

Introduction

The EVAL-L9960 and EVAL-L9960T are evaluation boards designed to provide the user a platform for the L9960 and L9960T, that are integrated H-Bridge (Twin for L9960T) for resistive and inductive loads for automotive applications, such as throttle control actuators or exhaust gas recirculation control valves.

The board offers all the main input/output capabilities needed to drive a DC motor properly and to provide diagnostic functionalities.

Full diagnostic is available through SPI. By using SPI communication, it is possible to program L9960 and L9960T while the application is running (e.i. set the current limitation).

A dedicated pin array allows connecting easily a SPC5 discovery+ board and the EVAL-L9960/L9960T. In association with the discovery board SPC560P-DISP a dedicated SW allows controlling a motor control application by using a PC via a USB port.

The device is an integrated H-Bridge for resistive and inductive loads for automotive applications, such as throttle control actuators or exhaust gas recirculation control valves.

The driving strategy is enhanced by configurable PWM / DIR pins as IN1/IN2. The H-Bridge contains integrated free-wheel diodes. In case of freewheeling conditions, the low side or the high side transistor is switched on in parallel of its diode to reduce power dissipation.

The integrated Serial Peripheral Interface (SPI) allows device parameters adjustment and to control all operating modes and read out diagnostic information.

Detailed failure diagnostics on each channel is provided via SPI: short circuit to battery, short circuit to ground, short circuit overload, over temperature. Open-load can be detected in ON condition, for the widest application ranges.

The EVAL-L9960 and EVAL-L9960T boards are suitable for both beginners and expert users working in standalone mode connected with any control system or combined with all SPC5 Discovery+ boards through a computer graphic interface or through embedded application examples.

The board is compatible with both 5V and 3.3V control systems

Contents

1	Hardware description	5
1.1	Application Block Diagram	5
2	EVAL-L9960 & L9960T: board description	6
2.1	EVAL-L9960 & EVAL-L9960T	6
2.2	EVAL- L9960 / L9960T	8
2.2.1	Jumper description	8
2.2.2	Connectors & Device	9
2.2.3	L9960T SPI configurator	11
2.3	Test Point description	12
3	Functional description	13
3.1	Jumper setting using L9960 & SPC5 Discovery+ board	13
3.2	Jumper setting using L9960T & SPC5 Discovery+ board	13
4	Getting started with EVAL-L9960 & EVAL-L9960T	15
Appendix A	Board layout	16
A.1	EVAL-L9960 & EVAL-L9960T PCB Layout	16
A.2	EVAL-L9960 & EVAL-L9960T schematic	18
	Revision history	19

List of tables

Table 1. Jumpers descriptions 8

Table 2. Connector & Device description 9

Table 3. Test point description 12

Table 4. Jumpers setting using L9960 13

Table 5. Jumpers setting using L9960T 13

Table 6. Document revision history 19

List of figures

Figure 1.	Application Block Diagram	5
Figure 2.	EVAL-L9960	6
Figure 3.	EVAL-L9960T	6
Figure 4.	Gate driver board (L9907) - components and connectors - top view	7
Figure 5.	SPC56 Discovery + Connector	9
Figure 6.	Motor A Connector	10
Figure 7.	Motor B Connector	10
Figure 8.	L9960T SPI configurator	11
Figure 9.	PCB Layout – Top view	16
Figure 10.	Gate driver board - PCB Layout – Bottom view	17
Figure 11.	EVAL-L9960 & EVAL-L9960T schematic	18

1 Hardware description

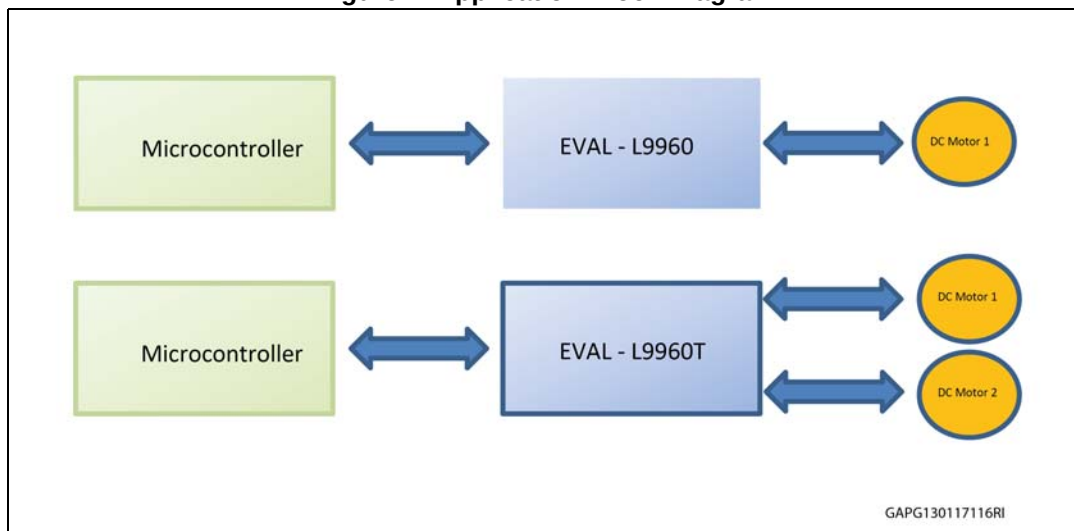
The EVAL-L9960/L9960T is an evaluation board designed to allow the whole hardware configuration flexibility, giving the user total access to all pins of the L9960/L9960T.

The main features are:

- Total accessibility to all devices pins
- Full HW compatibility with the SPC56 discovery boards through the standard SPC56 Discovery+ connector, 0.1" - 4x36 pin.
- Possibility to connect generic microcontroller boards^(a) by using a customised adaptor.

1.1 Application Block Diagram

Figure 1. Application Block Diagram



a. A dedicated connector allows plugging the EVAL-L9960/L9960T in a SCP5 Discovery+ board easily. Further microcontroller boards can be connected to drive the evaluation boards by using an adaptor.

2 EVAL-L9960 & L9960T: board description

2.1 EVAL-L9960 & EVAL-L9960T

Figure 2. EVAL-L9960

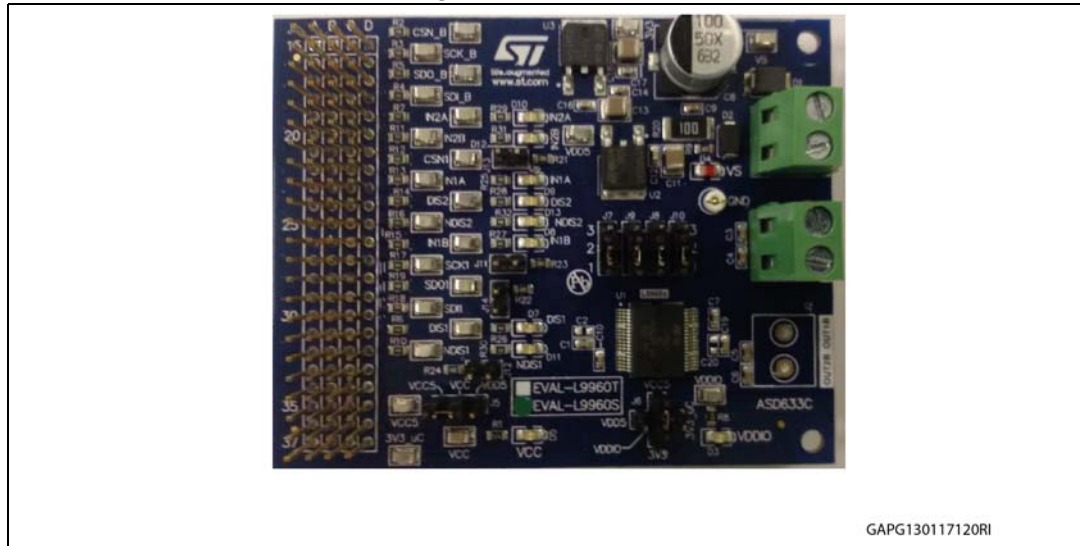


Figure 3. EVAL-L9960T

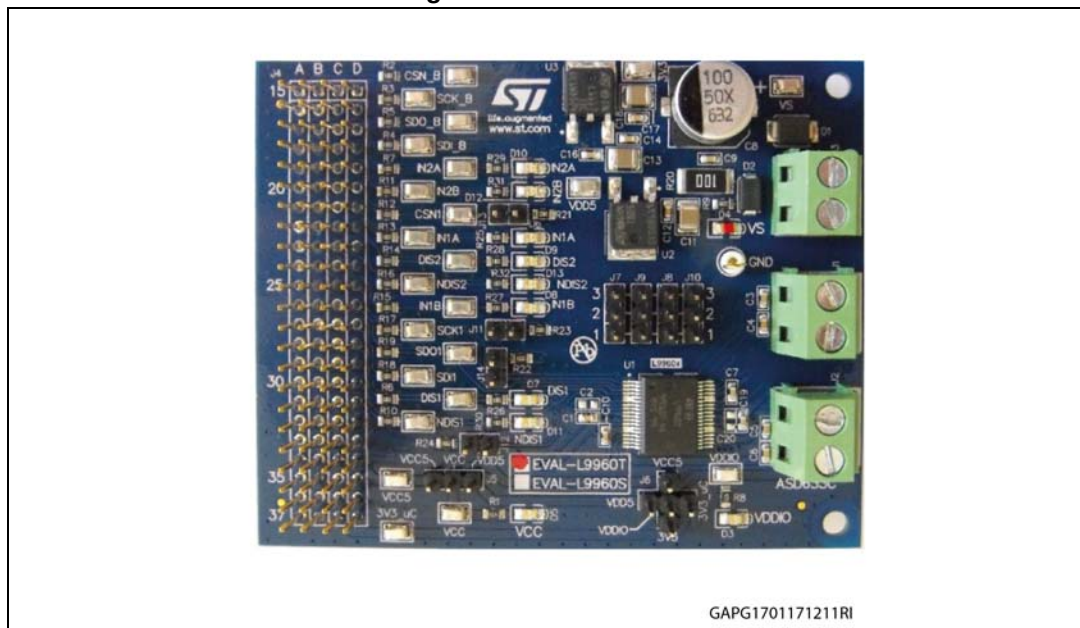
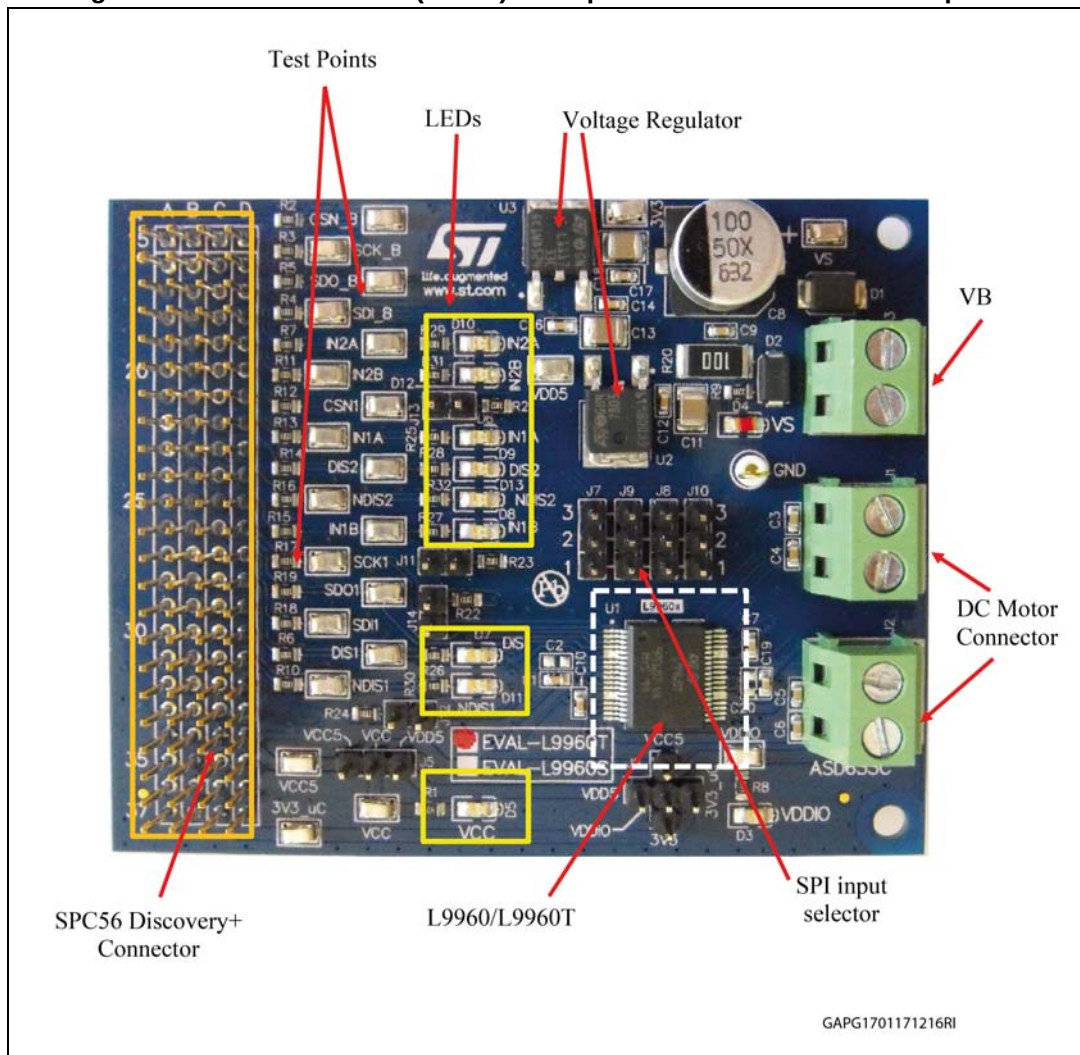


Figure 4. Gate driver board (L9907) - components and connectors - top view



2.2 EVAL- L9960 / L9960T

2.2.1 Jumper description

Table 1. Jumpers descriptions

Name	Description	Type
J5	Vcc source jumper: - 2-1= VcCC5= Vcc Micro - 3-2= VDD5 (L7805CDT-TR)	Configurable two positions jumper
J6	Vcc source jumper: - 2-1= VDDIO= VDD5 - 2-3= VDDIO= 3,3V Micro - 2-4= VDDIO= VDD5 (L7805CDT-TR) - 2-5= VDDIO= 3V3 LD1117DT33CTR	Configurable three positions jumper
J7	CSN2 Signal source jumper 1-2= CSN2=CSN1 3-2= Micro	Configurable two positions jumper
J8	SDI2 Signal source jumper - 1-2= SDI2=SDI1 - 3-2= Micro	Configurable two positions jumper
J9	SCK2 Signal source jumper - 1-2= SCK2= SCK1 - 3-2= Micro	Configurable two positions jumper
J10	SDO2 Signal source jumper - 1-2= SDO2= SDO1 - 3-2= Micro	Configurable two positions jumper
J11	NDIS2 pull down resistor - ON R=10k pull down	ON/OFF jumper
J12	NDIS1 pull down resistor - ON R=10k pull down	ON/OFF jumper
J13	DIS2 pull up resistor - ON R=10k pull up	ON/OFF jumper
J14	DIS1 pull up resistor - ON R=10k pull up	ON/OFF jumper

2.2.2 Connectors & Device

Table 2. Connector & Device description

Name	Description	Type
J1	Motor A Connector	Screw
J2	Motor B Connector (Only for EVAL-L9960T)	Screw
J3	VS Connector	Screw
J4_1,J4_2	Microcontroller connector	Multipin
U1	L9960 / L9960T	POWERSSO36
U2	5V Voltage Regulator L7805CDT-TR	DPAK
U3	3,3 V Voltage Regulator LD1117DT33CTR	DPAK

Figure 5. SPC56 Discovery + Connector

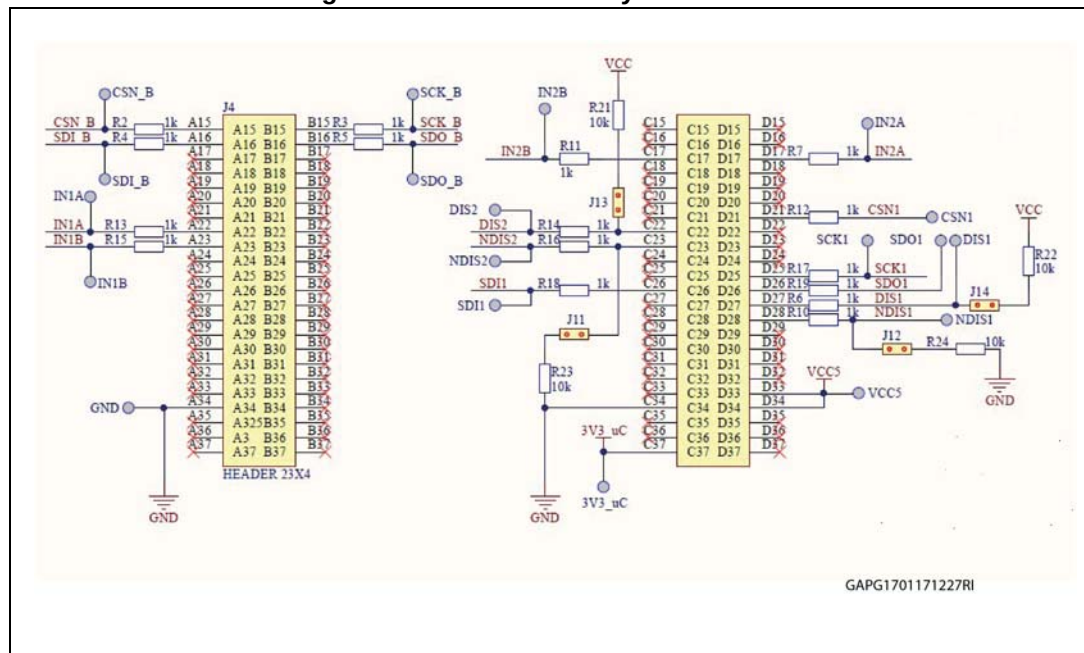


Figure 6. Motor A Connector

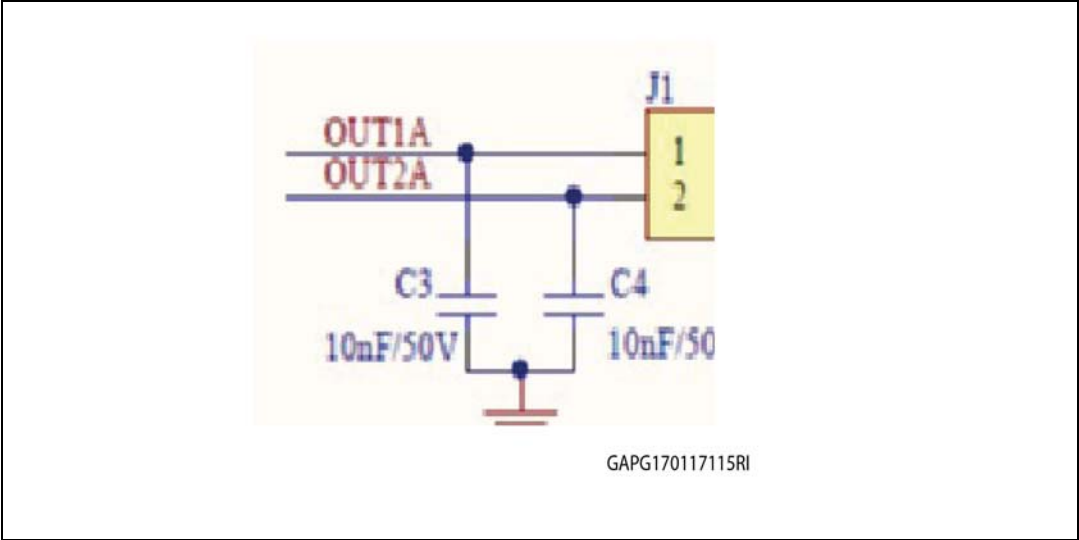
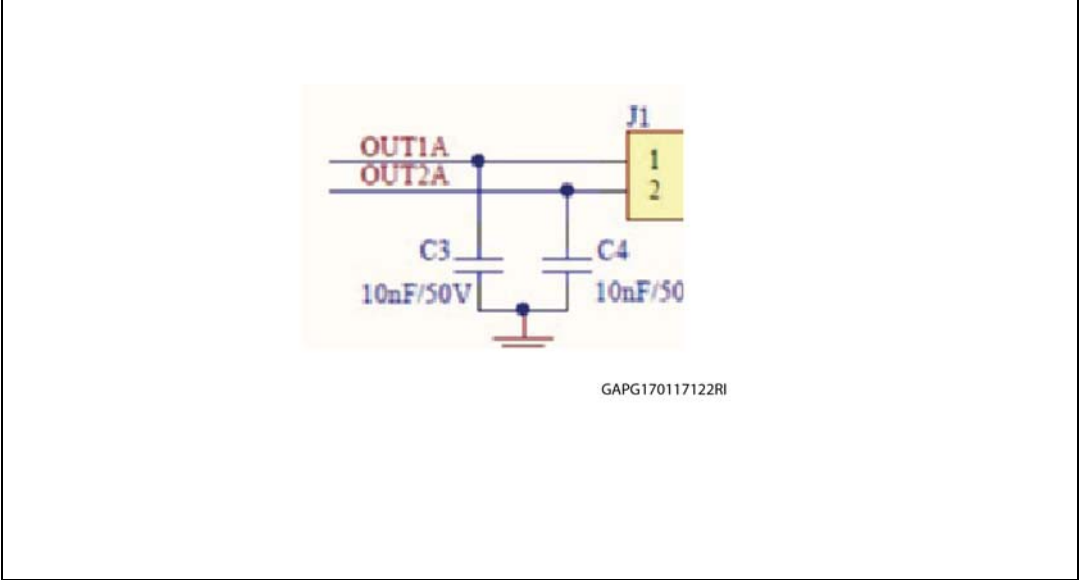
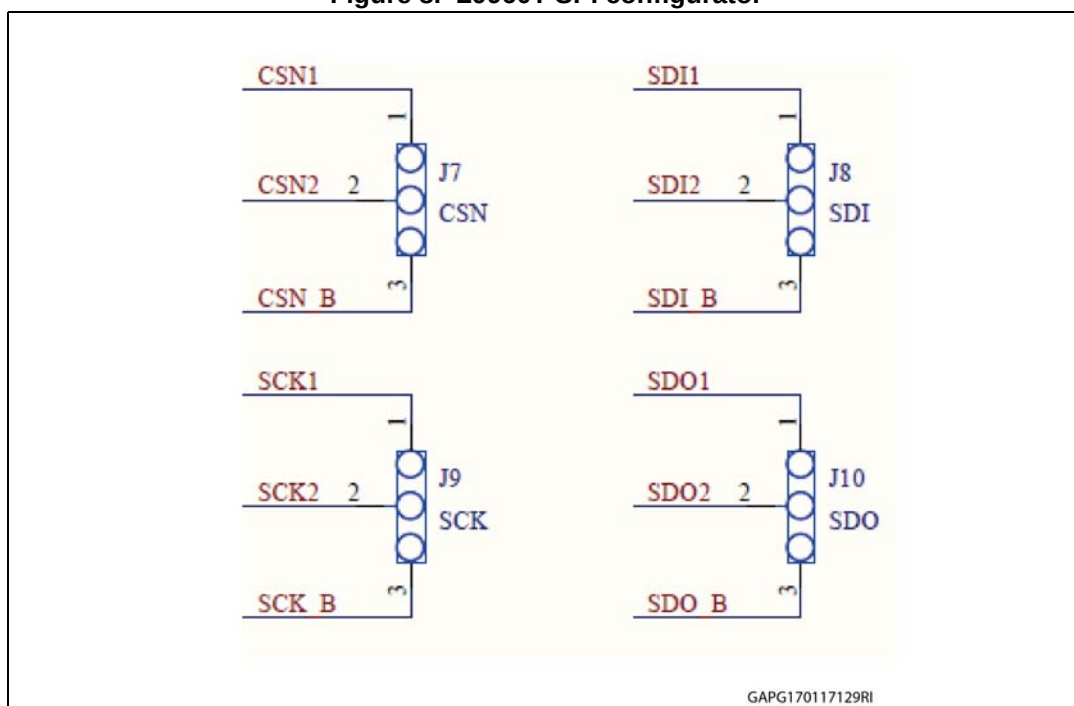


Figure 7. Motor B Connector



2.2.3 L9960T SPI configurator

Figure 8. L9960T SPI configurator



2.3 Test Point description

I: Input,

O: Output

Table 3. Test point description

TP Name	Pin Name	Description	I/O Type
VS	VB	Protected Battery supply	I
VDD5	VDD5	5V Supply Input	I
VCC5	VCC5	5V Supply Input Micro	I
3V3	--	3,3V Supply Input	I
3V3_uC	--	3,3V Supply Input Micro	I
VDDIO	VDDIO	VDDIO Supply Voltage	I
CSN1	CSN1	SPI CSN1 Input A	I
SDI1	SDI1	SPI SDI1 Input A	I
SDO1	SDO1	SPI SDO1 Input A	O
SCK_A	SCK_A	SPI Serial Clock Input A	I
CSN2	CSN2	SPI CSN1 Input B	I
SDI2	SDI2	SPI SDI1 Input B	I
SDO2	SDO2	SPI SDO1 Input B	O
SCK_B	SCK_B	SPI Serial Clock Input B	I
DIS1	DIS1	GPIO / PWM	I
NDIS1	NDIS1	GPIO / PWM	I
DIS2	DIS2	GPIO / PWM	I
NDIS2	NDIS2	GPIO / PWM	I
IN1A	IN1A	GPIO / PWM	I
IN2A	IN2A	GPIO / PWM	I
IN1B	IN1B	GPIO / PWM	I
IN2B	IN2B	GPIO / PWM	I
GND	GND	Ground	GND

3 Functional description

3.1 Jumper setting using L9960 & SPC5 Discovery+ board

Table 4. Jumpers setting using L9960

Name	Description	Configuration
J1	Motor A Connector	Motor A
J2	Motor B Connector	Not Present on EVAL-L9960
J3	VS Connector	VS Connector
J4	SPC Discovery+ or other Microcontroller Connector	SPC Discovery+ or other Microcontroller
J5	VCC Selector	3-2= VDD5 (L7805CDT-TR)
J6	VDDIO Selector	2-1= VDDIO= VDD5 OR 2-4= VDDIO= VDD5 (L7805CDT-TR)
J7	CSN2 Selector	OPEN (CSN2 for L9960T)
J8	SDI2 Selector	OPEN (SDI2 for L9960T)
J9	SCK2 Selector	OPEN (SCK2 for L9960T)
J10	SDO2 Selector	OPEN (SDO2 for L9960T)
J11	NDIS2 pull down resistor Selector	OPEN (No NDIS2 pull down resistor) ⁽¹⁾
J12	NDIS1 pull down resistor Selector	OPEN (No NDIS1 pull down resistor)
J13	DIS2 pull up resistor Selector	OPEN (No DIS2 pull up resistor)
J14	DIS1 pull up resistor Selector	OPEN (No DIS1 pull up resistor)

1. OPEN or CLOSE depending on the application

3.2 Jumper setting using L9960T & SPC5 Discovery+ board

Table 5. Jumpers setting using L9960T

Name	Description	Configuration
J1	Motor A Connector	Motor A
J2	Motor B Connector	Motor B
J3	VS Connector	VS Connector
J4	SPC Discovery+ or other Microcontroller Connector	SPC Discovery+ or other Microcontroller
J5	VCC Selector	3-2= VDD5 (L7805CDT-TR)
J6	VDDIO Selector	2-1= VDDIO= VDD5 OR 2-4= VDDIO= VDD5 (L7805CDT-TR)

Table 5. Jumpers setting using L9960T (continued)

Name	Description	Configuration
J7	CSN2 Selector	1-2= CSN2=CSN1
J8	SDI2 Selector	1-2= SDI2=SDI1
J9	SCK2 Selector	1-2= SCK2=SCK1
J10	SDO2 Selector	1-2= SDO2=SDO1
J11	NDIS2 pull down resistor Selector	OPEN (No NDIS2 pull down resistor)
J12	NDIS1 pull down resistor Selector	OPEN (No NDIS1 pull down resistor)
J13	DIS2 pull up resistor Selector	OPEN (No DIS2 pull up resistor)
J14	DIS1 pull up resistor Selector	OPEN (No DIS1 pull up resistor)

4 **Getting started with EVAL-L9960 & EVAL-L9960T**

A dedicated Graphical User Interface (GUI) is available to set and control the EVAL-L9960 & EVAL-L9960T board (ETC H/Bridge motor application boards for L9960) through the SPI protocol, manage the DIS, NDIS and IN2 pins and send PWM to IN1 pins.

The GUI (STSW-L9960) has been developed using Labview® 2015 and it works with SPC560P-DISP evaluation board programmed with a dedicated FW (GP-Pictus_v1.1.elf) available on the ST web site.

Appendix A Board layout

A.1 EVAL-L9960 & EVAL-L9960T PCB Layout

Figure 9. PCB Layout – Top view

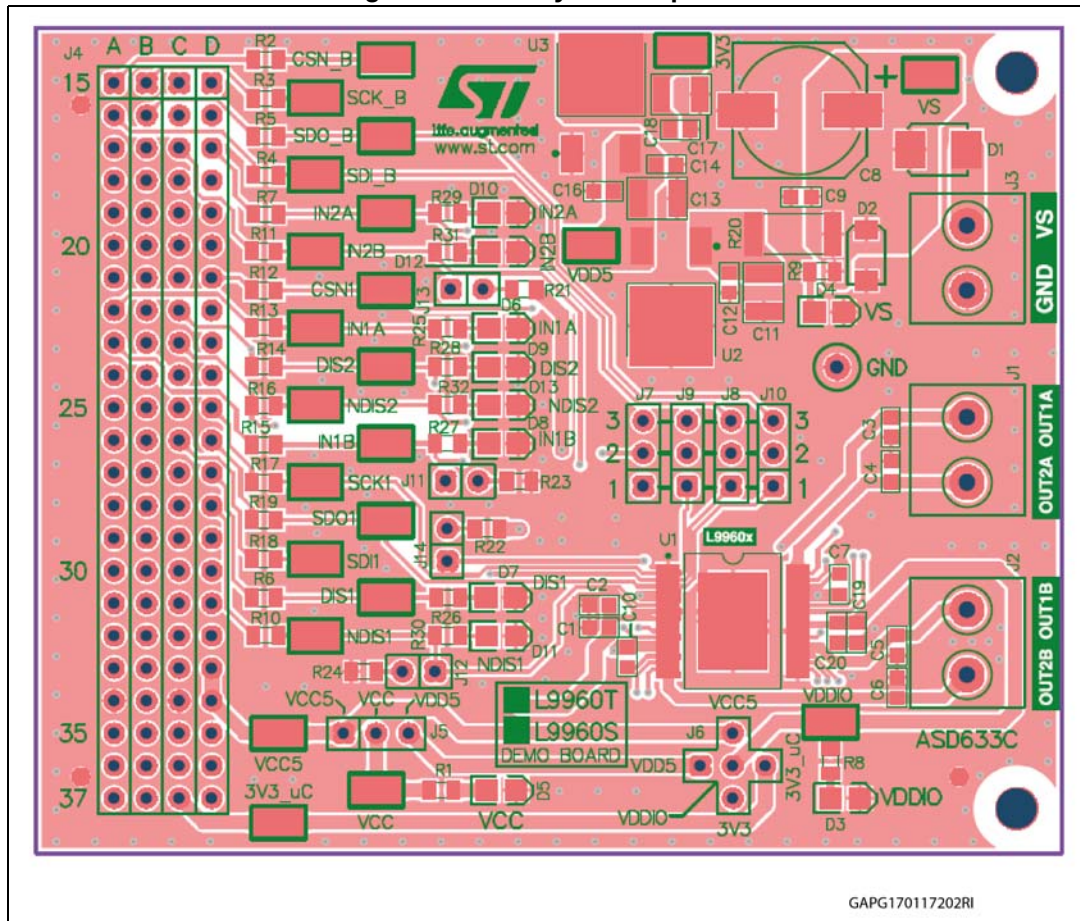
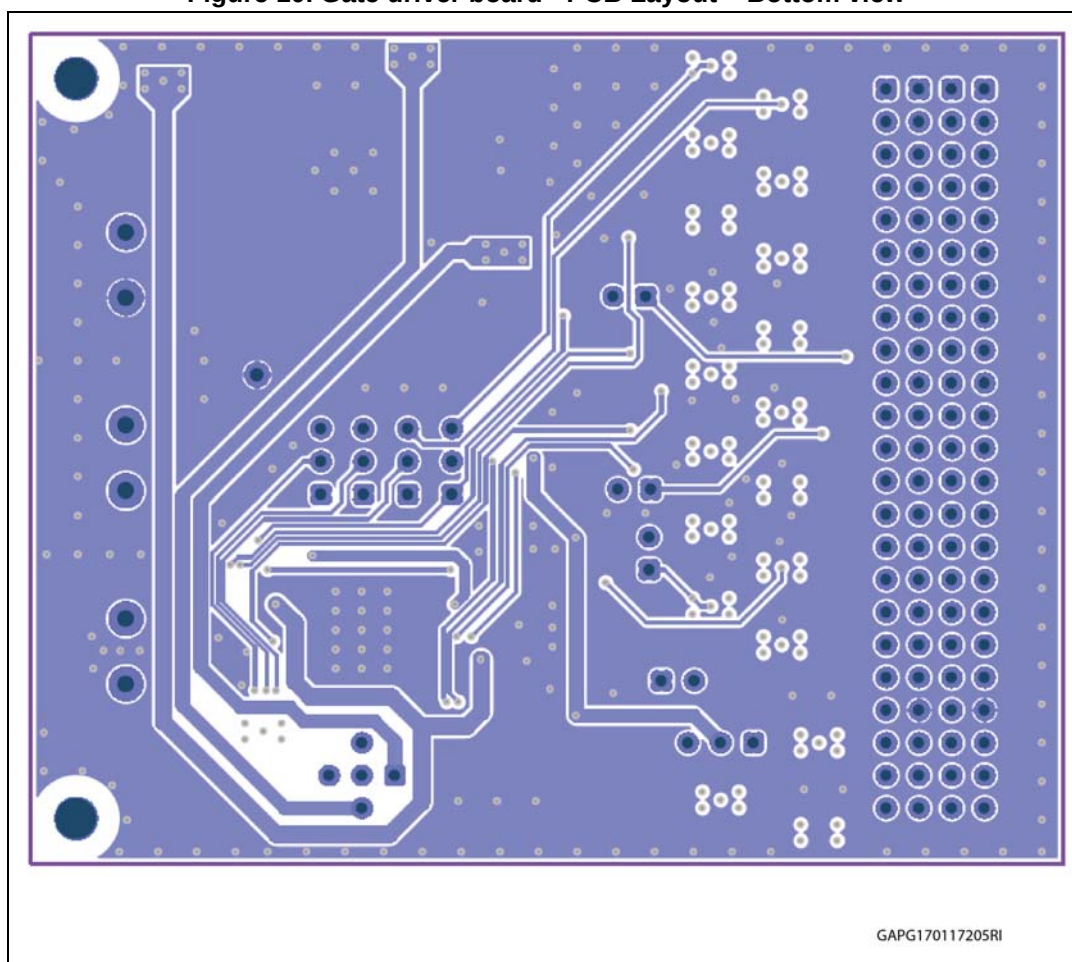
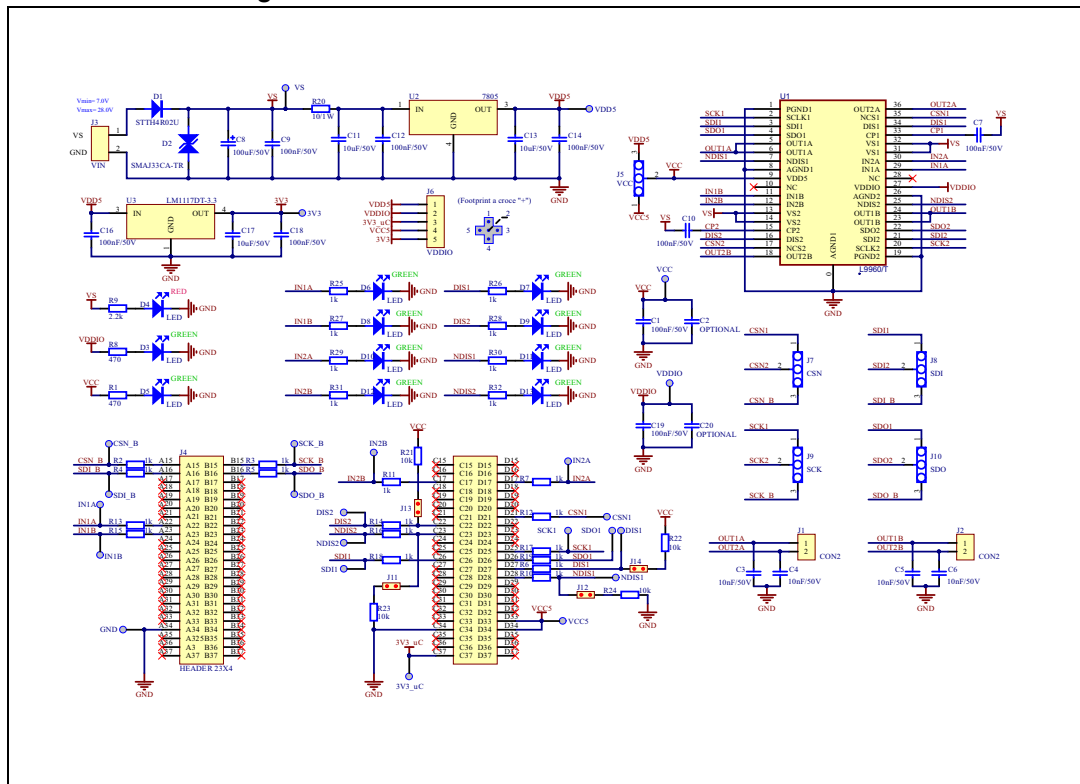


Figure 10. Gate driver board - PCB Layout – Bottom view



A.2 EVAL-L9960 & EVAL-L9960T schematic

Figure 11. EVAL-L9960 & EVAL-L9960T schematic



Revision history

Table 6. Document revision history

Date	Revision	Changes
30-Jan-2017	1	Initial release.
13-Jun-2017	2	Typo.
13-Mar-2018	3	Updated Figure 11: EVAL-L9960 & EVAL-L9960T schematic .

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