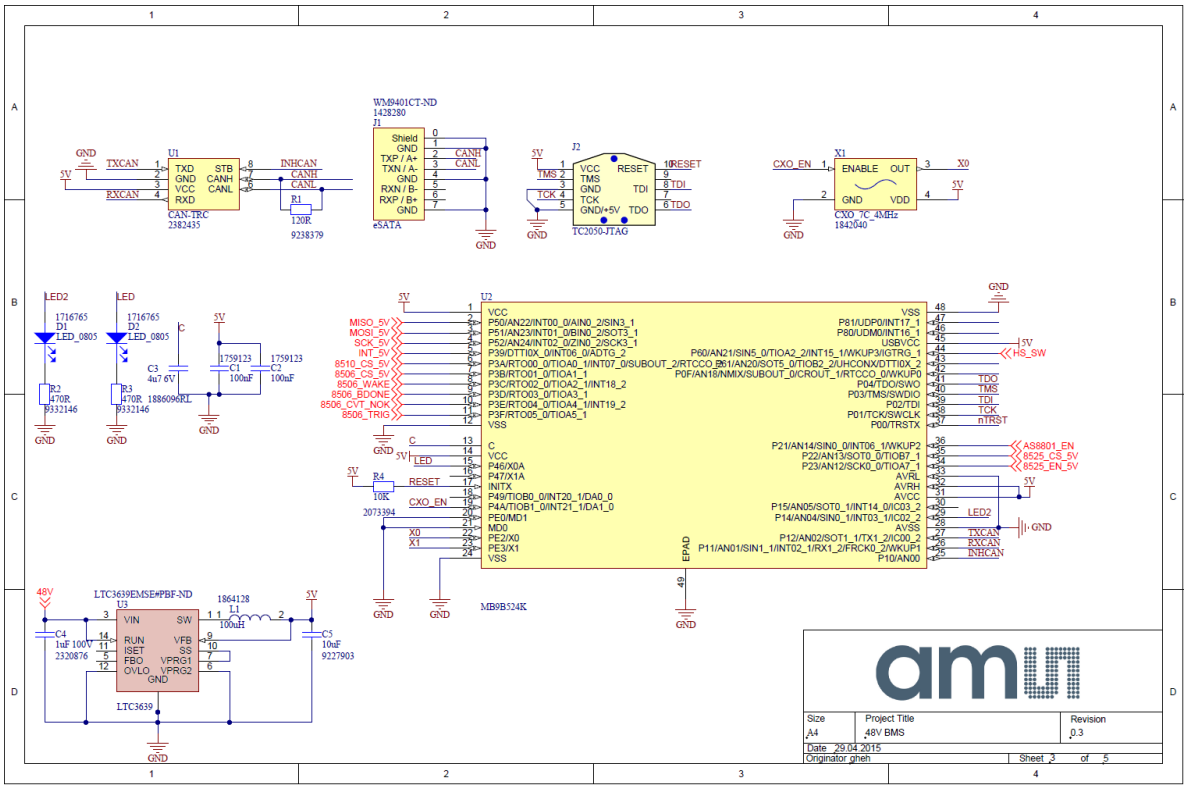


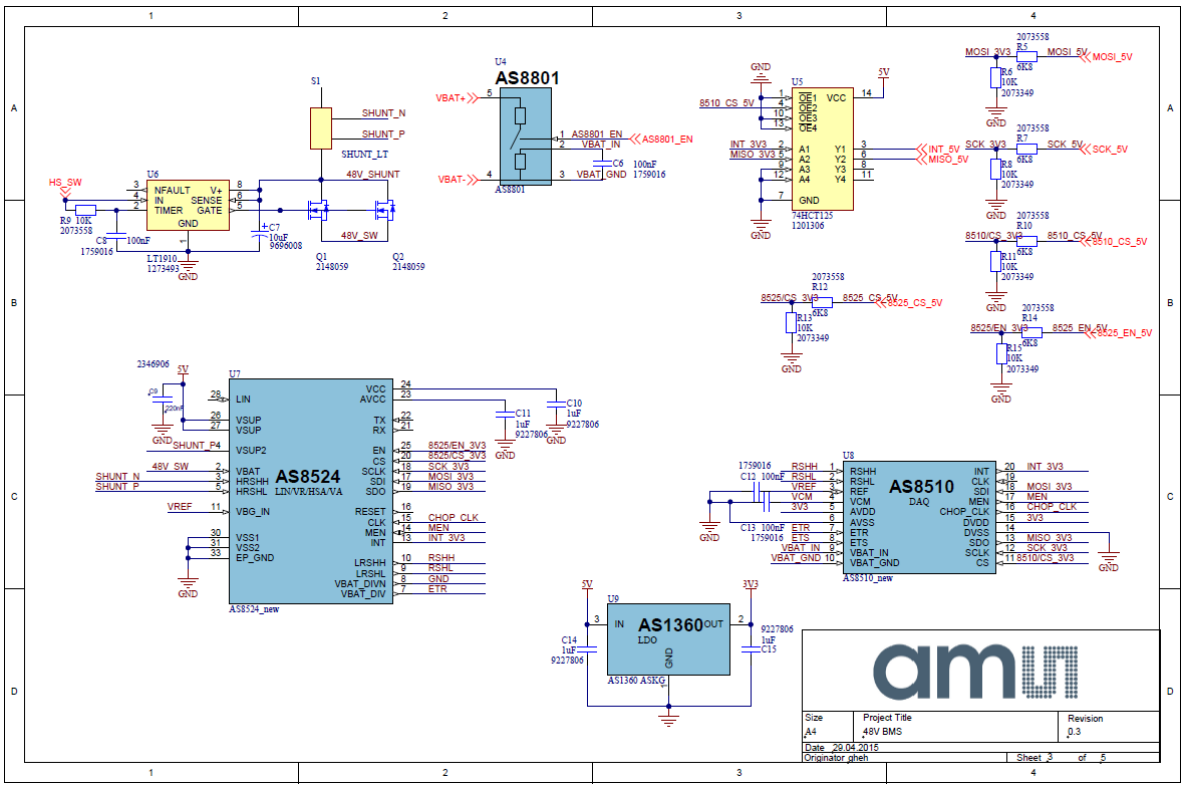
Figure 6: GUI Calibrate Tab

The Calibrate tab allows calibration of the current and voltage measurement. It also allows you to set the pack as well as the cell voltage limits. These limits are stored in non-volatile memory on the 48V BMS Board.

To redo the calibration apply a known pack voltage and load current to the BMS Board. Type in these known values in the appropriate fields and click on the calibrate button. The Board will do a measurement and calculate the required calibration coefficients. These are immediately used and you can see the effect in the Main Tab.

6 Board Schematics, Layout and BOM





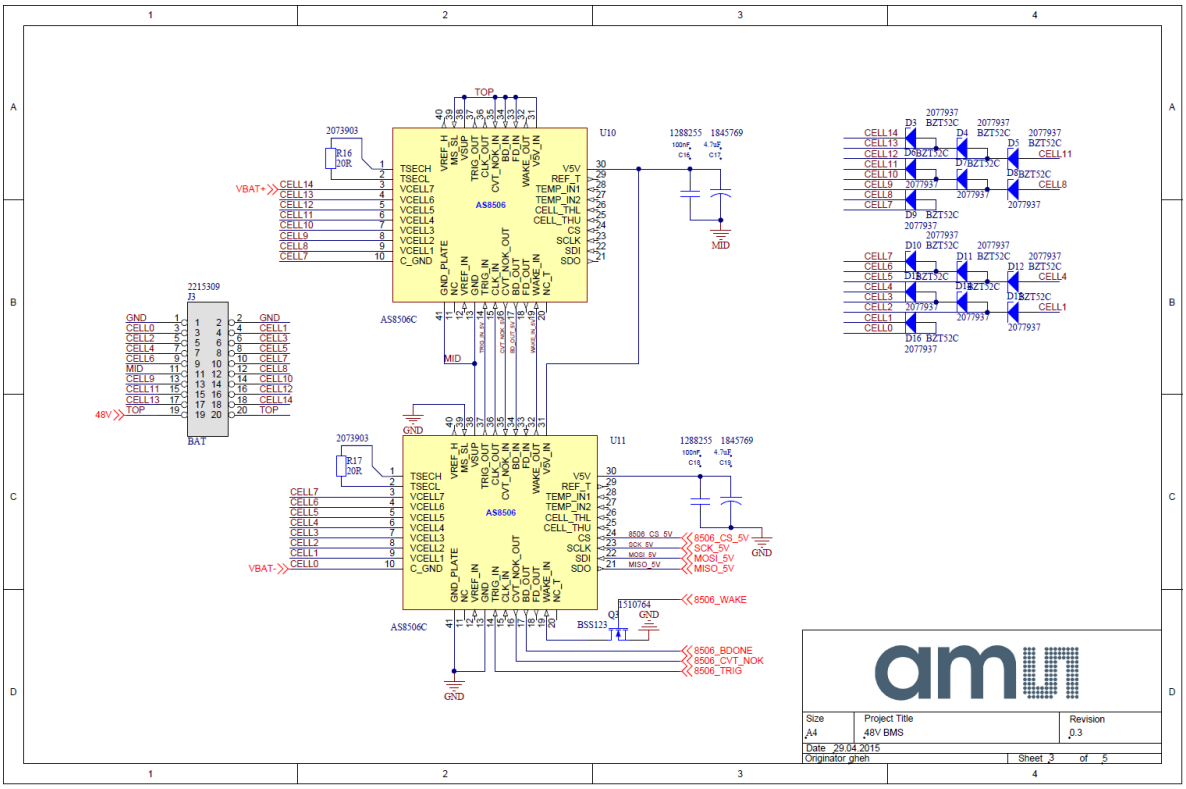


Figure 7: Schematics

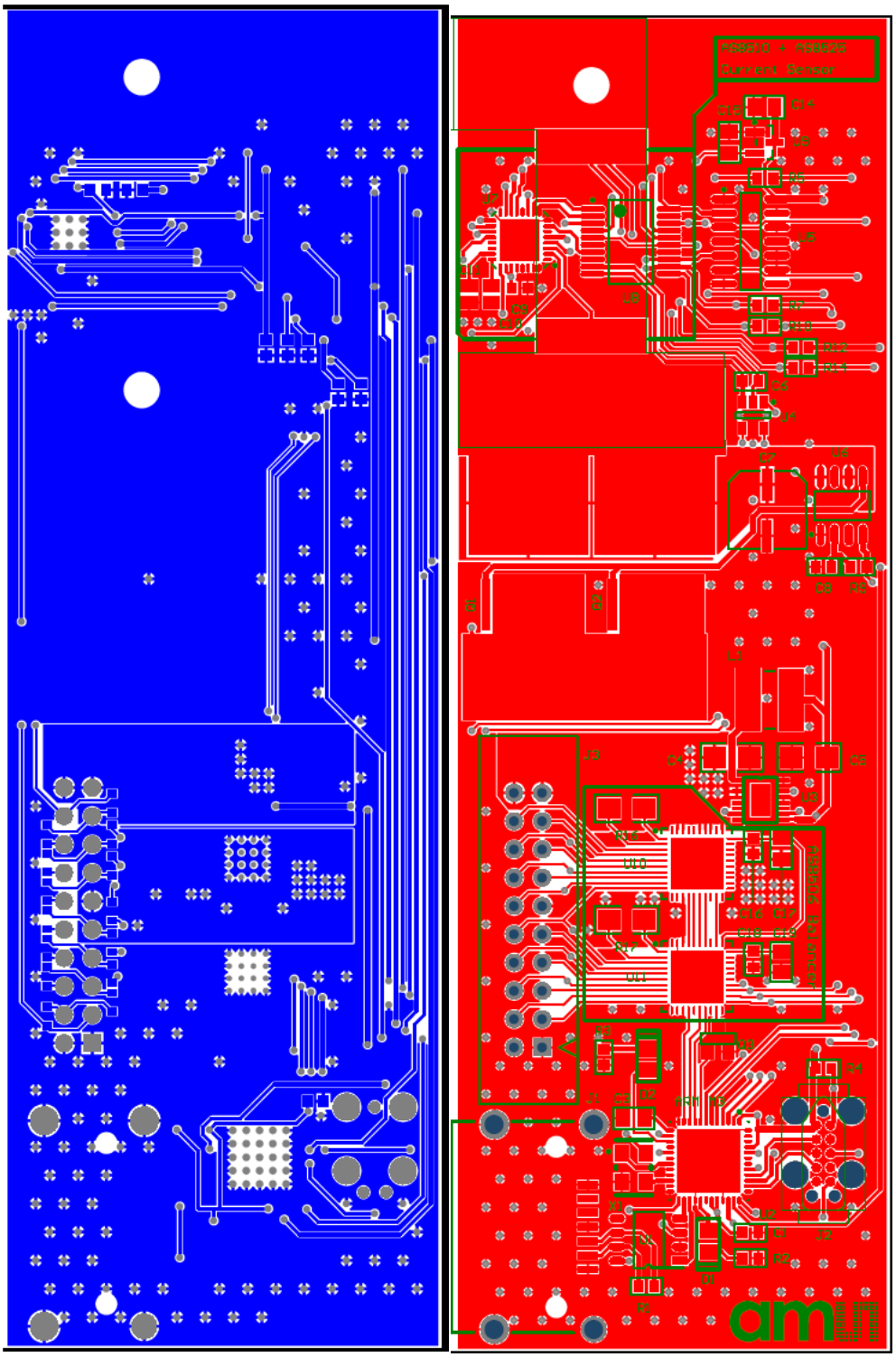


Figure 8: Top/Bottom PCB Side

	Bill of Materials		48V BMS					
	Company:		ams AG					
	Originator:		gheh					
	PCB Name:		48V BMS					
	PCB Version:		0.3					
	Report Date:		29.04.2015					
#	Designator	Comment	lame Error:Component_I	Manufacturer	Manufacturer Part Number	Supplier 1	Supplier Part Number 1	Quantity
1	C1	100nF		MULTICOMP	MC0603F104Z500CT	Farnell	1759123	1
2	C10	1uF		KEMET	C0805C105Z4VACTU	Farnell	9227806	1
3	C11	1uF		KEMET	C0805C105Z4VACTU	Farnell	9227806	1
4	C12	100nF		MULTICOMP	MC0603B104K160CT	Farnell	1759016	1
5	C13	100nF		MULTICOMP	MC0603B104K160CT	Farnell	1759016	1
6	C14	1uF		KEMET	C0805C105Z4VACTU	Farnell	9227806	1
7	C15	1uF		KEMET	C0805C105Z4VACTU	Farnell	9227806	1
8	C16	100nF		KEMET	C0603C104K5RACTU	Farnell	1288255	1
9	C17	4.7uF		MURATA	GRM21BR71A475KA73L	Farnell	1845769	1
10	C18	100nF		KEMET	C0603C104K5RACTU	Farnell	1288255	1
11	C19	4.7uF		MURATA	GRM21BR71A475KA73L	Farnell	1845769	1
12	C2	100nF		MULTICOMP	MC0603F104Z500CT	Farnell	1759123	1
13	C3	4u7 6V		JOHANSON DIELECTRICS	6R3R15X475KV4E	Farnell	1886096RL	1
14	C4	1uF 100V		MULTICOMP	MC1206B105K101CT	Farnell	2320876	1
15	C5	10uF		KEMET	C1206C106Z8VACTU	Farnell	9227903	1
16	C6	100nF		MULTICOMP	MC0603B104K160CT	Farnell	1759016	1
17	C8	100nF		MULTICOMP	MC0603B104K160CT	Farnell	1759016	1
18	C9	220nF		TDK	C1608X7R1H224K080AB	Farnell	2346906	1
19	D1	LED_0805		MULTICOMP	OVG-0803	Farnell	1716765	1
20	D10	BZT52C		DIODES INC.	BZT52C5V6T-7	Farnell	2077937	1
21	D11	BZT52C		DIODES INC.	BZT52C5V6T-7	Farnell	2077937	1
22	D12	BZT52C		DIODES INC.	BZT52C5V6T-7	Farnell	2077937	1
23	D13	BZT52C		DIODES INC.	BZT52C5V6T-7	Farnell	2077937	1
24	D14	BZT52C		DIODES INC.	BZT52C5V6T-7	Farnell	2077937	1
25	D15	BZT52C		DIODES INC.	BZT52C5V6T-7	Farnell	2077937	1
26	D16	BZT52C		DIODES INC.	BZT52C5V6T-7	Farnell	2077937	1
27	D2	LED_0805		MULTICOMP	OVG-0803	Farnell	1716765	1
28	D3	BZT52C		DIODES INC.	BZT52C5V6T-7	Farnell	2077937	1
29	D4	BZT52C		DIODES INC.	BZT52C5V6T-7	Farnell	2077937	1
30	D5	BZT52C		DIODES INC.	BZT52C5V6T-7	Farnell	2077937	1
31	D6	BZT52C		DIODES INC.	BZT52C5V6T-7	Farnell	2077937	1
32	D7	BZT52C		DIODES INC.	BZT52C5V6T-7	Farnell	2077937	1
33	D8	BZT52C		DIODES INC.	BZT52C5V6T-7	Farnell	2077937	1
34	D9	BZT52C		DIODES INC.	BZT52C5V6T-7	Farnell	2077937	1
35	J3	BAT		AMPHENOL	TB21120A1S100CEU	Farnell	2215309	1
36	R1	120R		YAGEO (PHYCOMP)	RC0603FR-07120RL	Farnell	9238379	1
37	R10	6K8		MULTICOMP	MCMR06X6801FTL	Farnell	2073558	1
38	R11	10K		MULTICOMP	MCMR06X1002FTL	Farnell	2073349	1
39	R12	6K8		MULTICOMP	MCMR06X6801FTL	Farnell	2073558	1
40	R13	10K		MULTICOMP	MCMR06X1002FTL	Farnell	2073349	1
41	R14	6K8		MULTICOMP	MCMR06X6801FTL	Farnell	2073558	1
42	R15	10K		MULTICOMP	MCMR06X1002FTL	Farnell	2073349	1
43	R16	2DR		MULTICOMP	MCMR12X200 JTL	Farnell	2073903	1
44	R17	2DR		MULTICOMP	MCMR12X200 JTL	Farnell	2073903	1
45	R2	470R		MULTICOMP	MC0063W06035470R	Farnell	9332146	1
46	R3	470R		MULTICOMP	MC0063W06035470R	Farnell	9332146	1
47	R4	10K		MULTICOMP	MCMR06X151 JTL	Farnell	2073394	1
48	R5	6K8		MULTICOMP	MCMR06X6801FTL	Farnell	2073558	1
49	R6	10K		MULTICOMP	MCMR06X1002FTL	Farnell	2073349	1
50	R7	6K8		MULTICOMP	MCMR06X6801FTL	Farnell	2073558	1
51	R8	10K		MULTICOMP	MCMR06X1002FTL	Farnell	2073349	1
52	R9	10K		MULTICOMP	MCMR06X6801FTL	Farnell	2073558	1
53	S1	SHUNT_LT				not populated		1
54	U1	CAN-TRC		ON SEMICONDUCTOR	NCV7342D10R2G	Farnell	2382435	1
55	U10	AS8506				ams	AS8506C	1
56	U11	AS8506				ams	AS8506C	1
57	U2	MB9B524K				AMS		1
58	U6	LT1910		LINEAR TECHNOLOGY	LT1910ES8#PBF	Farnell	1273493	1
59	X1	CXO_7C_4MHz		TXC	7C-4.000MBA-T	Farnell	1842040	1
60	U9	AS1360 ASKG				ams	AS1360-33-T	1
61	U8	AS8510_new				ams		1
62	U3	LTC3639		Linear Technology	LTC3639EMSE#PBF	Digi-Key	LTC3639EMSE#PBF-ND	1
63	U4	AS8601				ams		1
64	U7	AS8525_new				ams		1
65	J1	eSATA		Molex Inc	0473790100	Farnell	1428280	1
66	Q1			INTERNATIONAL RECTIFIER	AUIRF3006-7P	Farnell	2148059	1
67	Q2			INTERNATIONAL RECTIFIER	AUIRF3006-7P	Farnell	2148059	1
68	Q3	BSS123		NXP	BSS123	Farnell	1510764	1
69	C7	10uF		PANASONIC	EEEFK1J100P	Farnell	2696008	1
70	U5	74HCT125		NXP	74HCT125D	Farnell	1201306	1
71	L1	100uH		MULTICOMP	MCSD54-101KU	Farnell	1864128	1
72	J2	TC2050-JTAG				not populated		1
Approved			Notes					72

Figure 9: BOM

7 Ordering & Contact Information

SAP number	Ordering Code	Description
#990600868	REFERENCE DESIGN 48V	48V BMS Board

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