Introduction

This document describes the specifications for the L99LD21 discovery board that is able to work connected to SPC560B-DIS discovery board to create a complete front corner automotive LED solution.

The L99LD21 is a flexible LED driver, which is specifically designed for the control of two independent high brightness LED strings for automotive front lighting applications. It consists of a high efficiency monolithic boost controller and a dual buck converter.

The L99LD21-ADIS has onboard 2 L99LD21 and connected with SPC560B-DIS allows to control High Beam, Low Beam, DRL and Turn but could be used also to drive Position light, Side marker and Fog light.

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1   Quick start

L99LD21-ADIS is an easy-to-use board offered at budget price. Together with a dedicated GUI and firmware (STSW-L99LD21ADIS) and in combination with SPC560B-DIS board, it becomes a tool to evaluate L99LD21 drivers.

1.1   Getting started

Follow the sequence below to configure the system and launch the application:

1. Check jumper position in the SPC560B-DIS board:
    –   J14,J13,J12,J7,J6,J5,J4,J11 removed
    –   S1,S2,J10,J9,J3,J2,J1 inserted
2. Connect the SPC560B-DIS board to a PC with a USB cable 'type A to mini-B'
3. Download firmware STSW-L99LD21ADIS and program board as described on *www.st.com*
4. Disconnect USB cable
5. Plug L99LD21-ADIS board and connect 12 V power supply on J1
6. Install GUI on your PC as described on *www.st.com*
7. Connect loads to the outputs (J2,J3,J4,J5)
8. Check jumper position in the L99LD21-ADIS:
    –   JP3,JP5,JP6,JP7,JP8, removed
    –   JP4 inserted
9. Connect USB cable to PC
10. Execute GUI (*www.st.com*)

2 Hardware, schematic and layout

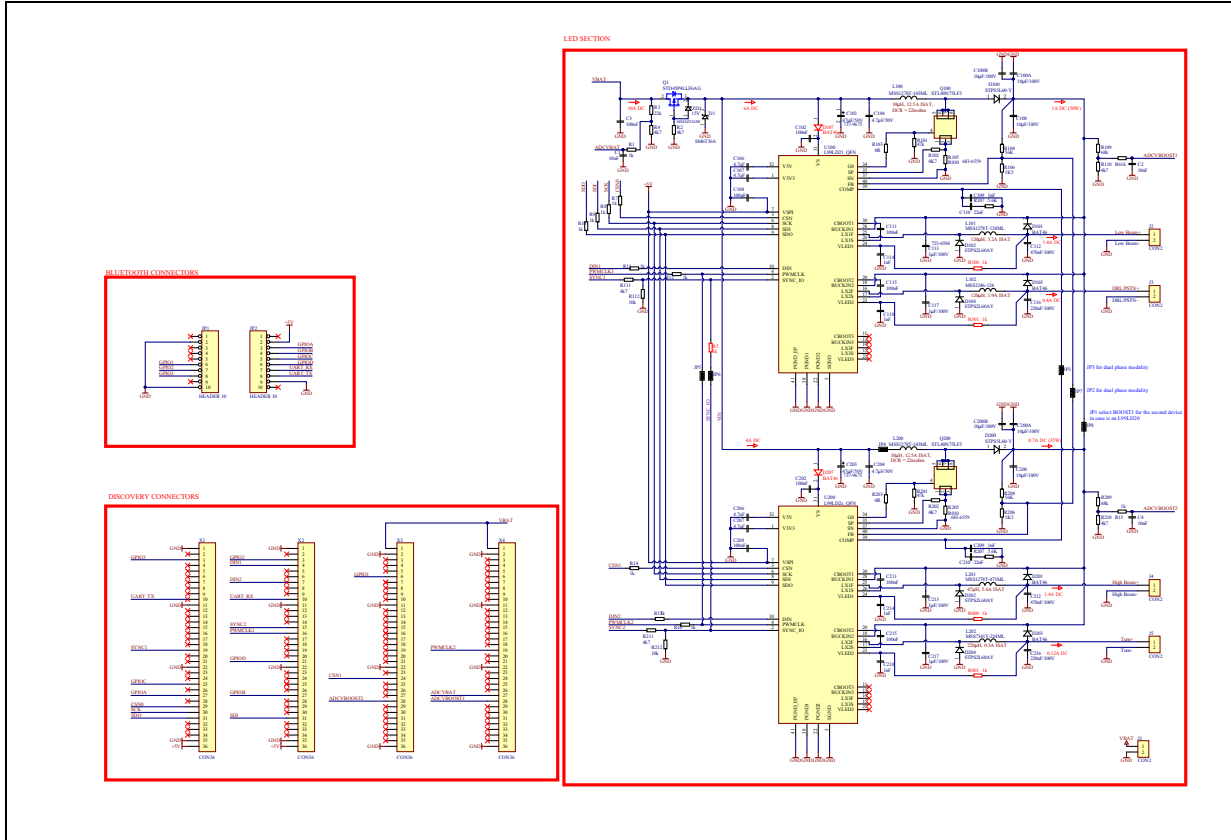**Figure 1. L99LD21-ADIS schematic**
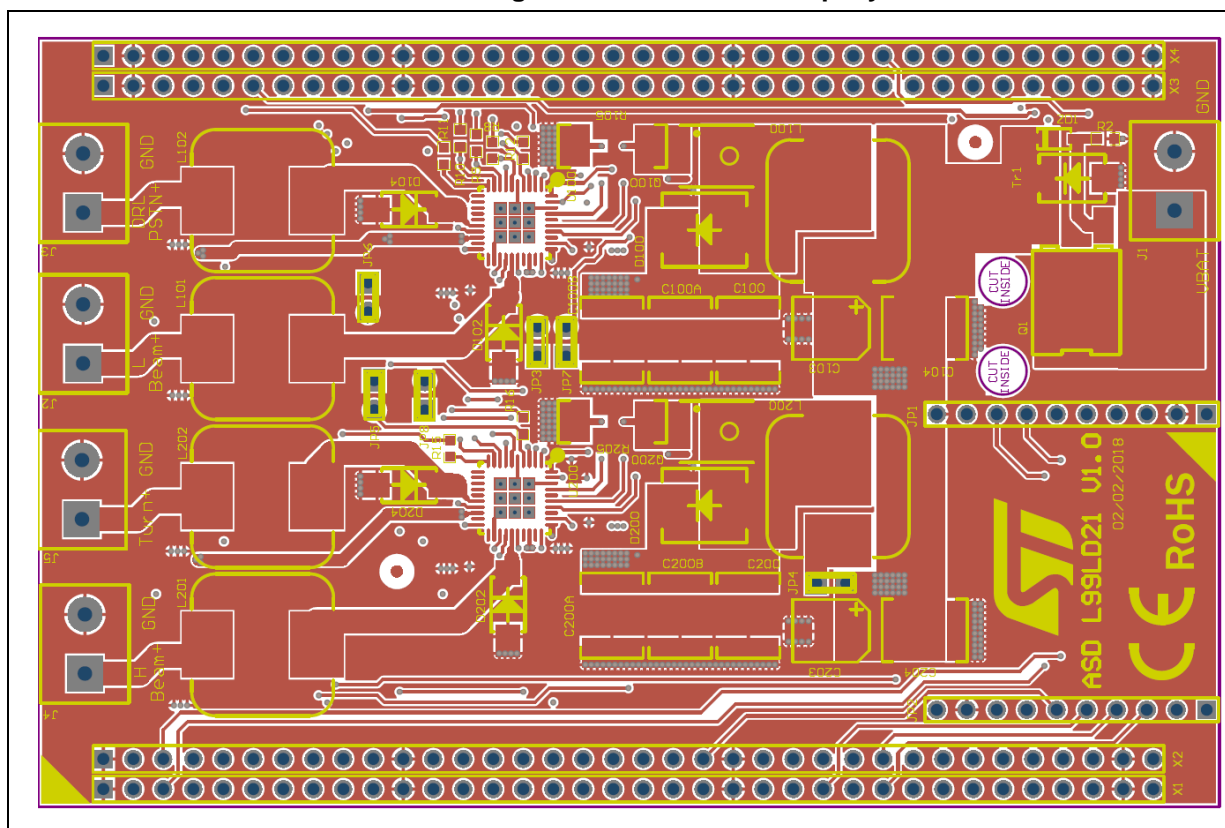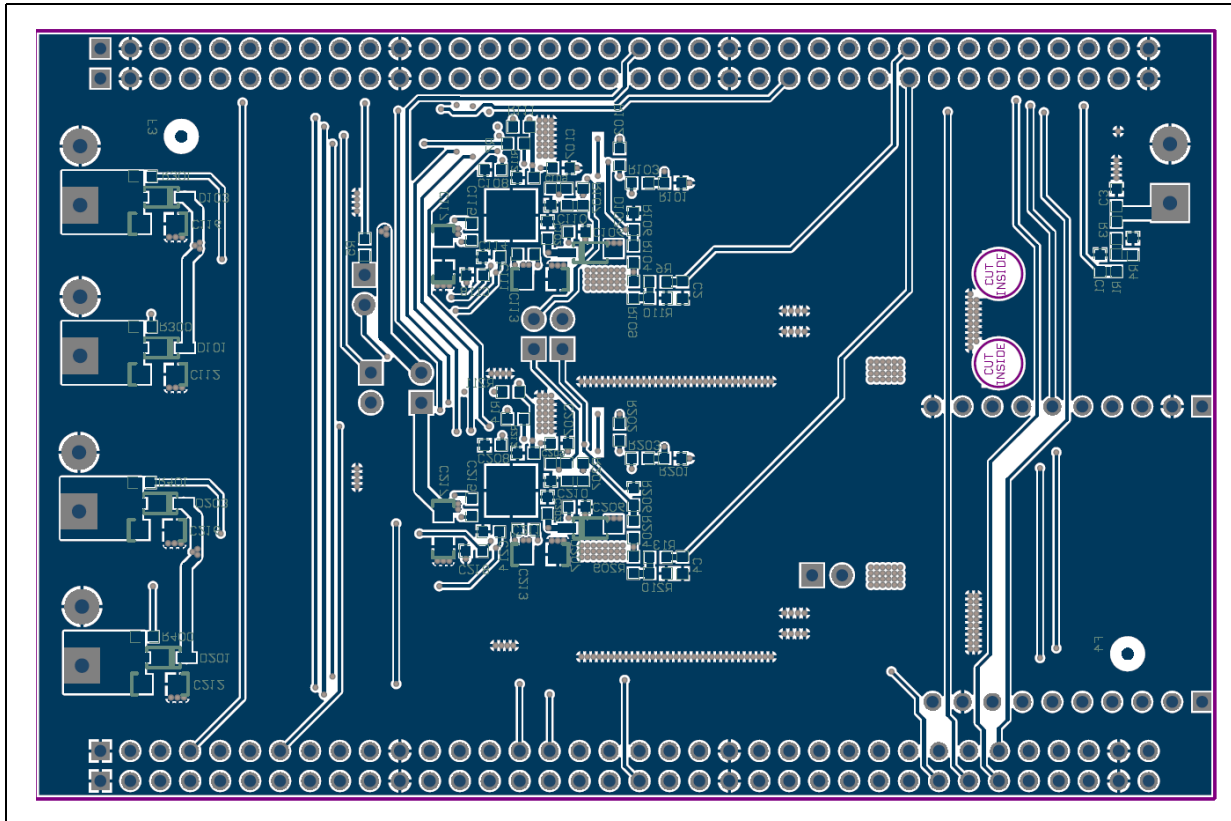
Figure 2. L99LD21-ADIS top layer

Figure 3. L99LD21-ADIS bottom layer

2.1 L99LD21 device

The L99LD21 is a monolithic driver IC, which controls the current of two independent high power LED strings, whose forward current and voltage can reach up to 1 .5 A (average) and up to 50V respectively. This device has been designed with dedicated functions, in order to fulfill the stringent requirements of automotive front lighting applications. The device offers a high level of flexibility, without any change of the external components, thanks to its programmability through the ST SPI interface. This feature support generic platform approaches, which require a software configurability of several parameters. This robust interface, offers a detailed diagnostic of the device itself, as well as of the controlled LED strings.

As the device potentially controls safety critical functions such as low beams and turn indicators, built-in features are integrated in order to support a high level of functional safety. The L99LD21 features a timeout watchdog, a monitoring of the watchdog counter, a limp home function and a direct input. The ST SPI protocol takes into account FMEA case.

Following a short description of the most important features of L99LD21 devices:

- General
  - ST SPI communication v4.1
  - 5.5 to 2 4 V Operating battery voltage range
  - Load dump protected
  - QFN40L 6x6 (wettable flanks) with exposed pad
  - Timeout watchdog and limp home function
  - Low standby current
- Protection and diagnostic
  - Battery under voltage
  - Temperature warning (2 thresholds)
  - Overtemperature shutdown
  - LED voltage digital feedback through SPI
  - Buck outputs short circuit and open load protection

The L99LD21-ADIS is equipped with 2 L99LD21.

2.2 Power supply

The power supply is provided through J1 connector and must be able to provide the current requested by all the loads connected.

2.3 Jumpers

JP3, JP7, JP6, JP8 : inserted to have dual phase modality

JP4: disconnected to read inductor current

JP5: inserted to use the same PWM signal

2.4 Loads connectors

JP2: Low Beam light

JP3: Day/Position light

JP4: High Beam light

JP5: Turn light

2.5 Extension connectors

The male headers X1,X2,X3 and X4 are two strip lines connectors of 2x36 each and are used to allow the access to all the Bolero's pins with exception of JTAG, TCK, TMS, TDI, TDO, XTAL, EXTAL and VDD_LV. The pins used in this M07 SPI applications are described into the *Table 1*.

Table 1. Extension connectors pins used

Discovery Connector X1		ASD_L99LD21_ADIS	Discovery Connector X2		ASD_L99LD21_ADIS	Discovery Connector X3		ASD_L99LD21_ADIS	Discovery Connector X4		ASD_L99LD21_ADIS
1	GND		1	GND		1	Batt		1	Batt	
2	PE[2]		2	PE[3]		2	GND		2	GND	
3	PC[5] (CSN)	GPIO3	3	PC[4]	GPIO2	3	TCK		3	TDI	
4	PE[4]		4	PE[5]	DIN1	4	TDO		4	TMS	
5	PH[4]		5	PH[5]		5	PA[6]		5	PA[5]	
6	PH[6]		6	PH[7]		6	PC[2]	GPIO1	6	PC[3]	
7	PH[8]		7	PE[6]		7	PG[11]		7	PG[10]	
8	PE[7]		8	PC[12]		8	PE[15]		8	PE[14]	
9	PC[13]		9	PB[1] (RxDC)		9	PG[15]		9	PG[14]	
10	PB[2]	UART_TX	10	PB[3]	UART_RX	10	PE[12]		10	PA[11]	
11	GND		11	GND		11	GND		11	GND	
12	PB[0] (TxDC)		12	PC[14]		12	PA[10]		12	PA[9]	
13	PC[15]		13	PG[5]		13	PA[8]		13	PA[7]	
14	PG[4]		14	PG[3]		14	PE[13]		14	PF[14]	
15	PG[2]		15	PA[2]	SYNC2	15	PF[15]		15	PG[0]	
16	PE[0]		16	PA[1]	PWMCLK1	16	PG[1]		16	PH[3]	
17	PE[1]		17	PE[8]		17	PH[2]		17	PH[1]	
18	PE[9]		18	PE[10]		18	PH[0]		18	PG[12]	
19	PA[0]	SYNC1	19	PE[11]		19	PG[13]		19	PA[3]	PWMCLK2
20	RESET_ASD		20	PG[9]		20	PB[15]		20	PD[15]	
21	PG[8]		21	PC[11]	GPIOD	21	PB[14]		21	PD[14]	
22	GND		22	GND		22	GND		22	GND	
23	PC[10]		23	PG[7]		23	PB[13]		23	PD[13]	
24	PG[6]		24	PC[9]		24	PB[12]	CSN1	24	PD[12]	
25	PC[8]	GPIOC	25	PF[9]		25	PB[11]		25	PD[11]	
26	PF[8]		26	PF[12]		26	PD[10]		26	PD[9]	
27	PC[6] (TxDL)	GPIOA	27	PC[7] (RxDL)	GPIOB	27	PB[7]		27	PB[6]	ADCVBAT

Table 1. Extension connectors pins used (continued)

	Discovery Connector X1	ASD_L99LD21_ADIS		Discovery Connector X2	ASD_L99LD21_ADIS		Discovery Connector X3	ASD_L99LD21_ADIS		Discovery Connector X4	ASD_L99LD21_ADIS
28	PF[10]		28	PF[11]		28	PB[5]	ADCVBOOST2	28	PB[4]	ADCVBOOST1
29	PA[15]	CSN0	29	PF[13]		29	PD[8]		29	PD[7]	
30	PA[14] (CLK)	SCK	30	PA[4]	IN3_1	30	PD[6]		30	PD[5]	
31	PA[12] (MISO)	SDO	31	PA[13] (MOSI)	SDI	31	PD[4]		31	PD[3]	
32	PB[9]		32	PB[8]		32	PD[2]		32	PD[1]	
33	PB[10]		33	PF[0]		33	PD[0]		33	PF[7]	
34	PF[1]		34	PF[2]		34	PF[6]		34	PF[5]	
35	GND		35	GND		35	PF[4]		35	PF[3]	
36	5V		36	5V		36	GND		36	GND	

3 Graphical User Interface

The used Graphical User Interface is available and can be download from *www.st.com*.

Appendix A

Table 2. Reference Documents

Document Name	Document Number	Version
Bolero_RM.pdf		Rev. 5

Revision history

Table 3. Document revision history

Date	Revision	Changes
25-Jun-2018	1	Initial release.

IMPORTANT NOTICE – PLEASE READ CAREFULLY