LTC5100
3.3V, 3.2Gbps VCSEL Driver

DESCRIPTION

The DC499A demonstration board features the LTC®5100, a 155Mbps to 3.2Gbps VCSEL* driver offering a high level of integration and high-speed performance. The DC499A board supports data transmission of up to the maximum 3.2Gbps data rate of the LTC5100.

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Demonstration software (Python Code) running on a personal computer allows easy access to the rich set of digital control features of the LTC5100. All that is needed is a PC with USB port, Python v2.7 or greater, Python USB COM port support such as USPP package, DC590B controller board, and a 5V power supply.

Design files for this circuit board are available.

LASER SAFETY

READ THIS WARNING BEFORE CONNECTING A LASER DIODE TO THE DC499A DEMO BOARD.

The LTC5100 is intended to drive laser diodes for fiber optic communications links. Communications lasers can emit levels of optical power that pose an eye safety risk. While the LTC5100 provides certain fault detection features, these features alone do not ensure that a laser transmitter using the LTC5100 is compliant with IEC 825 or the regulations of any particular agency. The user must analyze the safety requirements of his transceiver module or system, activate the appropriate laser safety features of the LTC5100, and take any additional precautions needed to ensure compliance of the end-product with the requirements of the relevant regulatory agencies. Moreover, the LTC5100 produces laser currents in response to digitally programmed commands. The user must also ensure that a software error in his test system or end product does not program the LTC5100 to a state that produces excessive optical power from the laser.

Follow these additional eye safety measures when using the DC499A demo board or the LTC5100 VCSEL driver:

Before connecting a laser diode to the DC499A demo board, **REMOVE THE ELECTRICAL EYE JUMPER** (labeled 'ELEC EYE'). If you leave this jumper in place and attach a laser diode, the laser will emit a potentially dangerous level of light. (If the electrical eye jumper is left in place, the demo board applies 1.8V to the laser through a 50Ω resistor.)

When working with the DC499A demo board and demo software, always disable the transmitter before making any changes to the laser diode or optical fiber. Disabling the transmitter stops current flow to the laser and in normal circumstances will drive the optical output power of the laser to zero.

Be aware that the LTC5100 is designed for hot plugging. The DC499A demo board may be configured to automatically enable the transmitter and power the laser the moment electrical power is applied to the demo board.

Any laser connected to a power source represents a potential eye safety hazard. Under no conditions should a laser that is connected to the LTC5100 be pointed in the direction of an eye, regardless of the state of the LTC5100.

QUICK START PROCEDURE

Setting up the Demo Board for Python register control:

1. Connect the DC499A demo board as shown in Figure 1. Make sure all jumpers are configured as shown. Initially, do not apply RF power or DC voltage to the demo board.

Note: The DC499A demo board includes an EEPROM that provides non-volatile storage for the LTC5100 configuration settings and parameters. If LTC5100 discovers the EEPROM on power-up, it will transfer the EEPROM data to its internal registers.

If you do not need to modify register parameters, you do not have to connect to a PC and DC590B.

2. Download the latest source code in Python language, available from the demo board link on the LTC5100 product page at analog.com.

   If necessary, download and install a USB COM port driver such as USPP. This is necessary because the Python code sends serial commands to the DC590B to write and read the I^{2}C signals.

3. The signal generator connects to demo board RFIN port (SMA connector J1) via coaxial cable. The input signal should be set to 1MHz at -40dBm.

4. Output SMA connector J3 connects to Spectrum Analyzer.

5. Set power supply to 5V with current limit to 150mA. Connect to the DC499A. Switch-on the DC supply and then the RF Signal source.

   With typical default register values stored in EEPROM, the spectrum Analyzer should display a 1MHz output tone at approximately -25dBm.

6. Execute the Python code, following on-screen instructions for editing register values. Further documentation for the Python code is self-contained as comments.

QUICK START PROCEDURE
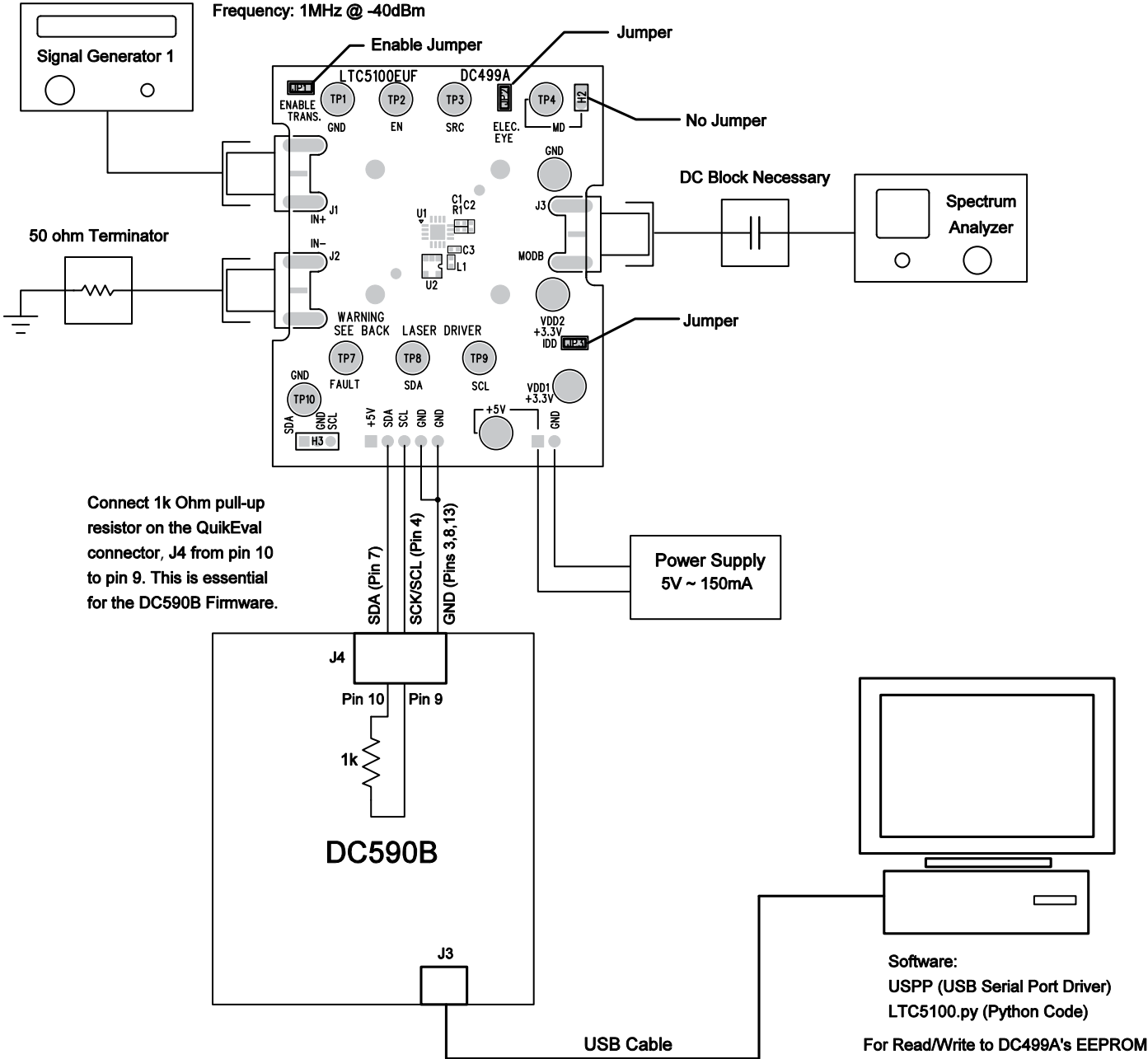
Figure 1. LTC5100 Test and Measurement Setup

OPERATION-DEMO HARDWARE

The core applications circuit for the LTC5100 VCSEL driver appears inside the box in Figure 2. This is the complete circuit for an optical transceiver module, including power supply filtering. It consists of the LTC5100 with EEPROM for storing setup parameters, L1 and C3 for power supply filtering, and R1, C1, and C2 for terminating the 50Ω modulation output, MODA. The circuitry outside the box in Figure 2 is for support of the demonstration. +5V power enters through two-pin connector P2 (or Turret 5V) and is regulated by U3 to +3.3V to power the LTC5100. Connector P1 serial control signals to the DC499A board, which allows a personal computer to control the LTC5100. U4 produces 1.8VDC to bias the modulation output for electrical eye measurements.

High speed data enters the LTC5100 through SMA connectors J1 and J2. The LTC5100 high-speed inputs are internally AC coupled with rail-to-rail common mode input voltage range. The input signal swing can go as much as 300mV above VDD or below VSS without degrading performance or causing excessive current flow. You may AC couple the high speed inputs, in which case the common mode voltage floats to mid-supply, or 1.65V nominally.

You can attach a common cathode VCSEL to the demo board via SMA connector J3. R1 establishes a precision, low reflection coefficient 50Ω modulation drive. If you maintain a wide-band, microwave quality 50Ω path, the length of the connection to the laser can be arbitrarily long. The LTC5100 generates 20-80% transition times of 55ps (80ps 10-90%), corresponding to an instantaneous

transition filtered by a 4.4GHz Gaussian low pass filter. At these speeds the primary limitation on line length is high frequency loss. For high grade, low loss laboratory cabling with silver coated center conductor and foamed PTFE dielectric a practical limit is about 30cm.

You can attach the laser's monitor diode (if needed) to either pin of two-pin header H2 (labeled MD) or to the test turret labeled MD. H2 is a 2mm, 2-pin header with 0.5mm square pins.

The demo board includes an EEPROM that provides non-volatile storage for the LTC5100's configuration settings and parameters. For example, the EEPROM stores parameters for the laser bias and modulation levels as well as temperature coefficients and fault detection modes. The LTC5100 transfers the data in the EEPROM to its internal registers at power up. The LTC5100 is designed for hot plugging and can be configured to load the EEPROM and enable the transmitter as soon as power is applied. **You should be careful with this mode of operation! You can leave the EEPROM in a state that automatically turns the laser on at power up, causing the laser to emit a potentially dangerous level of light.**

The LTC5100's FAULT output is available at the test turret labeled "FAULT." The FAULT pin can be software configured with several output pull-up options, including open-drain. In that case you need to provide a pull-up resistor of about 10kΩ.
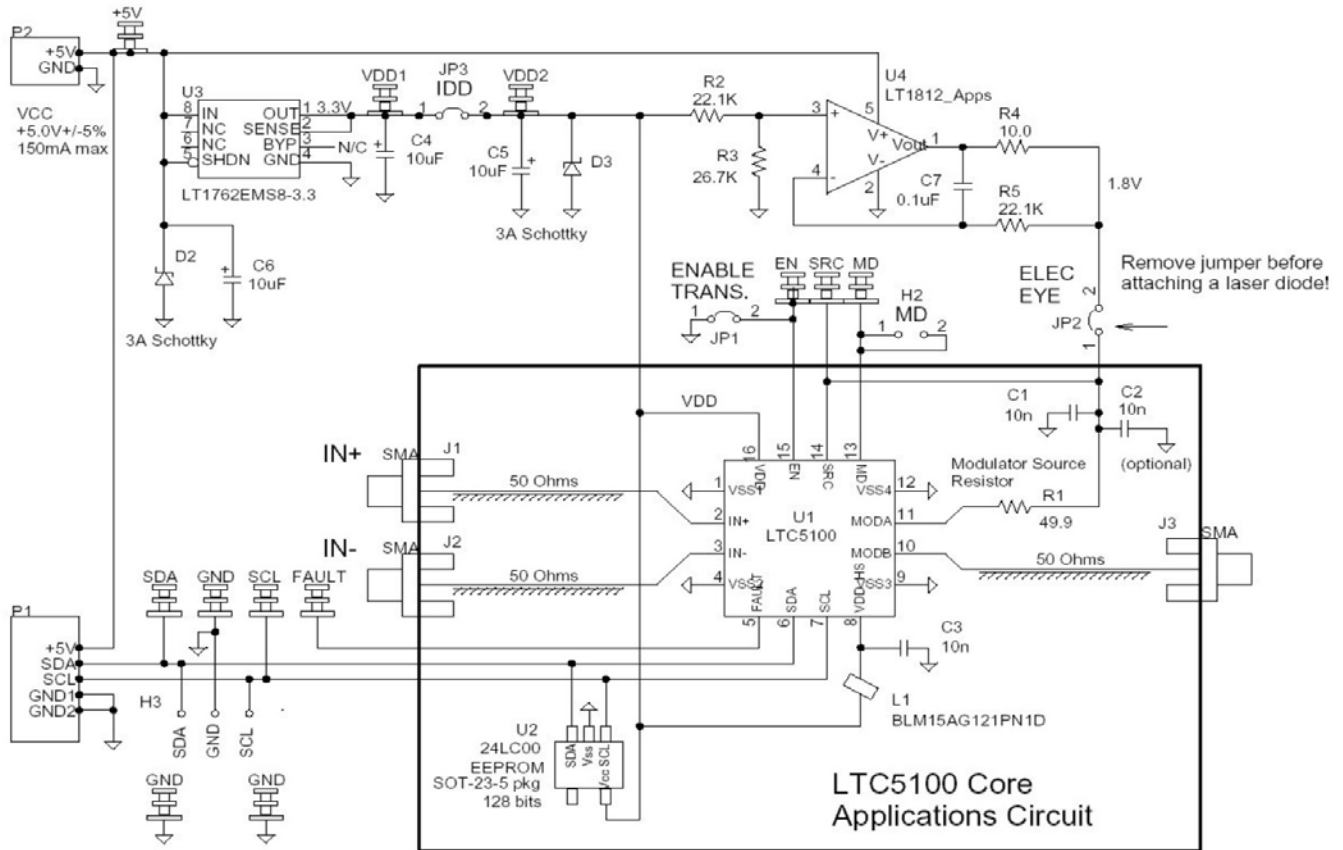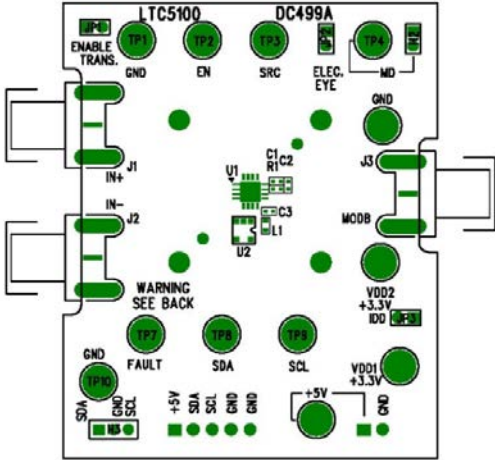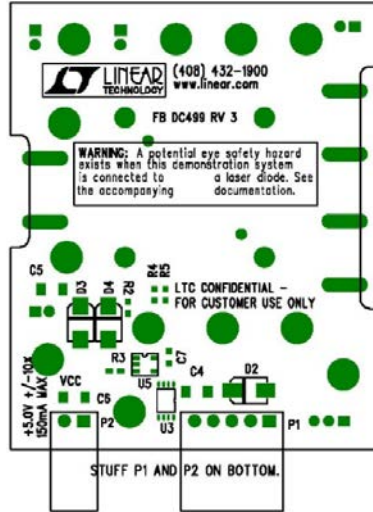
Rev. A

4

SCHEMATIC DIAGRAM
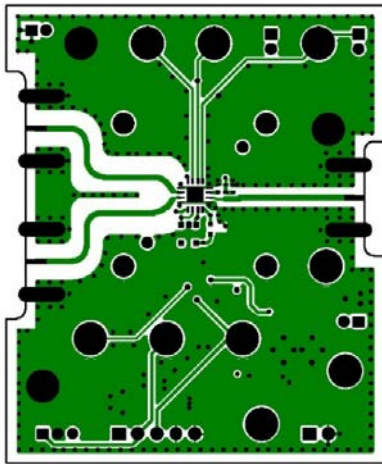

Figure 2. Schematic diagram of the DC499A demo board
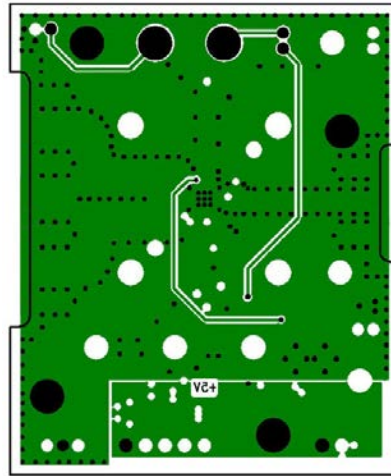
PCB REFERENCE
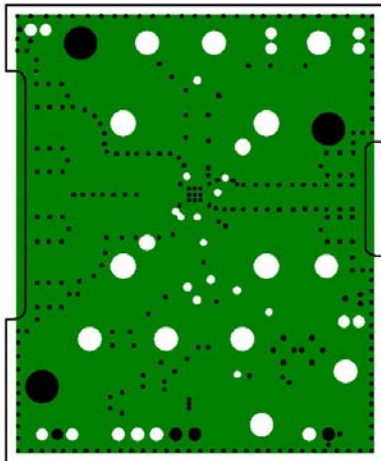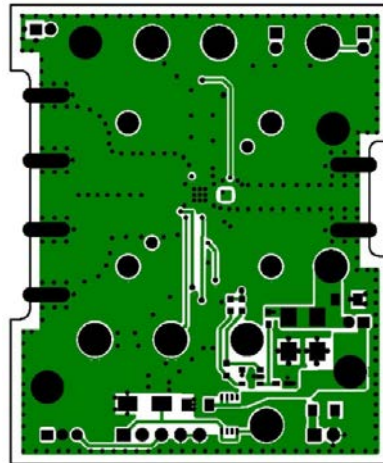

Component Side Silkscreen

Bottom Side Silkscreen

Component Side Copper (Layer 1)

Internal Copper (Layer 3)

Internal Copper (Layer 2)

Bottom Side Copper (Layer 4)

Rev. A

PARTS LIST

ITEM	QTY	REFERENCE	PART DESCRIPTION	MANUFACTURER/PART NUMBER
Required Circuit Components				
1	12	VDD1, VDD2, TP1-TP4, +5V, TP7-TP10, GND	TURRET	MILL-MAX, 2501-2
2	3	C1, C2, C3	CAP, X7R .01uF 25V 5% 0402	MURATA, GRP155R71E103JA01
3	3	C4, C5, C6	CAP, X5R 10uF 6.3V 20% 1206	AVX, 12066D106MAT
4	1	C7	CAP, X7R 0.1uF 16V 10% 0603	AVX, 0603YC104KAT
5	2	D2, D3	DIODE, SCHOTTKY RECTIFIER 3.0A	DIODES, INC., B320A
6	0	D4	DO NOT STUFF	DIODES, INC., SMAZ3V9 OPTION
7	4	JP1, JP2, H2, JP3	HEADER, 2PIN, 2mm	COMM CON, 2802S-02G2
8	1	H3	HEADER, 3 PINS 2mm	COMM, 2802S-03G2
9	3	J1, J2, J3	CONN, SMA 50-OHM EDGE-LANCH	E.F.JOHNSON, 142-0701-851
10	1	L1	FERRITE BEAD, 0402	MURATA, BLM15AG121PN1D
11	1	P1	HEADER, 5 PIN RIGHT ANGLE	MOLEX, 70553-0004
12	1	P2	HEADER, 2 PIN RIGHT ANGLE	MOLEX, 70553-0001
13	1	R1	RES, 49.9 OHM 1% 1/16W 0402	AAC, CR05-49R9FM
14	2	R2, R5	RES, 22.1K OHM 1% 1/16W 0603	AAC, CR16-2212FM
15	1	R3	RES, 26.7K OHM 1% 1/16W 0603	AAC, CR16-2672FM
16	1	R4	RES, 10 OHM 1% 1/16W 0603	AAC, CR16-10R0FM
17	1	U1	IC, LTC5100EUF QFN4X4mm	ANALOG DEVICES, LTC5100EUF
18	1	U2	IC, 128 BIT IC BUS SERIAL EEPROM 5-PIN SOT-23	MICROCHIP, 24LC00
19	1	U3	IC, LT1762EMS8-3.3 LOW NOISE LDO MICROPOWER REGULATOR	ANALOG DEVICES, LT1762EMS8-3.3
20	1	U4	IC, OP AMP WITH SHUT-DOWN	ANALOG DEVICES, LT1812CS5
	1	H3	SHUNT, 2 PINS 2mm	COMM CON, CCIJ2mm-138G

ESD Caution
ESD (electrostatic discharge) sensitive device. Charged devices and circuit boards can discharge without detection. Although this product features patented or proprietary protection circuitry, damage may occur on devices subjected to high energy ESD. Therefore, proper ESD precautions should be taken to avoid performance degradation or loss of functionality.

Rev. A

10/19
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