
EVAL-L9788 hardware documentation

Introduction

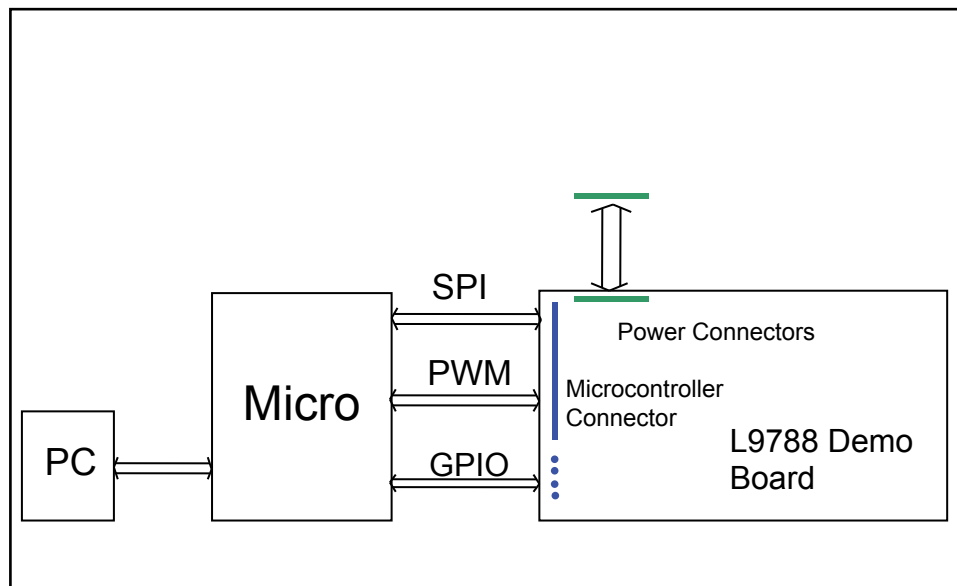
The EVAL-L9788 is an evaluation board designed to provide the user with a set of info tools for the evaluation of the product L9788, a multifunction IC for automotive engine management system. The board provides all the main input/output capabilities needed to drive all the supported loads and to interface with sensors providing diagnostic functionalities.

1 Hardware description

The EVAL-L9788 board provides maximum flexibility, giving access to all pins to simplify the evaluation and the debug phase of the device.

1.1 Block diagram

Figure 1. Application block diagram

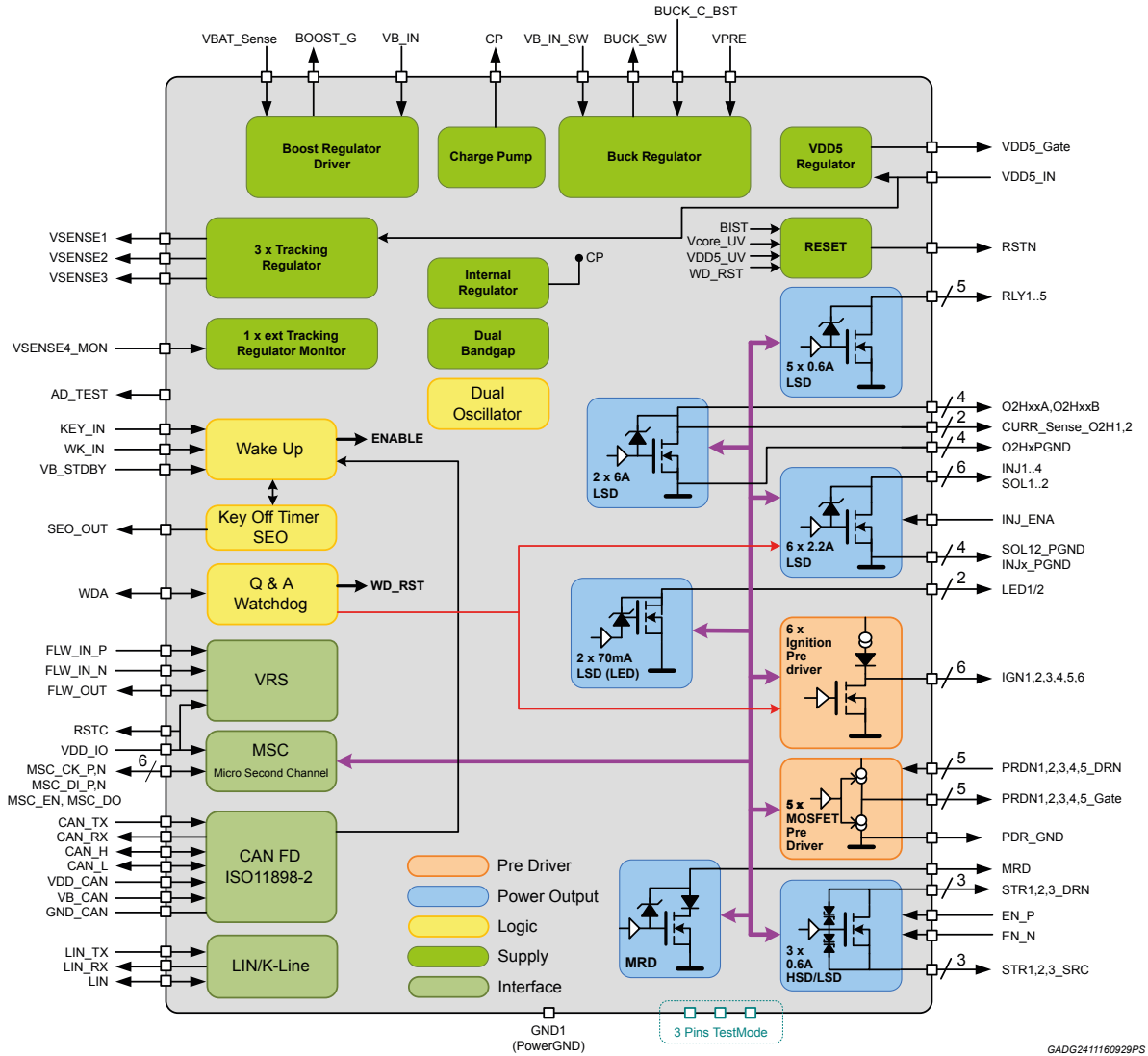


Microcontroller

- Standard APG connector 4x36
- GPIO/PWM output
- Configuration and Diagnostic of L9788 via MSC (Microsecond Channel)
- Possibility to easily connect the board to other microcontroller boards through a wire adaptor

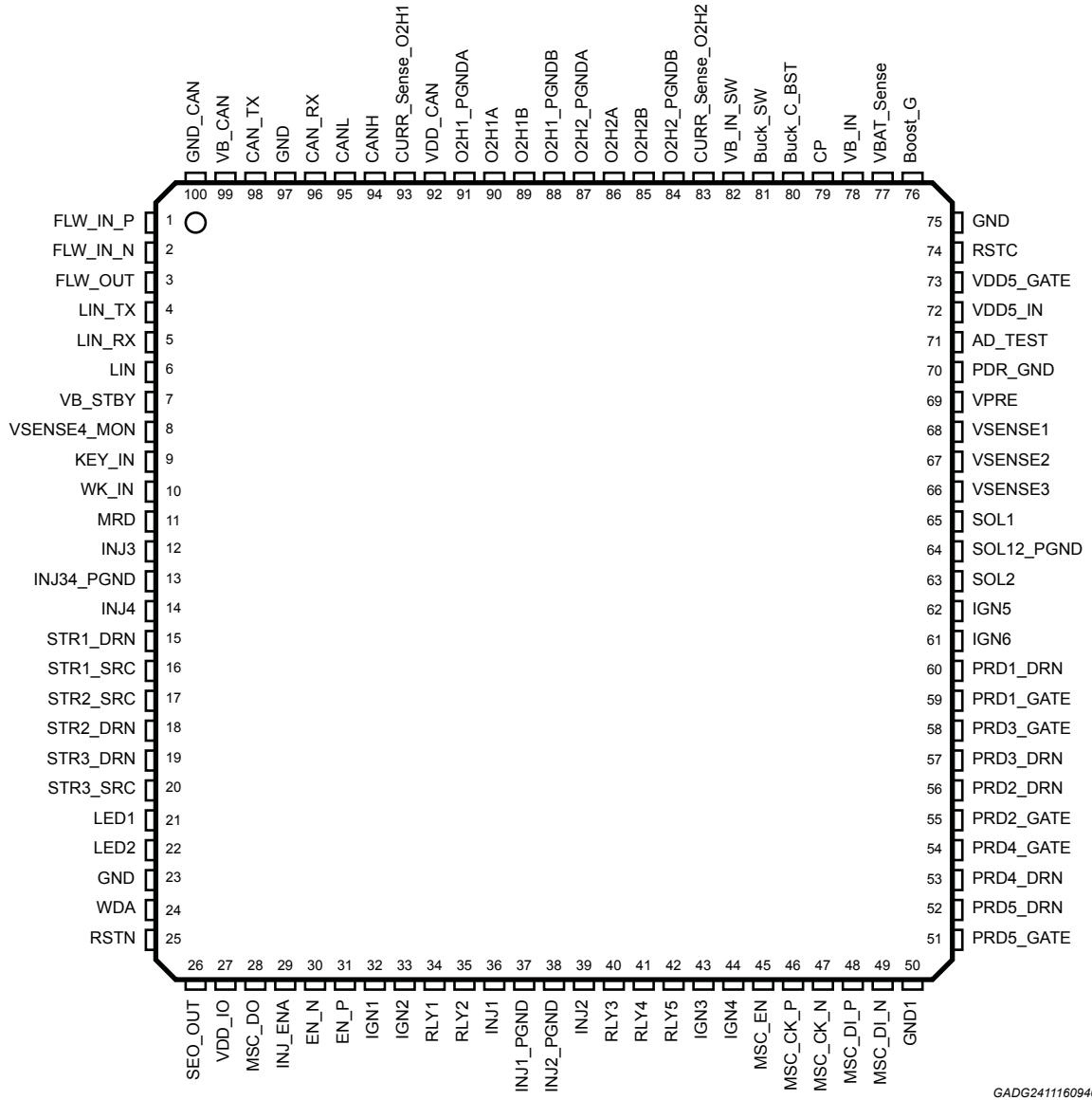
2 L9788 block diagram

Figure 2. L9788 Block diagram



GADG2411160929PS

3 L9788 pinout and pin description

Figure 3. Pinout diagram


GADG2411160940PS

Table 1. Pin descriptions

Pin Number	Name	Function
1	FLW_IN_P	Flying wheel inputs voltage positive
2	FLW_IN_N	Flying wheel inputs voltage negative
3	FLW_OUT	Flying wheel output voltage
4	LIN_TX	LIN data input
5	LIN_RX	LIN data output
6	LIN	LIN driver output

Pin Number	Name	Function
7	VB_STBY	Standby function supply voltage
8	VSENSE4_MON	Tracking sensor supply monitor
9	KEY_IN	Key signal input
10	WAKE_IN	wake up signal input
11	MRD	Main relay drivers outpour voltage
12	INJ3	Injector Driver output voltage
13	INJ34_PGND	Ground
14	INJ4	Injector Driver output voltage
15	STR1_DRN	Configurable high/low side drain voltage
16	STR1_SRC	Configurable high/low side source voltage
17	STR2_SRC	Configurable high/low side source voltage
18	STR2_DRN	Configurable high/low side drain voltage
19	STR3_DRN	Configurable high/low side drain voltage
20	STR3_SRC	Configurable high/low side source voltage
21	LED1	LED Driver output voltage
22	LED2	LED Driver output voltage
23	GND	Ground
24	WDA	Watchdog output
25	RSTN	Reset output for VDD5
26	SEO_OUT	SEO output pin
27	VDD_IO	Dedicated supply for FLW_OUT, MSC_DO, LIN_RX, CAN_RX
28	MSC_DO	MSC digital I/O voltage
29	INJ_ENA	Enable pin for injector driverPower
30	EN_N	enable signals
31	EN_P	enable signals
32	IGN1	Ignition pre-driver output voltage
33	IGN2	Ignition pre-driver output voltage
34	RLY1	Relay Driver output voltage
35	RLY2	Relay Driver output voltage
36	INJ1	Injector Driver output voltage
37	INJ1_PGND	Ground
38	INJ2_PGND	Ground
39	INJ2	Injector Driver output voltage
40	RLY3	Relay Driver output voltage
41	RLY4	Relay Driver output voltage
42	RLY5	Relay Driver output voltage
43	IGN3	Ignition pre-driver output voltage
44	IGN4	Ignition pre-driver output voltage
45	MSC_EN	MSC digital I/O voltage
46	MSC_CK_P	MSC digital I/O voltage

Pin Number	Name	Function
47	MSC_CK_N	MSC digital I/O voltage
48	MSC_DI_P	MSC digital I/O voltage
49	MSC_DI_N	MSC digital I/O voltage
50	GND1	Power ground
51	PRD5_GATE	General purpose pre-drivers gate voltage
52	PRD5_DRN	General purpose pre-drivers feedback voltage
53	PRD4_DRN	General purpose pre-drivers feedback voltage
54	PRD4_GATE	General purpose pre-drivers gate voltage
55	PRD2_GATE	General purpose pre-drivers gate voltage
56	PRD2_DRN	General purpose pre-drivers feedback voltage
57	PRD3_DRN	General purpose pre-drivers feedback voltage
58	PRD3_GATE	General purpose pre-drivers gate voltage
59	PRD1_GATE	General purpose pre-drivers gate voltage
60	PRD1_DRN	General purpose pre-drivers feedback voltage
61	IGN6	Ignition pre-driver output voltage
62	IGN5	Ignition pre-driver output voltage
63	SOL2	Valve Driver output voltage
64	SOL12_PGND	Ground
65	SOL1	Valve Driver output voltage
66	VSENSE3	5 V tracking sensor supply output voltage
67	VSENSE2	5 V tracking sensor supply output voltage
68	VSENSE1	5 V tracking sensor supply output voltage tracking sensor supply Monitor
69	VPRE	Buck output voltage
70	PDR_GND	Ground pin for predriver supply feedback input
71	AD_TEST	AD test pin
72	VDD5_IN	5 V regulator feedback voltage
73	VDD5_GATE	5 V linear regulator pre-driver output
74	RSTC	Reset output for VDDIO supply
75	GND	Ground
76	Boost_G	Boost LS gate voltage
77	VBAT_Sense	Battery supply voltage
78	VB_IN	Battery supply voltage
79	CP	Charge pump
80	Buck_C_BST	Bootstrap capacitor pin
81	Buck_SW	Buck switching pin
82	VB_IN_SW	Battery BUCK supply voltage
83	CURR_Sense_O2H2	O2heater drivers output current value
84	O2H2_PGND A	Ground
85	O2H2B_PGND B	O2H2B Driver output voltage
86	O2H2A	Driver output voltage

Pin Number	Name	Function
87	O2H2_PGND A	Ground
88	O2H1_PGND B	Ground
89	O2H1B	Driver output voltage
90	O2H1A	O2H1A Driver output voltage
91	O2H1_PGND A	Ground
92	VDD_CAN	CAN Supply 5 V
93	CURR_Sense_O2H1	O2heater drivers output current value
94	CANH	CANH output
95	CANL	CANL output
96	CAN_RX	CAN RX data output
97	GND	Ground
98	CAN_TX	CAN TX data input
99	VB_CAN	CAN Enable Signal
100	GND_CAN	Ground CAN

4 Board layout

Figure 4. Board front layout

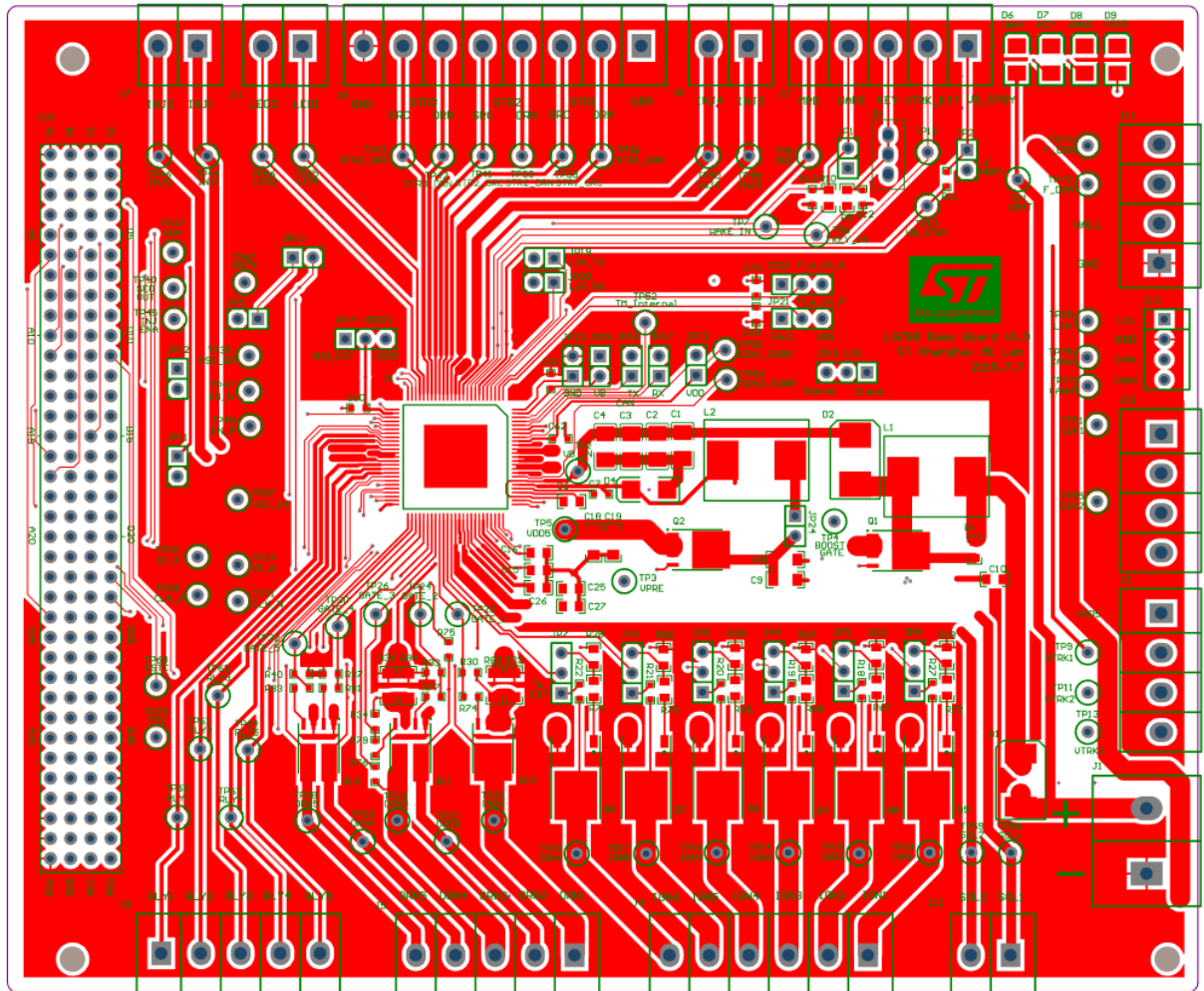


Figure 5. Board back layout

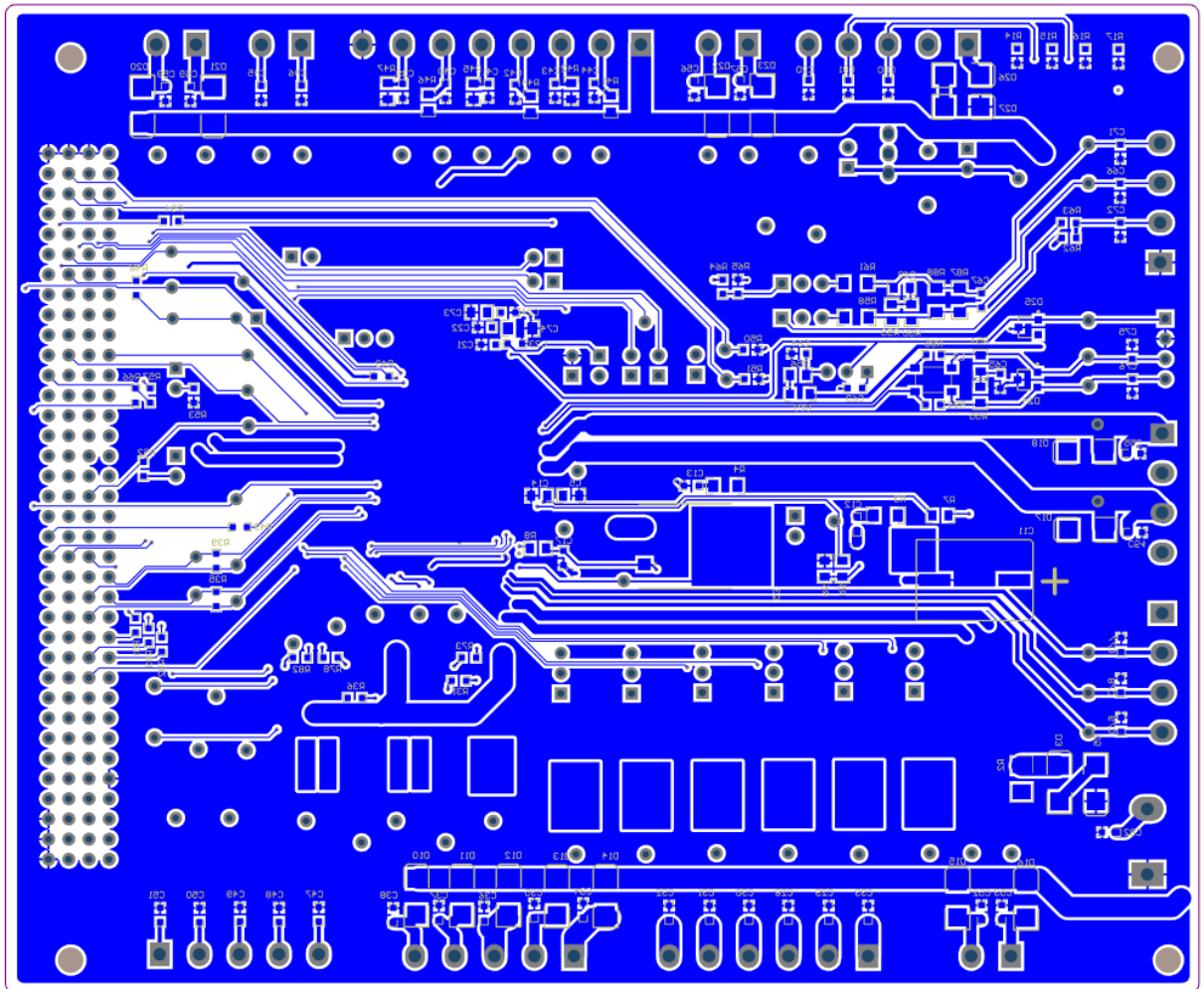
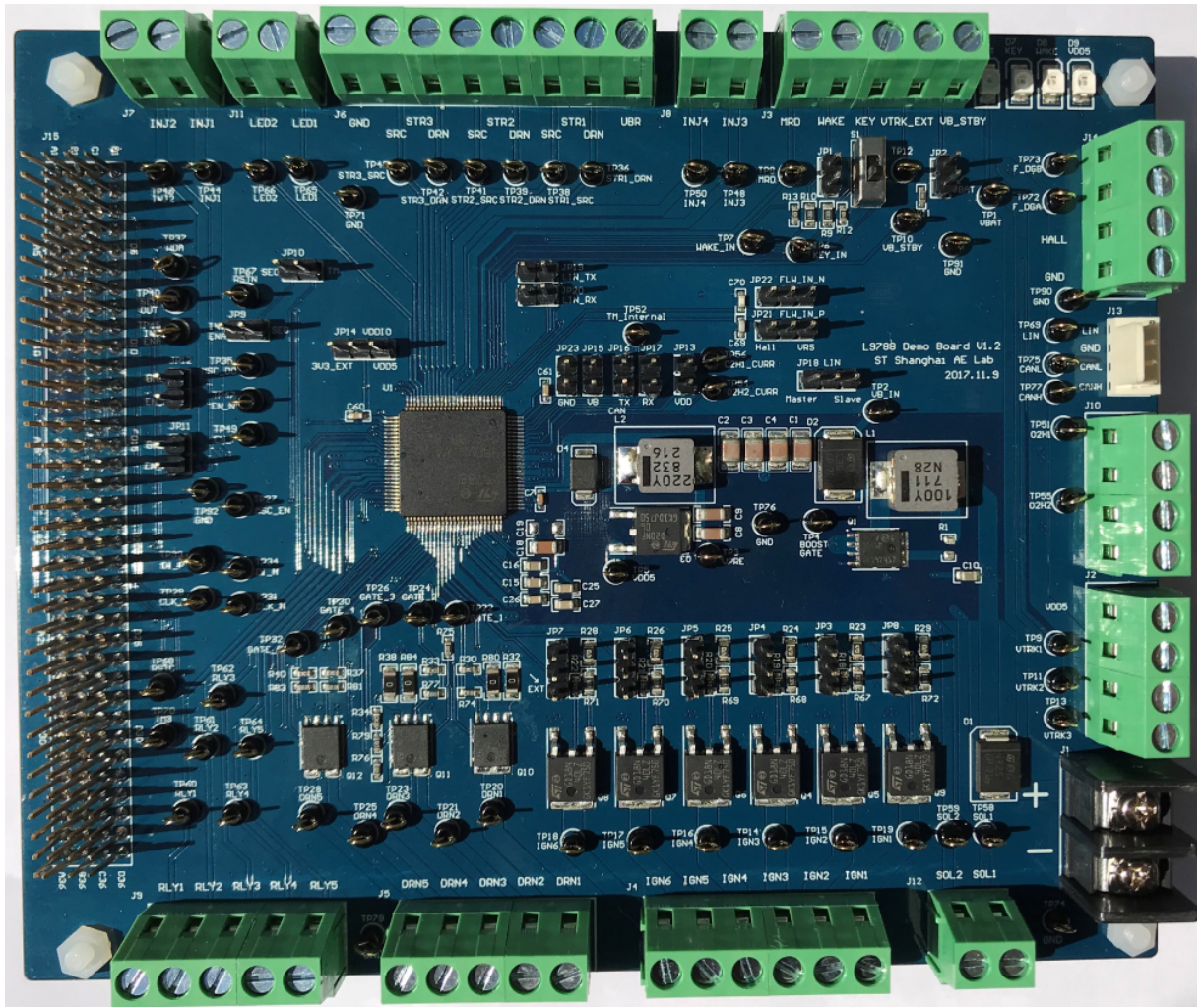


Figure 6. Board front view



5 Jumpers and connectors

5.1 Mother board jumpers and connectors

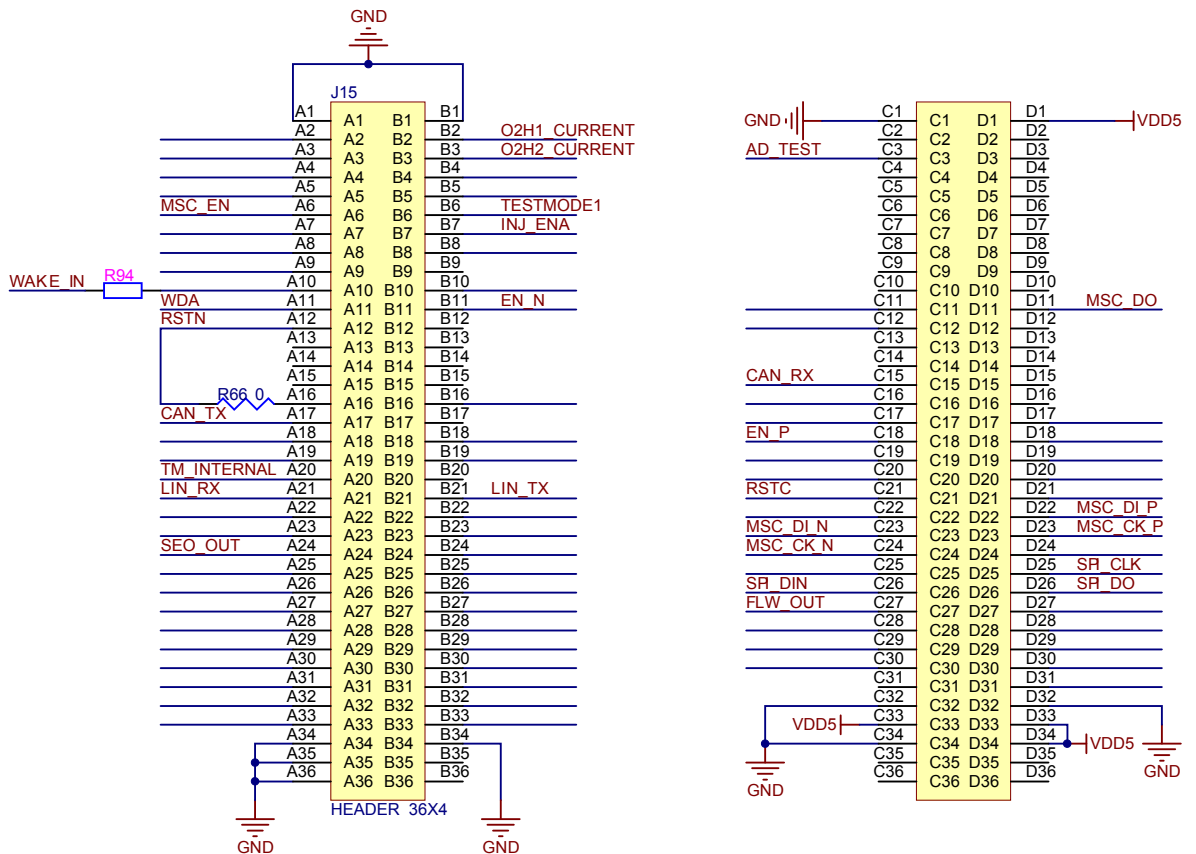
Table 2. Mother board jumpers and connectors

Name	Description	Type
J1J1	Main battery input	Screw connector
J2	<ol style="list-style-type: none"> 1. VDD5 output 2. VTRK1 output 3. VTRK2 output 4. VTRK3 output 	Multi screw connector
J3	<ol style="list-style-type: none"> 1. MRD output 2. WAKE IN input 3. KEY IN input 4. VTRK external monitoring input 5. VB stby input 	Multi screw connector
J4	Ignition output 1..6 <ol style="list-style-type: none"> 1. IGN1 2. IGN2 3. IGN3 4. IGN4 5. IGN5 6. IGN6 	Multi screw connector
J5	Pre-driver output 1...5 <ol style="list-style-type: none"> 1. DRN1 2. DRN2 3. DRN3 4. DRN4 5. DRN5 	Multi screw connector
J6	Starter relay output 1...8: <ol style="list-style-type: none"> 1. Battery 2. STR1_DRN 3. STR1_SRC 4. STR2_DRN 5. STR2_SRC 6. STR3_DRN 7. STR3_SRC 8. GND 	Multi screw connector
J7	Injector output 1..2 <ol style="list-style-type: none"> 1. INJ1 2. INJ2 	Multi screw connector
J8	Injector output 3..4 <ol style="list-style-type: none"> 1. INJ3 2. INJ4 	Multi screw connector

Name	Description	Type
J9	Relay output 1..5 1. RLY1 2. RLY2 3. RLY3 4. RLY4 5. RLY5	Multi screw connector
J10	Lambda heater output 1..4 1. O2H1 2. Not Connected 3. O2H2 4. Not Connected	Multi screw connector
J11	Led Output 1..2 1. LED1 2. LED2	Multi screw connector
J12	Solenoid driver output 1..2 1. SOL1 2. SOL2	Multi screw connector
J13	LIN/CAN Network connector 1. LIN 2. GND 3. CANL 4. CANH	Pin strip
J14	Flywheel sensor input connector 1. GND 2. E_F_DGH: Positive Hall sensor input (please set JP21 accordingly) 3. E_F_DGA: Positive variable reluctance sensor input (please set JP21 accordingly) 4. E_F_DGB: Negative variable reluctance sensor input (please set JP22 accordingly)	Multi screw connector
J15	Microcontroller connector	4x36 multipin connector
JUMPERS		
JP1	Wake-in jumper	Closed : Wake-in asserted Open: Wake in not asserted
JP2	VB_STBY jumper	Closed : VB_STBY connected to battery Open: VB_STBY not connected to battery
JP3	IGN2 output selector	3 way jumper: 1-2: L9788 IGN2 output connected externally by 50 ohm resistor 2-3: L9788 IGN2 output connected to IGBT gate
JP4	IGN3 output selector	3 way jumper: 1-2: L9788 IGN3 output connected externally by 50 ohm resistor 2-3: L9788 IGN3 output connected to IGBT gate
JP5	IGN4 output selector	3 way jumper: 1-2: L9788 IGN4 output connected externally by 50 ohm resistor 2-3: L9788 IGN4 output connected to IGBT gate

Name	Description	Type
JP6	IGN5 output selector	3 way jumper: 1-2: L9788 IGN5 output connected externally by 50 ohm resistor 2-3: L9788 IGN5 output connected to IGBT gate
JP7	IGN6 output selector	3 way jumper: 1-2: L9788 IGN6 output connected externally by 50 ohm resistor 2-3: L9788 IGN6 output connected to IGBT gate
JP8	IGN1 output selector	3 way jumper: 1-2: L9788 IGN1 output connected externally by 50 ohm resistor 2-3: L9788 IGN1 output connected to IGBT gate
JP9	SEO_INJ jumper	Closed : SEO_INJ connected to INJ_ENA Open : SEO_INJ not connected to INJ_ENA
JP11	EN_P jumper	Closed : EN_P asserted Open : EN_P not asserted
JP12	EN_N jumper	Closed : EN_N asserted Open : EN_N not asserted
JP13	VDD_CAN jumper	Closed: VDD_CAN connected to 5 V, CAN transceiver is powered Open: VDD_CAN not connected to 5 V, CAN transceiver is not powered
JP14	CAN interface digital input level selector	3 ways jumper: 1-2: 5 V interface 2-3: 3.3 V interface
JP15	CAN enable jumper	Closed: VB_CAN connected to VB_STBY, CAN transceiver is enabled Open: VB_CAN not connected to VB_STBY, CAN transceiver is disabled
JP16	CAN_TX jumper	Closed: CAN_TX is connected to the microcontroller connector (J15) Open: CAN_TX is floating
JP17	CAN_RX jumper	Closed: CAN_RX is connected to the microcontroller connector (J15) Open: CAN_RX is floating
JP18	Lin Master/Slave selector	3 ways jumper: 1-2: LIN configured as master 2-3: LIN configured as slave
JP19	LIN_TX jumper	Closed: LIN_TX is connected to the microcontroller connector (J15) Open: LIN_TX is floating
JP20	LIN_RX jumper	Closed: LIN_RX is connected to the microcontroller connector (J15) Open: LIN_RX is floating
JP21	Flywheel sensor positive input selector	3 ways jumper: 1-2: Magnetic reluctance sensor positive input 2-3: Hall sensor

Name	Description	Type
JP22	Flywheel sensor negative input selector	3 ways jumper: 1-2: Magnetic reluctance sensor negative input 2-3: Hall sensor polarization
JP23	CAN Ground Jumper	Closed : CAN ground connected to ground Open: CAN ground floating
JP24	VPRE fault simulator	Closed: VPRE correctly connected to BUCK output Open: VPRE floating
S1	Key-In switch	ON: KEY-IN asserted OFF: KEY-IN not asserted

Figure 7. Microcontroller connector


5.2 Default jumpers setting

Table 3. Jumpers configuration

Name	Description	Configuration
JP1	Wake-in not asserted	Open
JP4	IGN3 output connected to IGBT gate	2-3
JP5	IGN4 output connected to IGBT gate	2-3
JP6	IGN5 output connected to IGBT gate	2-3
JP7	IGN6 output connected to IGBT gate	2-3
JP8	IGN1 output connected to IGBT gate	2-3
JP9	SEO_INJ not connected to INJ_ENA	Open
JP11	EN_P asserted	Closed
JP12	EN_N asserted	Closed
JP13	VDD_CAN connected to 5V, CAN transceiver is powered	Closed
JP14	CAN interface digital input level 5V interface	1-2
JP15	CAN transceiver is enabled	Closed
JP16	CAN_TX TX is connected to the microcontroller connector (J15)	Closed
JP17	CAN_RX TX is connected to the microcontroller connector (J15)	Closed
JP18	LIN configured as master	1-2
JP19	LIN_TX is connected to the microcontroller connector (J15)	Closed
JP20	LIN_RX is connected to the microcontroller connector (J15)	Closed
JP21	Flywheel sensor Magnetic reluctance sensor positive input	1-2
JP22	Flywheel sensor Magnetic reluctance sensor negative input	1-2
JP23	CAN ground connected to ground	Closed
JP24	VPRE correctly connected to BUCK output	Closed
S1	Key-In switch	ON: KEY-IN asserted OFF: KEY-IN notasserted

5.3 Getting started

5.3.1 Start up

1. Configure all the jumper according to [Table 3. Jumpers configuration](#);
2. Connect a Power supply to JP1 respecting the right polarity;
3. Configure the power supply connected to J1 to 13.5 V ;
4. Switch on the power supply;
5. Switch ON S1 (Key-in) to enable the device;
6. For further information connect a μC and follow the related documentation to check the internal register status of L9788.

Appendix A L9788 Evaluation board schematics

Figure 8. EVAL-L9788 regulators schematic diagram

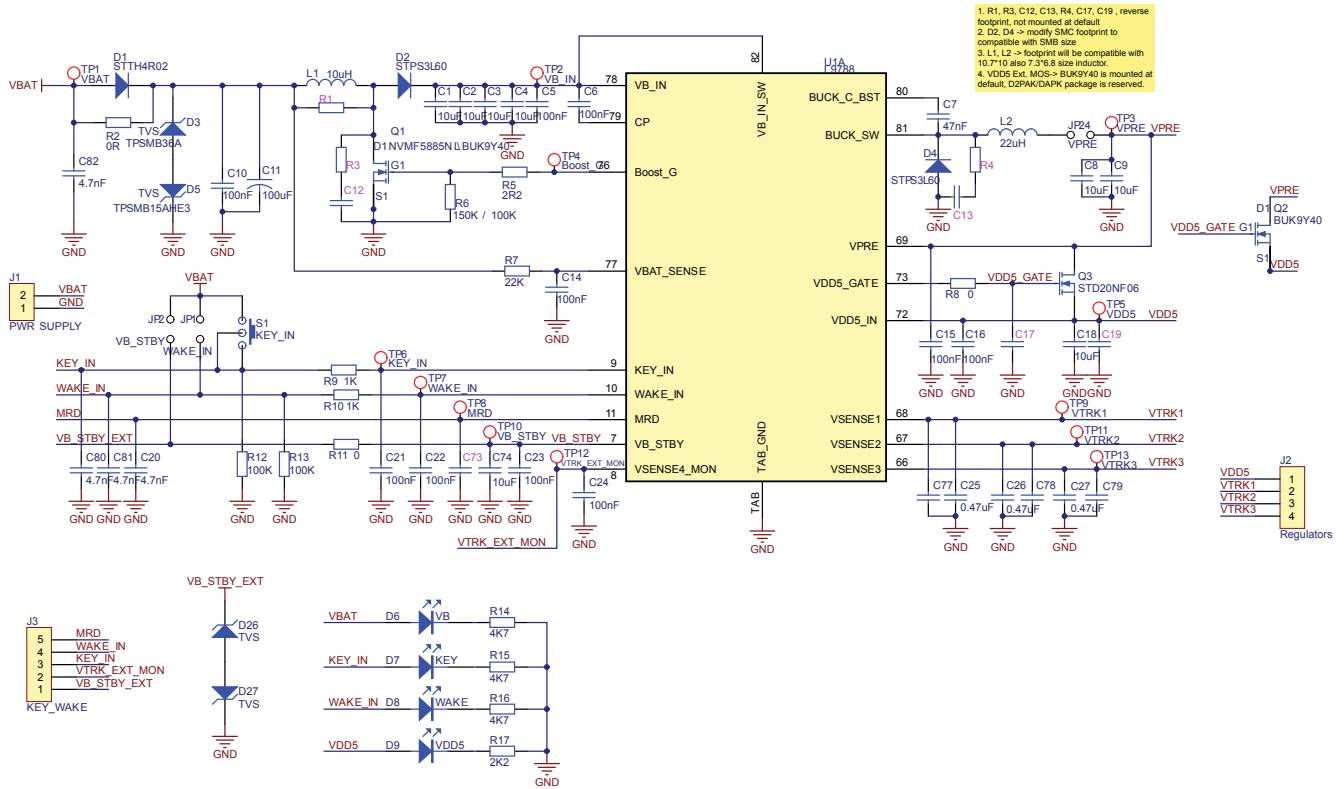


Figure 9. EVAL-L9788 drivers schematic diagram

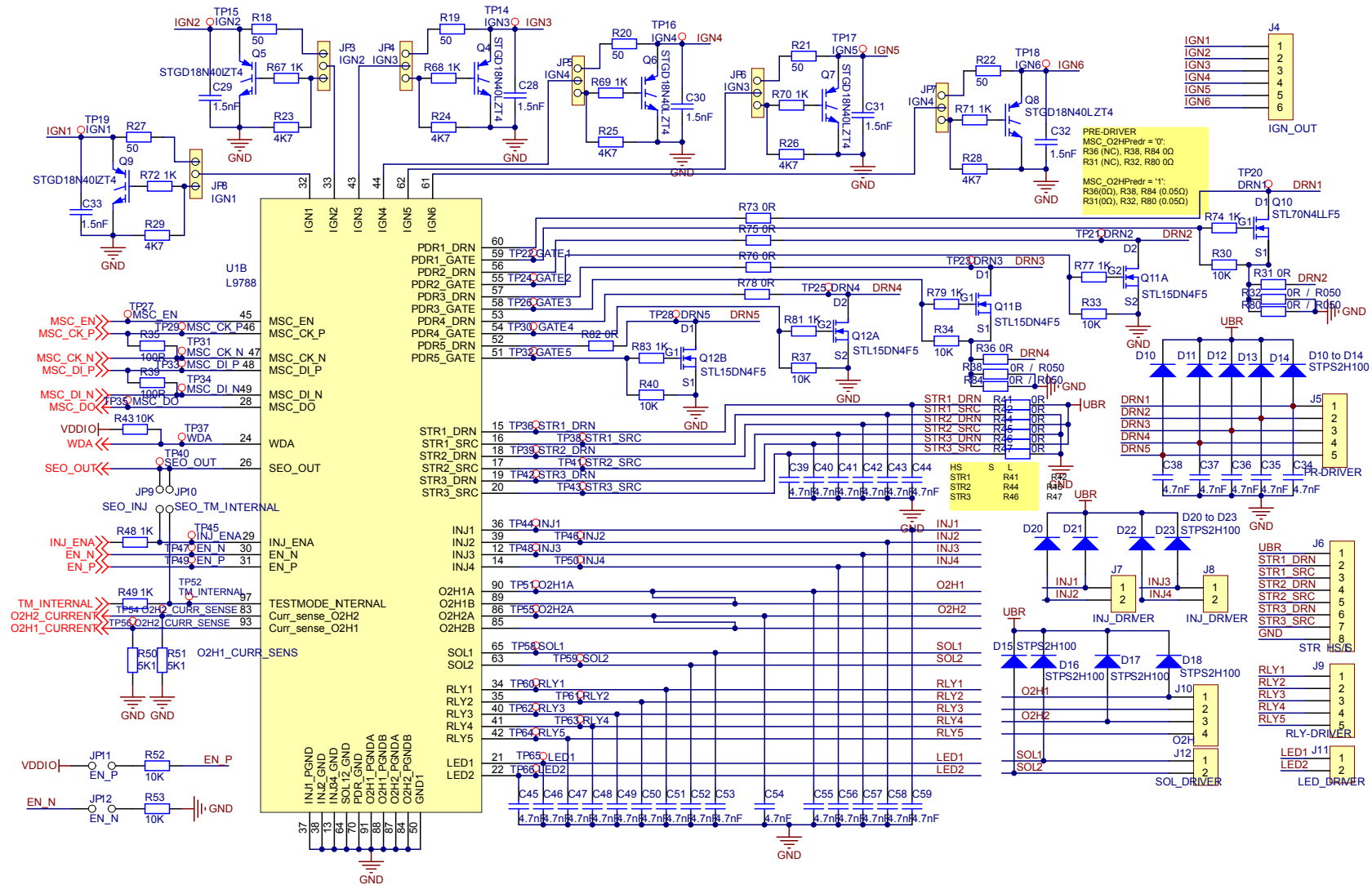
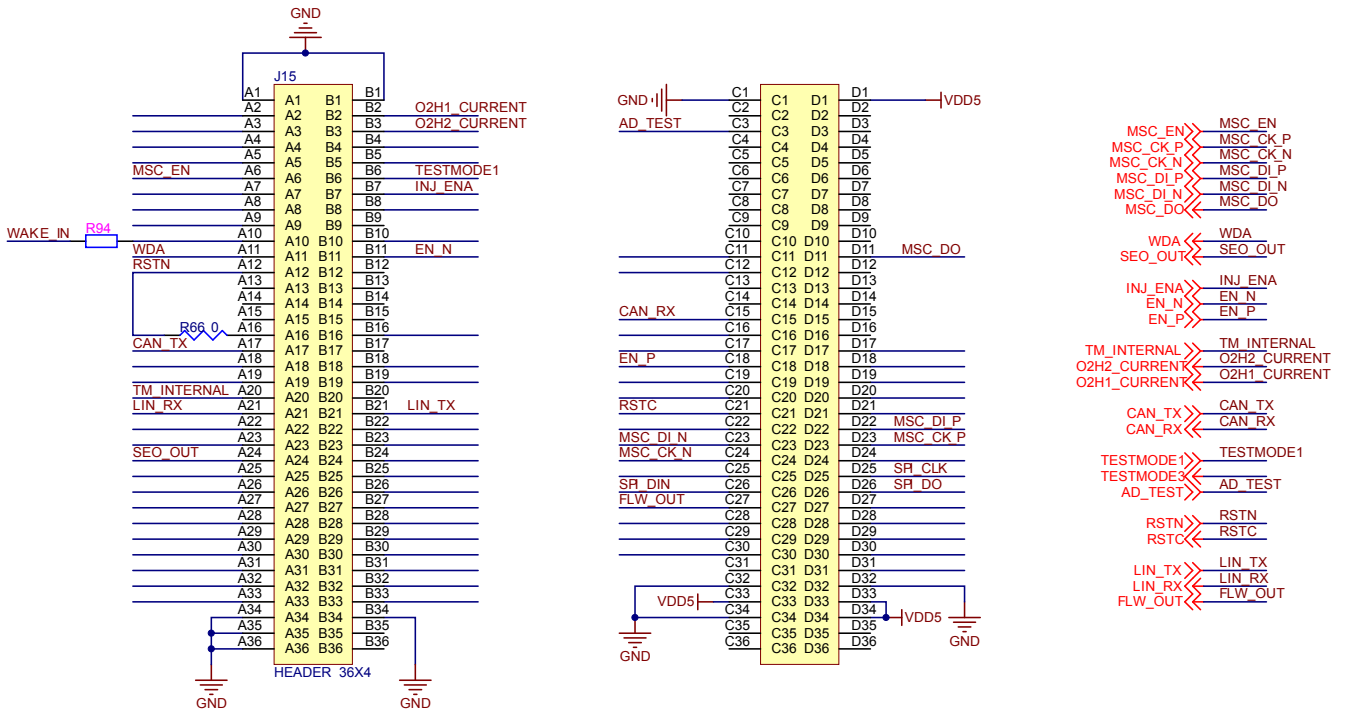
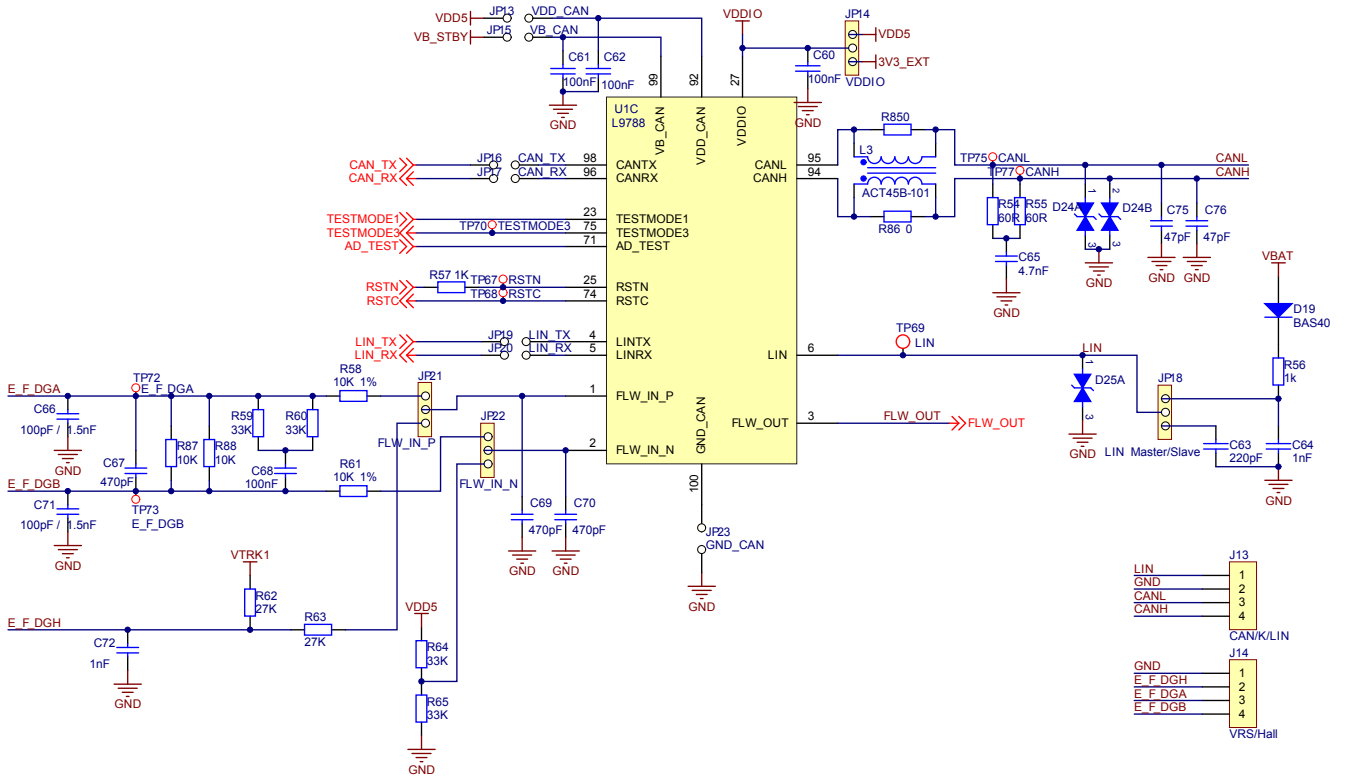


Figure 10. EVAL-L9788 interface schematic diagram



Revision history

Table 4. Document revision history

Date	Version	Changes
03-May-2019	1	Initial release.

Contents

1	Hardware description	2
1.1	Block diagram	2
2	L9788 block diagram	3
3	L9788 pinout and pin description	4
4	Board layout	8
5	Jumpers and connectors	11
5.1	Mother board jumpers and connectors	11
5.2	Default jumpers setting	15
5.3	Getting started	15
5.3.1	Start up	15
Appendix A	L9788 Evaluation board schematics	16
	Revision history	19

List of tables

Table 1.	Pin descriptions	4
Table 2.	Mother board jumpers and connectors	11
Table 3.	Jumpers configuration	15
Table 4.	Document revision history	19

List of figures

Figure 1.	Application block diagram	2
Figure 2.	L9788 Block diagram	3
Figure 3.	Pinout diagram	4
Figure 4.	Board front layout	8
Figure 5.	Board back layout	9
Figure 6.	Board front view	10
Figure 7.	Microcontroller connector	14
Figure 8.	EVAL-L9788 regulators schematic diagram	16
Figure 9.	EVAL-L9788 drivers schematic diagram	17
Figure 10.	EVAL-L9788 interface schematic diagram	18
Figure 11.	EVAL-L9788 MCU connector schematic diagram	18

IMPORTANT NOTICE – PLEASE READ CAREFULLY

STMicroelectronics NV and its subsidiaries (“ST”) reserve the right to make changes, corrections, enhancements, modifications, and improvements to ST products and/or to this document at any time without notice. Purchasers should obtain the latest relevant information on ST products before placing orders. ST products are sold pursuant to ST’s terms and conditions of sale in place at the time of order acknowledgement.

Purchasers are solely responsible for the choice, selection, and use of ST products and ST assumes no liability for application assistance or the design of Purchasers’ products.

No license, express or implied, to any intellectual property right is granted by ST herein.

Resale of ST products with provisions different from the information set forth herein shall void any warranty granted by ST for such product.

ST and the ST logo are trademarks of ST. For additional information about ST trademarks, please refer to www.st.com/trademarks. All other product or service names are the property of their respective owners.

Information in this document supersedes and replaces information previously supplied in any prior versions of this document.

© 2019 STMicroelectronics – All rights reserved