

DESCRIPTION

The DC499 demonstration board features the LTC[®]5100, a 155Mbps to 3.2Gbps VCSEL (vertical cavity surface emitting laser) driver offering an unprecedented level of integration and high speed performance. The LTC5100 and three low cost external components form a complete solution for driving VCSELs in high speed optical transceiver modules. With the DC499 demo board and demo software you can fully explore the LTC5100's features and performance.

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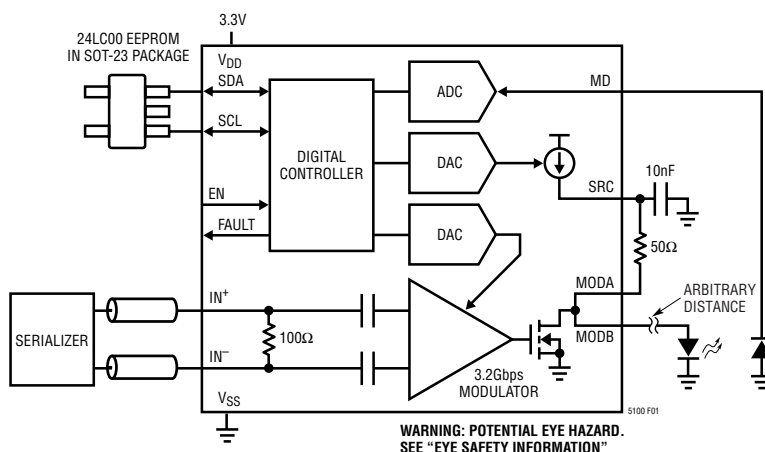
The DC499 board supports measurement of electrical and optical eye diagrams up to the maximum 3.2Gbps data rate of the LTC5100. An unpopulated laser interface board is also provided.

Demonstration software 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 serial port, an RS232 cable and a 5V power supply.

WARNING: Potential eye safety hazard. See Laser Safety section for details.

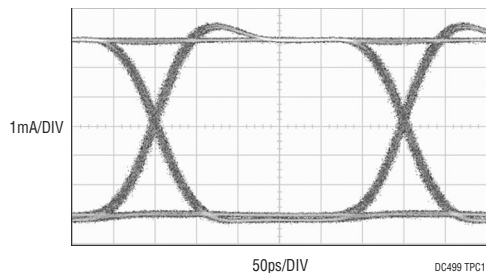
TYPICAL APPLICATION

VCSEL Transmitter with Automatic Power Control

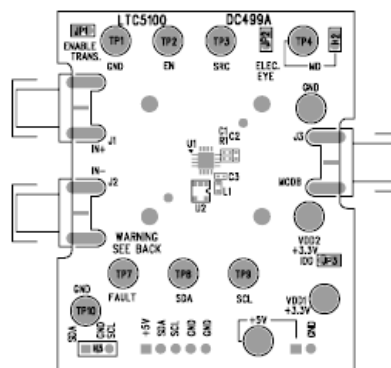


TYPICAL PERFORMANCE CHARACTERISTICS AND BOARD PHOTOS

3.2Gbps Electrical Eye Diagram



Demo Board



dc499f

DEMO MANUAL DC499

VCSEL DRIVER BOARD

PERFORMANCE SUMMARY

PARAMETER	CONDITIONS	VALUE
Data Rate		155Mbps to 3.2Gbps
Rise and Fall Times	20% to 80%	60ps
Input Resistance	50Ω to V _{DD} in CML Mode	100Ω Differential
Modulator Source Resistance	Set By an External Resistor	Nominally 50Ω
Laser Bias Current	Can be Higher Depending On Conditions	12mA
Laser Modulation Current	Can be Higher Depending On Modulation Source Resistance Relative to Laser Dynamic Resistance	12mA
ADC Resolution	(9 Bits for Modulation Current)	10 Bits
DAC Resolution		10 Bits

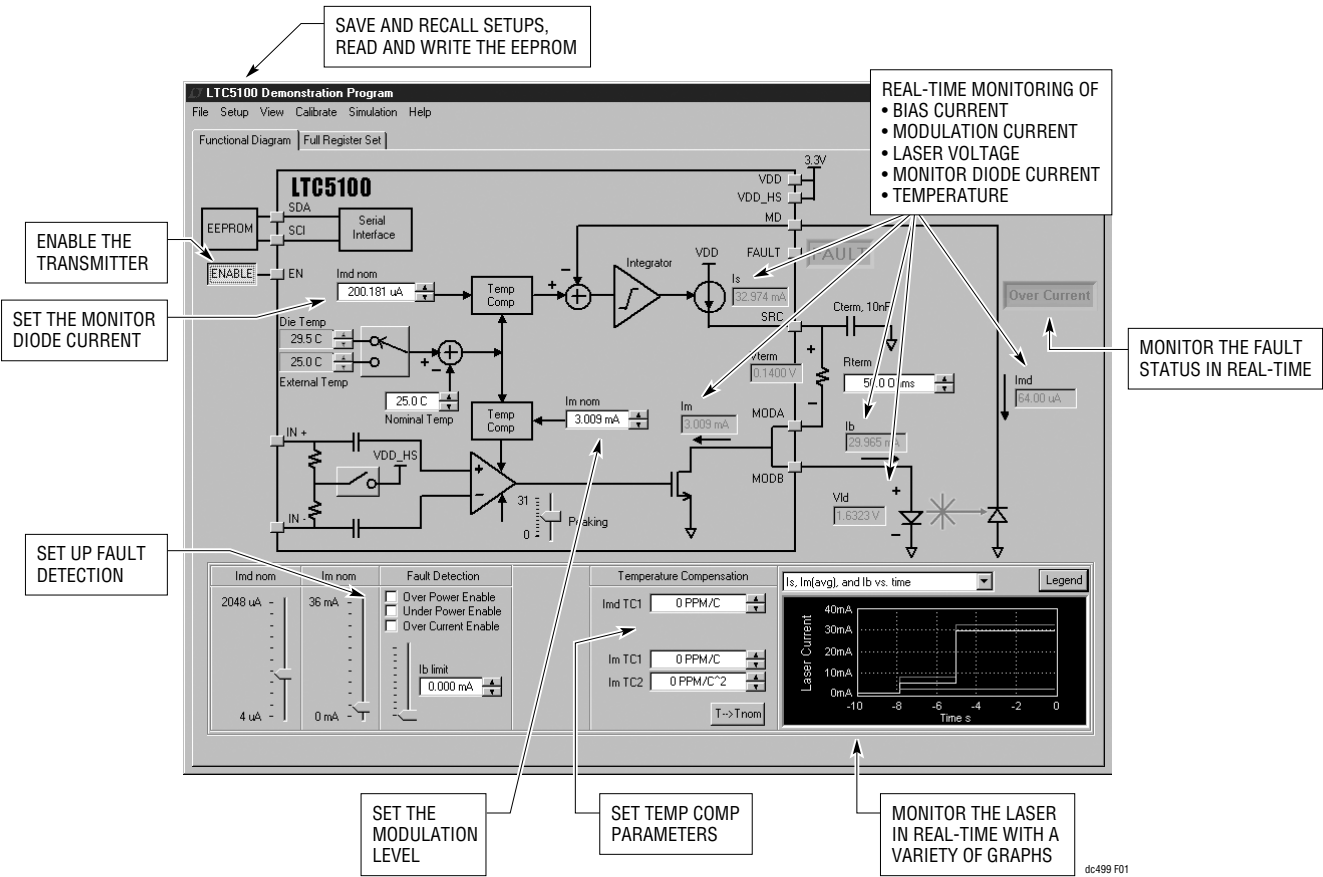


Figure 1. Demo Program Preview

LASER SAFETY

Read this warning before connecting a laser diode to the DC499 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 DC499 demo board or the LTC5100 VCSEL driver:

- Before connecting a laser diode to the DC499 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 DC499 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. You can configure the DC499 demo board 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.

PACKAGE AND SCHEMATIC DIAGRAM

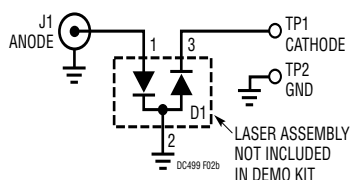


Figure 2b. Schematic Diagram of the DC669 Laser Interface Board

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VCSEL DRIVER BOARD

PARTS LIST (DC499)

REFERENCE	QUANTITY	PART NUMBER	DESCRIPTION	VENDOR	TELEPHONE
5V, V _{DD1} , V _{DD2} , SDA, SCL, FAULT, EN, SRC, MD, GND(3)	12	2501-2	1-Pin Terminal Turret Test Point	Mill-Max	(516) 922-6000
C1, C2, C3	3	GRP155R71E103JA01	0.01μF 25V 5% 0402 X7R Capacitor	Murata	(770) 436-1300
C4, C5, C6	3	12066D106MAT	10μF 6.3V 20% 1206 X5R Capacitor	AVX	(843) 946-0362
C7	1	0603YC104KAT	0.1μF 16V 10% 0603 X7R Capacitor	AVX	(843) 946-0362
D2,D3	2	B320A	3A Schottky Rectifier Diode	Diodes, Inc.	(805) 446-4800
D4	0	Option (No Load)	N/A (No Load)		
H2, JP1, JP2, JP3	4	2802S-02G2	2mm 2-Pin Header	Comm Con	(626) 301-4200
H3	1	2802S-03G2	2mm 3-Pin Header	Comm Con	(626) 301-4200
J1, J2, J3	3	142-0701-851	50Ω SMA Edge-Launch Connector	Johnson Components	(800) 247-8256
L1	1	BLM15AG121PN1D	0402 Ferrite Bead	Murata	(770) 436-1300
P1	1	70553-0004	5-Pin Right Angle Header	Molex	(630) 969-4550
P2	1	70553-0001	2-Pin Right Angle Header	Molex	(630) 969-4550
R1	1	CR05-49R9FM	49.9Ω 1% 1/16W 0402 Resistor	AAC	(800) 508-1521
R2, R5	2	CR16-2212FM	22.1k 1% 1/16W 0603 Resistor	AAC	(800) 508-1521
R3	1	CR16-2672FM	26.7k 1% 1/16W 0603 Resistor	AAC	(800) 508-1521
R4	1	CR16-10R0FM	10Ω 1% 1/16W 0603 Resistor	AAC	(800) 508-1521
U1	1	LTC5100	QFN 4mm × 4mm IC	LTC	(408) 432-1900
U2	1	24LC00	128-Bit I ² C™ Bus Serial EEPROM 5-Pin SOT-23	Microchip	(602) 786-7200
U3	1	LT1762EMS8-3.3	Low Noise LDO Micropower Regulator IC	LTC	(408) 432-1900
U4	1	LT1812CS5	Op Amp with Shutdown IC	LTC	(408) 432-1900
H3	1	CCIJ2mm-138G	2-Pin 2mm Shunt	Comm Con	(626) 301-4200

I²C is a trademark of Philips Electronics N.V.

(DC669)

REFERENCE	QUANTITY	PART NUMBER	DESCRIPTION	VENDOR	TELEPHONE
J1	1	142-0701-851-LN1	0.062" Edge-Launch SMA Connector	E.F Johnson	(800) 247-8256
TP1, TP2	2	2501-2	0.090 Turret Test Point	Mill-Max	(516) 922-6000

DEMO MANUAL DC499

VCSEL DRIVER BOARD

QUICK START GUIDE

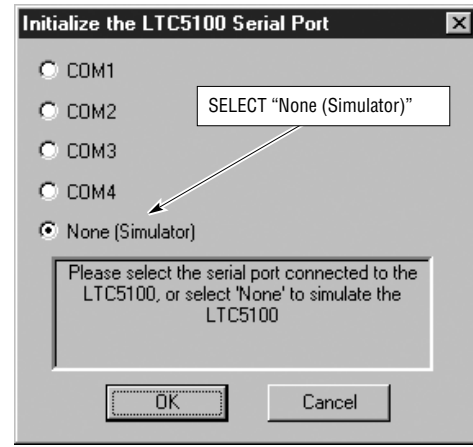
You can quickly and easily begin evaluating the LTC5100 VCSEL driver with the DC499 demonstration system. For a super quick start you can run the demo software in simulation mode without the demo board.

Simulating the LTC5100

The simulator allows you to explore nearly all LTC5100 features and functions and shows more details of the LTC5100's low frequency operation than the real demo board. For example, the simulator estimates total power consumption and displays detailed servo loop performance. The simulator also allows you to simulate ambient temperature changes, including the effect of temperature on the laser.

To simulate the LTC5100, insert the demo CD in your personal computer and run LTC5100.exe. (You will need Microsoft Windows® 98, NT, 2000 or XP.)

Select "None (Simulator)" when you see this dialog:



When the LTC5100 demo screen appears, follow the instructions in the white boxes shown in Figure 3.

Windows is a registered trademark of Microsoft Corporation.

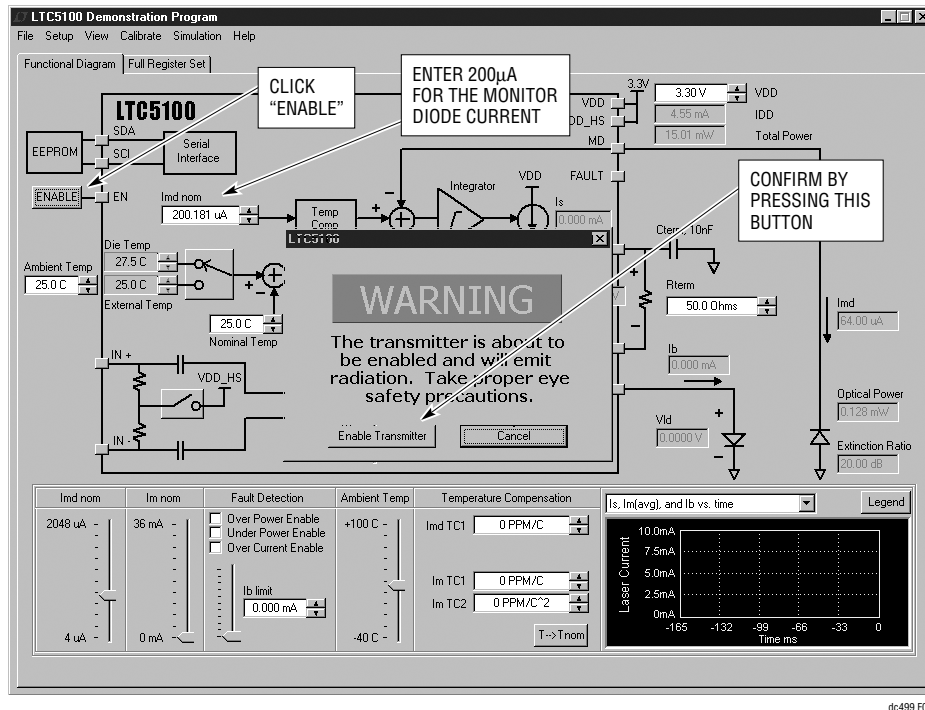
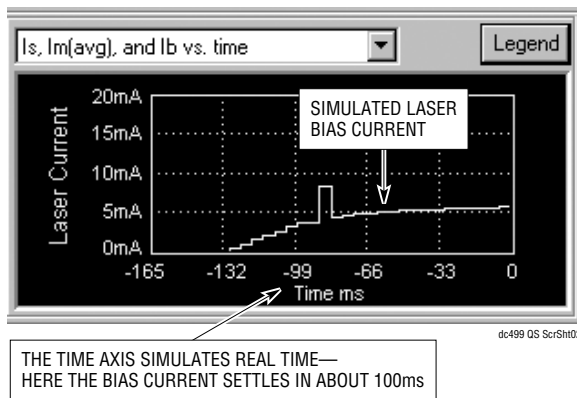


Figure 3. The LTC5100 Demonstration Program in Simulation Mode

QUICK START GUIDE

The simulator defaults to automatic power control (APC) mode. In APC mode, the simulator models feedback from a monitor diode and simulates automatic control of the laser bias current. The graph shows the laser bias current rising and settling to 6mA. The bump is caused by an automatic range change made by the demo program. It does not occur in a real optical transceiver.



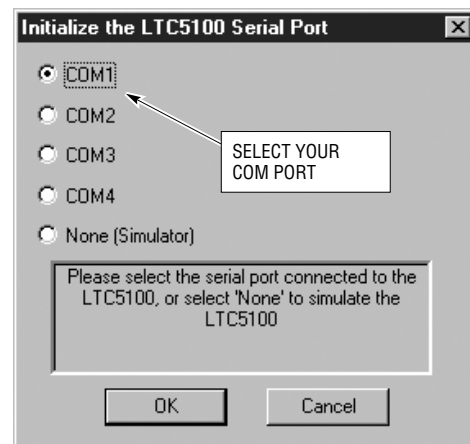
The simulator faithfully represents the LTC5100's digital registers, laser servo loops, fault detection logic and data acquisition hardware. The simulator models a typical VCSEL, including its V-I, L-I and temperature characteristics, and realistically depicts how the LTC5100 interacts with the laser at low frequency. High frequency characteristics of the LTC5100 and VCSEL are not simulated.

You can explore many more aspects of the LTC5100 with the simulator. For example you can investigate fault detection and laser temperature compensation. You can even change the laser model to represent your own laser. See the SIMULATION section for further details. To simulate constant current control (CCC) mode, follow the instructions given in Figure 6. To see the LTC5100's full register set, follow the instructions in Figure 7. See Figure 8 for tips on getting further information and help.

Setting Up the Demo Board with a Laser

Figure 4 shows how to connect the demo hardware to your computer, a power supply, and a laser diode to observe and measure optical eye diagrams. Follow these steps:

1. Remove the electrical eye jumper (labeled "ELEC EYE") from the DC499 demo board. **This is an important eye safety issue! If left in place the jumper will supply current to the laser even with the transmitter disabled.**
2. Connect a 5V $\pm$ 5% supply to the DC499 with the 2-wire cable provided. Set the current limit of the supply to 150mA.
3. Connect the DC636A to the DC499 with the 5-wire cable provided.
4. Connect the DC636A to a COM port (i.e., a serial port) on the PC. Use a straight RS232 serial cable (do not use a null-modem cable). A straight cable has Pin 2 connected to Pin 2 and Pin 3 connected to Pin 3.
5. Attach a laser diode as shown in Figure 4. The LTC5100 has a precision, low reflection coefficient 50 Ω output that can drive a laser over any length of quality 50 Ω line. The only limitation on length is high frequency line loss.
6. If the laser has a monitor diode, you can connect it to either one of the two "MD" header pins or to the "MD" test point, a metal turret labeled "MD" on the DC499 demo board.
7. Insert the LTC5100 demo CD in the computer and run the program "LTC5100.exe."
8. When the following dialog appears, select your COM port number. (If you don't know your port number, just restart the program and try a different port until it works.)



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VCSEL DRIVER BOARD

QUICK START GUIDE

9. You will see the screen depicted in Figure 5. If the laser has a monitor diode, follow the instructions in the white boxes to enable the transmitter and turn on the laser. Otherwise, switch to constant current control (CCC) mode as described in step 10.
10. You can run the laser with automatic power control (APC), taking feedback from the monitor diode. You can also run in constant current control (CCC) mode, forcing a fixed bias current into the laser diode. Figure 6 shows how to switch to CCC mode.
11. Select the "Full Register Set" tab (Figure 7) to gain access to every monitoring and control function of the LTC5100. No automatic scanning is done in this view of the chip. You must press "Read All" or one of the other buttons to read out register values from the chip.
12. See Figure 8 for tips on getting further information and help.

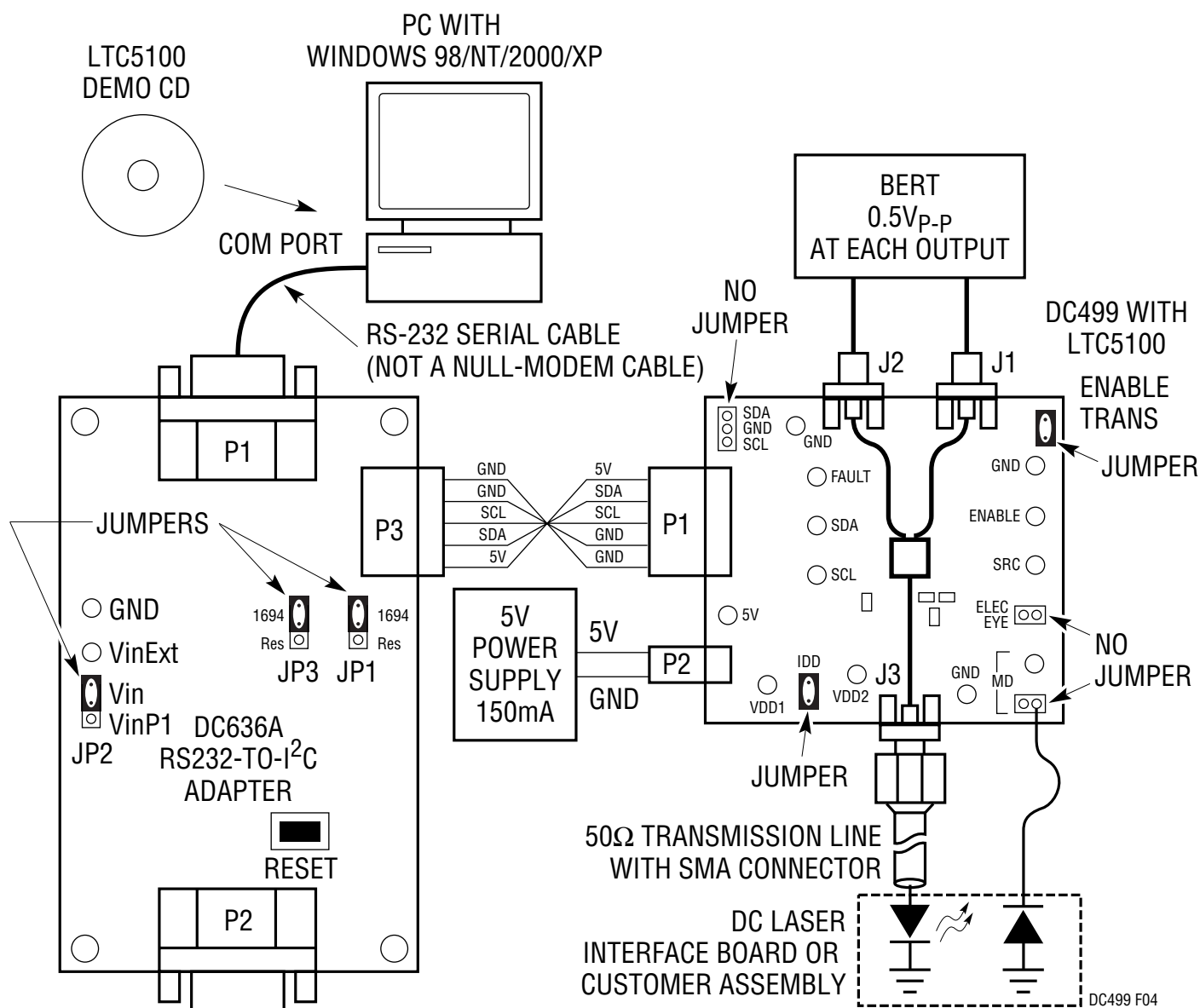


Figure 4. Setup for Observing an Optical Eye Diagram with a Laser

dc499f

QUICK START GUIDE

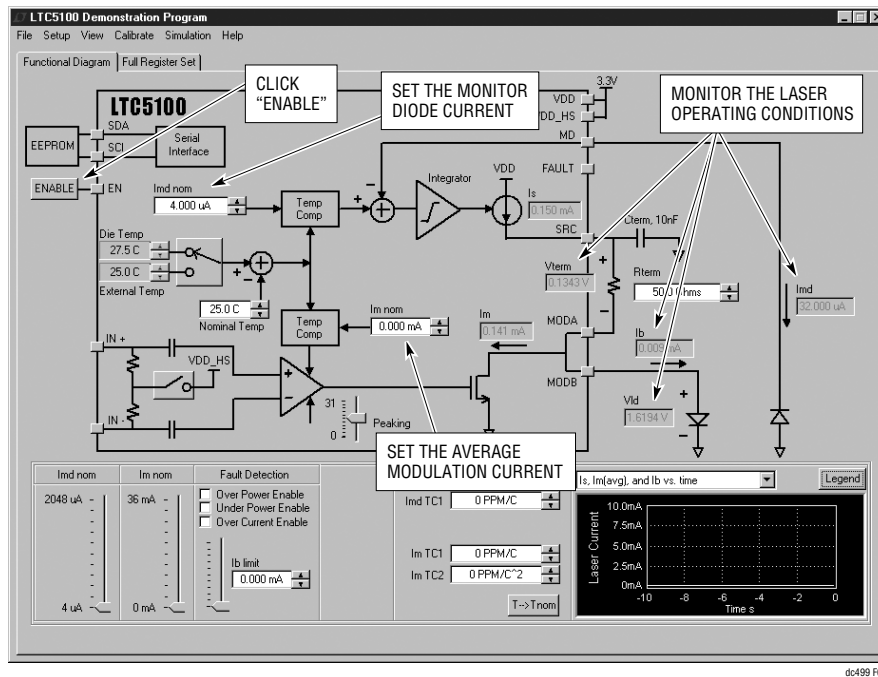


Figure 5. The LTC5100 Demonstration Program in Automatic Power Control (APC) Mode

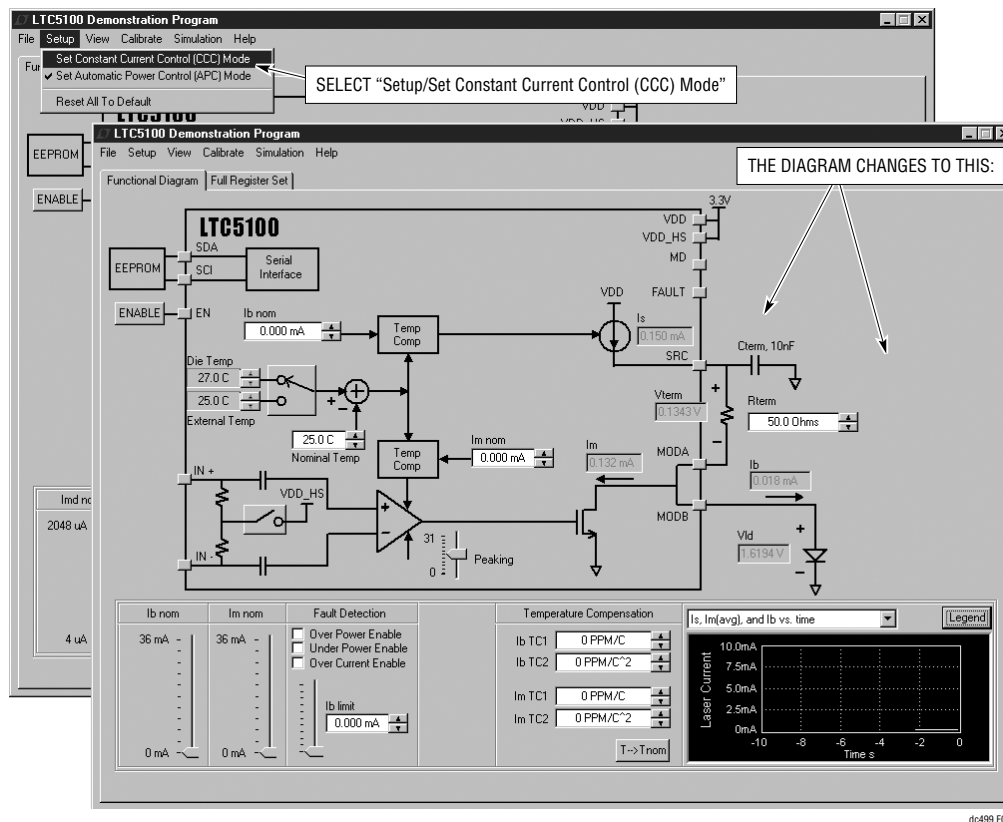


Figure 6. Switching to Constant Current Control (CCC) Mode

QUICK START GUIDE



QUICK START GUIDE

Measuring the Electrical Eye Diagram

Figure 9 shows how to measure the electrical eye diagram. Follow these steps:

1. Install the electrical eye jumper (labeled "ELEC EYE") on the DC499 demo board. The electrical eye jumper provides a 1.8V, 50Ω bias to the modulation output of the LTC5100, simulating the bias conditions of a laser diode.
2. Insert a microwave blocking capacitor (Picosecond Pulse Labs model 5508, for example, <http://www.picosecond.com/>) between the demo board and oscilloscope. This capacitor isolates the 1.8VDC modulation voltage from the scope and prevents the 50Ω input of the scope from debiasing the LTC5100.
3. Follow steps 2 through 8 in the previous section, Setting up the Demo Board with a Laser, to hook up the cables and power and start the software.
4. Switch to constant current control (CCC) mode as shown in Figure 6.
5. Follow the instructions in the white boxes in Figure 10.

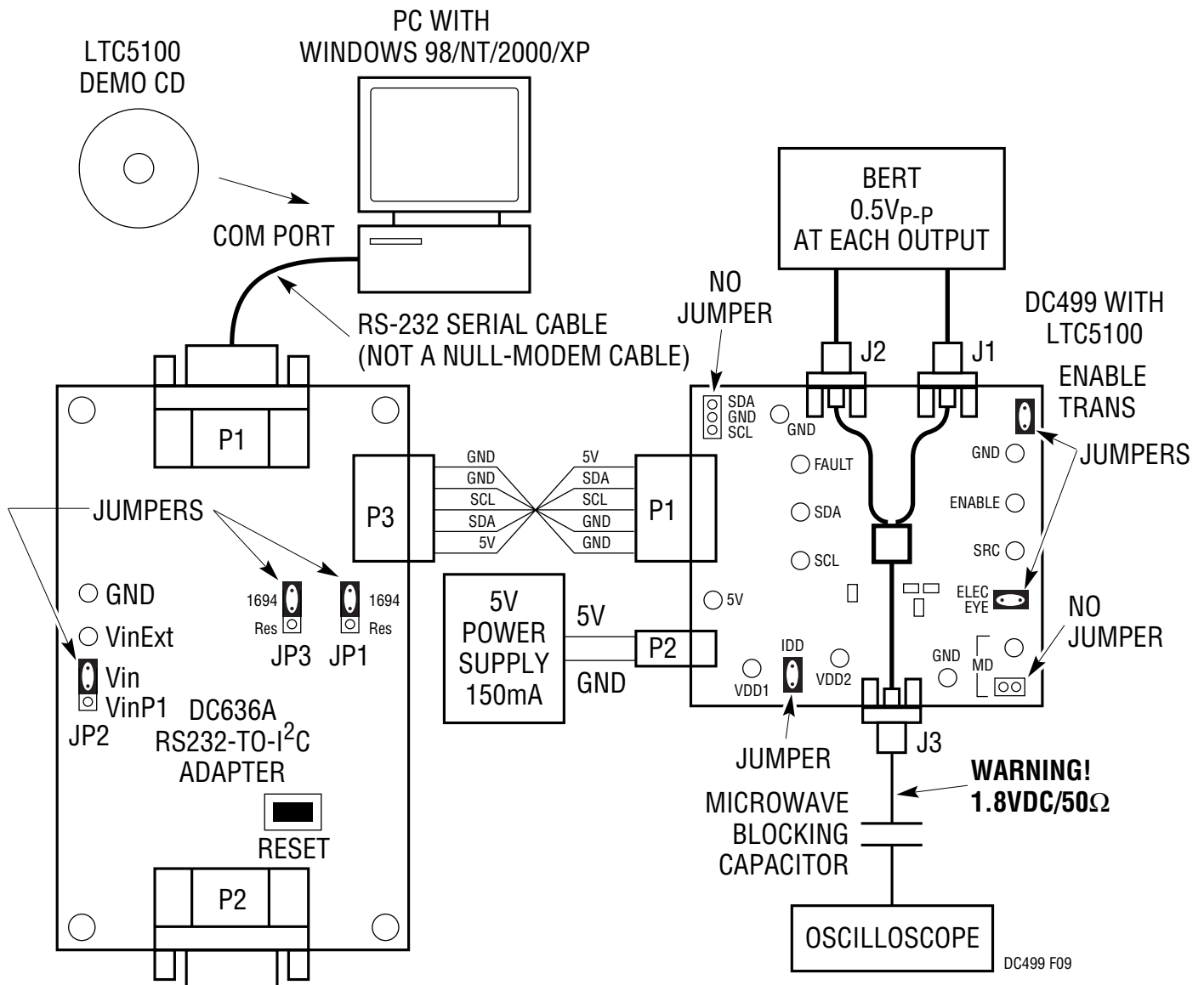


Figure 9. Setup for Measuring an Electrical Eye Diagram

QUICK START GUIDE

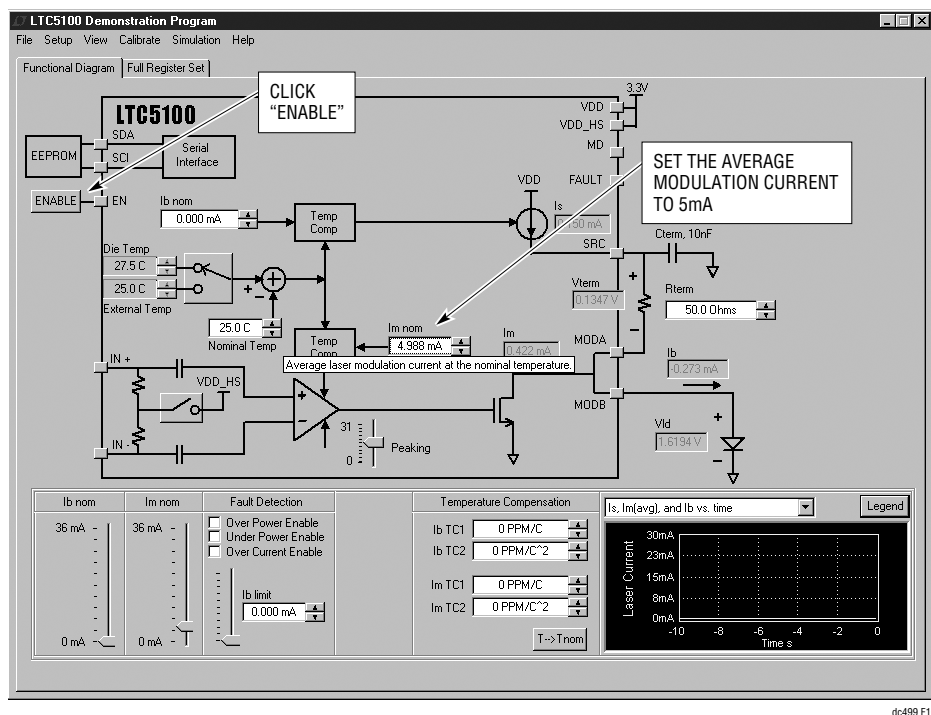


Figure 10. The LTC5100 Demonstration Program Setup for an Electrical Eye Diagram

LTC5100 OVERVIEW

The LTC5100 is specifically optimized to drive VCSELs at speeds up to 3.2Gbps in optical transceiver modules. The LTC5100's unique high speed circuitry and state-of-the-art digital technology yield an extremely compact and easy-to-use solution. As the typical application figure on the first page of this demo manual shows, only four external components are needed to build a complete laser transmitter: a resistor, a capacitor, low cost EEPROM in a tiny SOT-23 package and the laser diode itself. On-chip DACs eliminate external pots. On-chip AC coupling eliminates external capacitors. In applications with a host microprocessor, even the EEPROM can be omitted.

The LTC5100's high precision, 50Ω modulation output produces very fast 60ps (typical) rise and fall times. This output stage absorbs more than 90% of the energy reflected by the laser to preserve the speed and quality of the

eye diagram regardless of the distance between the chip and laser.

The unique design of the modulation output forces all high speed current to circulate locally in the ground system. No modulation signal reaches the power supply to interfere with sensitive receiver electronics. To further protect the receiver and minimize RFI, the high speed amplifiers are heavily filtered on-chip, keeping the power supply clean and quiet.

Extensive eye safety and digital monitoring capabilities round out the LTC5100's feature set. Digital control via an I²C interface supports fully automated production of high-volume optical transceiver modules.

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 50 Ω modulation output. The circuitry outside the box in Figure 2 is for support of the demonstration. 5V power enters through the 2-pin connector P2 and is regulated by U3 to 3.3V to power the LTC5100. Connector P1 sends 5V power to and receives serial control signals from the DC636A board, which allows a personal computer to control and monitor 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 V_{DD} or below V_{SS} without degrading performance or causing excessive current flow. You may AC couple the high speed inputs, in which case the input 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 50 Ω modulation drive. If you maintain a wideband, microwave quality 50 Ω path, the length of the connection to the laser can be arbitrarily long. The LTC5100 generates 20% to 80% transition times of 60ps (85ps 10% to 90%), corresponding to an instantaneous transition filtered by a 4.1GHz Gaussian lowpass 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 2-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 nonvolatile 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 read 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 10k.

The demo board has three jumpers for enabling the transmitter, observing the electrical eye diagram and measuring the LTC5100's power supply current. A description of each follows:

JP1: Enable Transmitter

Jumper JP1 pulls the EN pin low, enabling the transmitter if the following conditions are met:

1. En_polarity = 0 in the SYS_CONFIG register
2. Soft_en = 1 in the SYS_CONFIG register

You can remove JP1 and drive the EN test turret to experiment with enabling and disabling the transmitter.

If you remove JP1 and leave the EN pin open, an internal 10 μ A current source pulls the LTC5100's EN pin to the inactive state regardless of its programmed polarity. This safety mechanism disables the transmitter if the EN pin goes open. Therefore, you must actively drive the EN pin to enable the transmitter. JP1 must be installed for the demo program to enable the transmitter on request.

JP2: Electrical Eye

Jumper JP2 applies DC bias for observing the electrical eye diagram. Adding a microwave blocking capacitor as shown in Figure 9 allows observation of the electrical eye without debiasing the LTC5100's modulation output or overdriving the oscilloscope.

OPERATION

Be careful with jumper JP2. If you leave it in place and attach a laser diode, it will apply 1.8V to the laser through a 50Ω resistor, turning the laser on. **Remember to remove jumper JP2 before attaching a laser Diode.**

JP3: IDD

Jumper JP3 connects 3.3V power to the LTC5100. You can remove it and apply your own power source, measure the LTC5100's IDD current, vary the supply voltage or experiment with hot plugging performance.

DEMO SOFTWARE

Capabilities and Features

The LTC5100 demo program gives you full control of the LTC5100 VCSEL driver with no programming required. You can control the chip and monitor its state from your PC through a convenient graphical interface. With the demo program you can configure the modes of the LTC5100. For example, you can choose automatic power control mode and enable overcurrent fault detection. You can enable the transmitter and set the monitor diode current for a desired optical power level. You can then adjust the modulation current to set the extinction ratio. While you make these adjustments you get continuous feedback from the LTC5100's on-board ADC readings, allowing you to monitor the laser bias current and the chip temperature, for example.

When you are satisfied with the setup of the LTC5100, you can save the settings to a file. You can recall the settings from the file and automatically load them into the chip. You can save the LTC5100's settings to the EEPROM, making the demo board ready for standalone operation. At this point, you could disconnect the computer and cycle the power to the demo board. The LTC5100 will operate fully independently, as it would in a real transceiver module.

You can use the demo program to communicate with the LTC5100 on a PC board of your own design. All features

and capabilities of the program are available. In this way the demo program can serve as a laboratory design aid for your transceiver product design.

The demo program contains a simulator so you can even explore the features and functionality of the LTC5100 without any demo hardware.

The remainder of this section explains the demo program in detail.

System Requirements

- IBM Compatible PC with 1024 × 768 or better screen resolution
- Windows 98/NT/2000/XP operating system
- An available serial port

You need Adobe® Acrobat® Reader™ to open and read the demo documentation (<http://www.adobe.com>).

Installation

You can run the demo program from a CD with no installation. The only limitation is that you cannot change the simulated laser parameters when running from a CD.

To install the demo software, simply copy all files on the CD to a writeable directory on the hard drive. The files are:

- LTC5100.exe: The demo program
- datasheet.pdf: The data sheet in PDF format.
- demo-manual.pdf: The demo manual in PDF format.

The first time you run the demo program, it creates LTC5100.ini in your Windows directory. If you are running from a writeable directory on your hard drive, the program creates a file called LaserParams.ini in the installation directory. LaserParams.ini contains the characteristics of the simulated laser. You can modify those characteristics by editing the file.

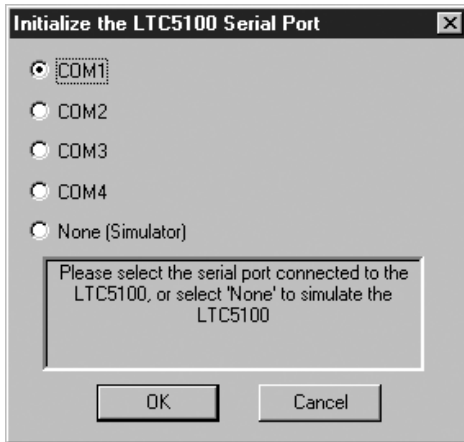
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Reader is a trademark of Adobe Systems Inc.

OPERATION

Start-Up and Troubleshooting

(For start-up in simulation mode, see the SIMULATION section.)

Follow the directions in the Quick Start Guide to set up the hardware. Then run LTC5100.exe from the CD or hard drive. You will see this dialog:



Choose your COM port and press OK. The demo program will detect if the DC636A and DC499 demo boards are there and working and advise you of the status. If you do not know your COM port number, just try different COM ports until one succeeds.

If no COM port works, do these checks:

- Check the jumper positions on the DC636A translator board. See Figure 4 or Figure 9.
- Probe the DC636A translator board to see if it has 5V on connector P3.
- Probe the DC499 demo board to see if it has 3.3V at test turret VDD2.
- Check your RS232 cable. It must be a straight-through cable with Pin 2 to Pin 2 and Pin 3 to Pin 3. Do not use a null-modem cable, which has Pins 2 and 3 swapped.
- Cycle power to the DC499 demo board (which cycles power to the DC636A as well).

If your screen is distorted (i.e. the Block Diagram does not line up with the user interface controls) after you establish communications, you may have “Large Fonts” enabled in

your operating system. To remedy this problem, switch the display to “Small Fonts” or “Normal Size (96 dpi)”.

Windows 98, 2000 and XP: In the control panel, go to Display/Settings/Advanced. Set Font Size to Small Fonts or Normal Size (96 dpi).

Windows NT: In the control panel, go to Display/Settings/Advanced. Set Font Size to Small Fonts.

The program requires a screen resolution of 1024 × 768 or better. If the LTC5100 demo window does not fit your screen, go to Settings/Control Panel/Display and increase the resolution if possible.

Functional Diagram

Once you have established communication with the demo board, you will see the Functional Diagram, as shown in Figure 11. This diagram gives you direct access to the LTC5100’s most important controls and lets you monitor the status of the chip and laser. From this screen you can set the LTC5100’s parameters in real-world units rather than in binary codes. For example, you enter modulation current in milliamps and you read die temperature in degrees Celsius.

To enable the transmitter, press the ENABLE button on the screen. Adjust other controls as needed to set the laser bias current, etc.

In the Functional Diagram view, the demo program scans the LTC5100’s registers continuously, updating the screen in real time. Scanning generates a continuous stream of serial data traffic on the SCL and SDA pins. If you probe those pins with an oscilloscope you will see this traffic.

When you work within the Functional Diagram, the demo program is making many decisions for you. For example, the operating modes are automatically set to the most sensible values. Even more importantly, the demo program automatically selects the SRC, MOD and MD pin current ranges. Automatic ranging makes the program easier to use, but causes short-lived current transients in the laser. These transients would not occur in a real transceiver module because you would not change ranges with the transmitter enabled in normal operation.

OPERATION



dc499 F12

Figure 12. Functional Diagram Showing an Overcurrent Fault

OPERATION

Safety Fault Handling

The LTC5100 detects five types of safety faults:

- Undervoltage
- Memory Load Error
- Overpower
- Underpower
- Overcurrent

Undervoltage and Memory Load Error detection are always enabled. You can manually enable detection of Overpower, Underpower and Overcurrent faults by setting the corresponding enable bit (see Figure 11).

When a fault occurs, a red indicator pops up on the screen, as shown in Figure 12. You can clear the fault by pressing the ENABLE button or the Clear Fault button. This does more than clear the indicators on the screen. It actually clears the faulted state in the LTC5100.

Full Register Set

You can select the “Full Register Set” tab to gain access to the full complement of registers in the LTC5100. Every bit

in every register can be set and monitored from this screen. There is no automatic scanning of registers, so to update the screen with new information from the chip, click “Read All” to read all registers or click one of the title bars such as “SYSTEM CONFIG” to read a small group of registers.

Three important buttons are:

- “Read All”: reads all registers in the LTC5100 and updates every field on the screen.
- “Write All”: writes every field on the screen to the LTC5100’s registers. This button is useful for reloading the chip after cycling power.
- “Reset All”: reset all registers in the LTC5100 to their power on defaults. There is one exception: The Operating_mode bit is set to prevent the chip from spontaneously loading itself from EEPROM.

The demo program does not automatically scan the registers in the “Full Register Set”. Therefore, no spontaneous serial bus traffic is generated as in the “Functional Diagram”.

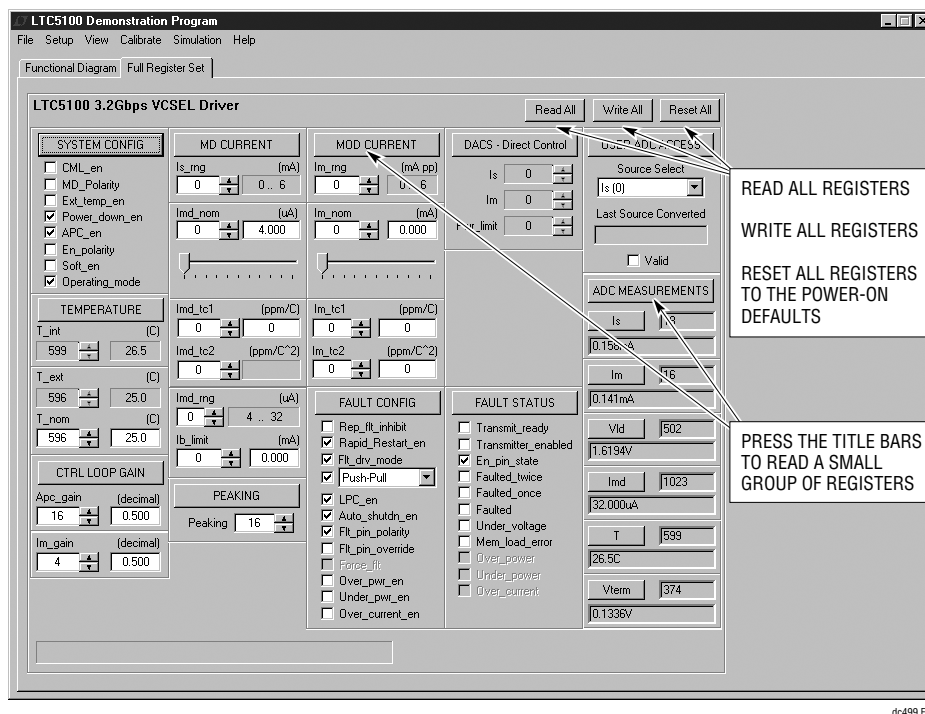


Figure 13. Full Register Set View for the LTC5100 Demo Program

OPERATION

Switching Views

You can switch freely between the Functional Diagram (FD) and the Full Register Set (FRS) views. From the FD, you can switch to the FRS to see precisely how the chip is configured and to see the raw binary codes stored in the registers. You can also go to the FRS to modify the default modes and settings used in the FD. For example, you could go to the FRS and change the drive mode of the FAULT pin.

Be aware that changing operating modes in the FRS can cause non-standard behavior in the FD.

Menus

File Menu

Write Registers to File

Read Registers From File

Allows you to store the LTC5100's setup in a file and later recall the setup. The registers are automatically transferred to the LTC5100 when you recall them. The registers are stored in the following format, with each line representing a logical field within a register. (The notation is "REGISTER_NAME.FIELD_NAME=decimal value".)

```
SYS_CONFIG.Cml_en = 0
SYS_CONFIG.Md_polarity = 0
```

```
.
```

```
SYS_CONFIG.Operating_mode = 1
LOOP_GAIN.Ib_gain = 4
LOOP_GAIN.Im_gain = 1
PEAKING.Peaking = 16
```

```
.
```

Store Registers to EEPROM

Transfer the current contents of the LTC5100's registers to the EEPROM. The next time you cycle power to the demo board, the LTC5100 will automatically load the contents of the EEPROM into its internal registers.

Print LTC5100 Register Set

Print the register set to a printer. The format is the same as that used for writing to a file.

Exit

Exit the program

Setup Menu

Set Constant Current Control (CCC) Mode

Sets the registers to values appropriate for driving the laser with a constant current (i.e. without optical feedback from a monitor diode.)

Set Automatic Power Control (APC) Mode

Sets the registers to values appropriate for driving the laser with a constant average power using optical feedback from a monitor diode.

Reset All to Default

Reset all LTC5100 registers to sensible defaults. In the Functional Diagram, this means setting the registers to values that are appropriate for the currently selected mode (CCC or APC mode). In the Full Register Set, "Reset All to Default" sets the registers to the power on defaults (with the exception of the SYS_CONFIG.Operating_mode bit.)

View Menu

Show All Fault Indicators (enabled only in the Functional Diagram). Turns on all of the fault indicator displays, as shown in Figure 14. Select "Show All Fault Indicators" again to hide the indicators.

Calibrate Menu

(Enabled only in the Functional Diagram, APC mode)

Calibrate the Monitor Diode

Calibrating the monitor diode response allows you to see the average optical power displayed in milliwatts. When "Calibrate Monitor Diode" is selected, you will see the following screen:

Calibrate the Monitor Diode Response

Measure the average optical power emitted from the laser and enter here: 400.000 uW Average optical power

Monitor diode current (Imd) measured by the on-chip ADC: 198.56 uA

Monitor diode response: 0.496 A/W

OK Cancel

OPERATION

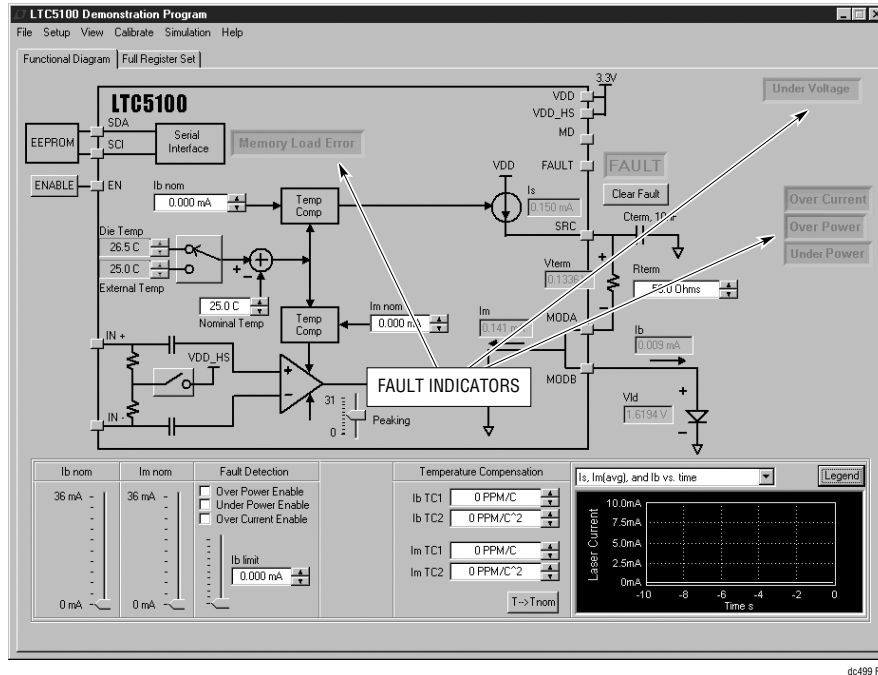


Figure 14. Functional Diagram with “Show All Fault Indicators” Turned On

To calibrate the monitor diode, measure the laser output on an optical power meter and enter the value in microwatts. The demo program assumes that the monitor diode current is linearly proportional to the optical power. The screen now shows the optical power of the laser, as in Figure 15.

Simulation Menu

Simulate the LTC5100 and Laser ...

Switch into or out of simulation mode. When you switch to simulation mode, the demo program ignores the demo hardware and simulates the LTC5100. See the SIMULATION section for details. To switch from simulation to hardware mode, select “Simulate the LTC5100 and Laser” again.

Fast Simulation Speed

Simulate the LTC5100 laser servo cycle at 150ms per cycle

Medium Simulation Speed

Simulate the LTC5100 laser servo cycle at 300ms per cycle

Slow Simulation Speed

Simulate the LTC5100 laser servo cycle at 600ms per cycle

You can select Slow Simulation Speed to more closely observe the settling behavior of the laser bias and modulation currents.

Help Menu

Show Tool Tips

Show or hide the Tool Tips, which are helpful reminders that pop up whenever you allow your cursor to hover over a feature on the screen.

Display the LTC5100 Data Sheet

Display the LTC5100 data sheet in PDF format. You will need Adobe Acrobat or Acrobat Reader to view the data sheet on your computer (<http://www.adobe.com>).

Display Demo Board Application Note

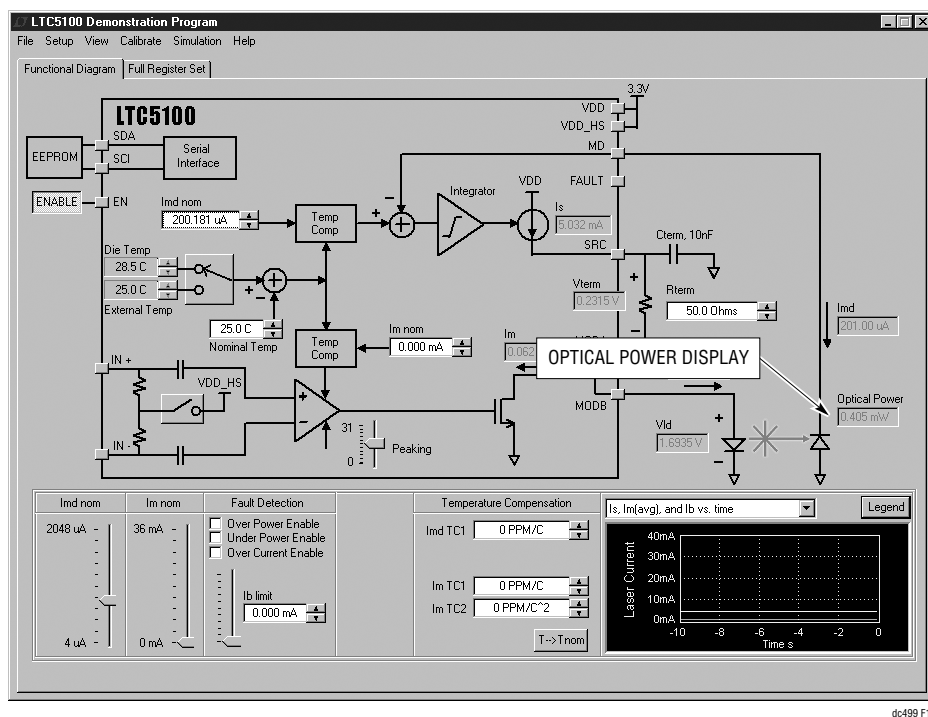
Display this document in PDF format. You will need Adobe Acrobat or Acrobat Reader to view the data sheet on your computer (<http://www.adobe.com>).

About the LTC5100 Demo Software

Report the version, build date and copyright information for the demo program.

DEMO MANUAL DC499

VCSEL DRIVER BOARD

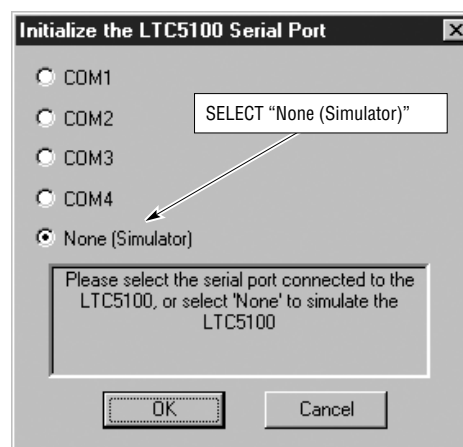


SIMULATION

The LTC5100 demo program has a detailed, low frequency simulator for the LTC5100 VCSEL driver. You can use the simulator to explore the features and functionality of the chip without setting up any demo hardware. The simulator shows certain aspects of the LTC5100, such as power consumption and servo loop performance, in greater detail than the demo hardware. The simulator realistically models a simplified laser diode. You can change the parameters of this model to more closely reflect your laser. The simulator does not attempt to simulate the high frequency characteristics of the LTC5100 or the laser.

To simulate the LTC5100, insert the DC499 compact disk in your personal computer and run LTC5100.exe. (You will need Microsoft Windows 98, NT, 2000, or XP.)

Select "None (Simulator)" when you see this dialog:



SIMULATION

You will see the screen in Figure 3, the Functional Diagram. When you are working in the Functional Diagram, the simulator is continuously updating the LTC5100's laser servo loops. These are the digital control loops that servo and temperature compensate the laser bias and modulation currents.

Nearly all features and functionality of the LTC5100 are faithfully simulated. You can switch to the Full Register Set to control and monitor every detail of the chip. (You cannot change LPC_en, which would turn off the simulated laser servo loops.) When working in the Full Register Set view, the simulator does not automatically update the laser servo loops. Instead, it does one digital controller iteration every time you read the SRC (source) pin current, designated I_S . To read I_S and trigger a servo iteration, press one of these buttons:

- Read All
- ADC MEASUREMENTS
- I_S

The simulator models the effects of ambient temperature changes. Figure 16 shows how to change the simulated ambient temperature. The ambient temperature affects the simulated die temperature and the simulated laser characteristics.

The simulator estimates the die temperature from the ambient temperature, the power dissipation of the chip, and the nominal thermal resistance of the chip.

The simulator models the laser diode in a simplified way. The parameters for this model are stored in a file called LaserParams.ini in the same directory as the demo program. A default version of this file is created the first time you run the demo program. After that you are free to modify the parameters to match your specific laser.

The default contents of the LaserParams.ini file are shown in Figure 17. You can view plots of the simulated laser characteristics in the graph in the Functional Diagram.

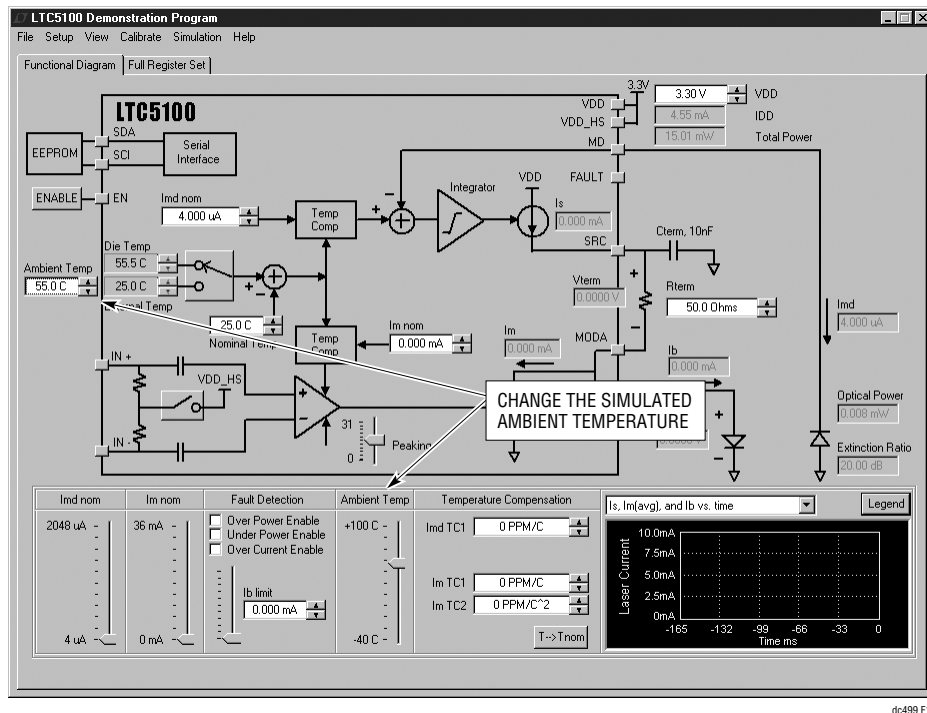


Figure 16. Changing the Simulated Ambient Temperature

DEMO MANUAL DC499

VCSEL DRIVER BOARD

SIMULATION

```
# LaserParams.ini file
# Set Laser Parameters for the LTC5100
# Use the # symbol for comments. All succeeding characters until a
# newline will be ignored. Whitespace is ignored.
# '=' is necessary preceding parameter values.
# Values not set will use the default values.

TNom = 25.0 # Nominal temperature, Degrees C

[Rld]
# Dynamic resistance parameters
RldNom = 35.0 # Ohms
RldTC1 = -0.002400
RldTC2 = -0.000025

[Ith]
# Current threshold parameters
IthNom = 0.002000 # Amperes
IthTC1 = 0.001300
IthTC2 = 0.000165

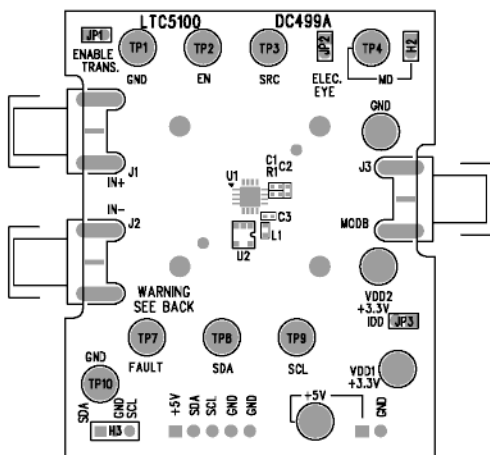
[Eta]
# Slope efficiency parameters
EtaNom = 0.10 # Watts/Ampere
EtaTC1 = -0.000400
EtaTC2 = -0.000016

[Gamma]
# Monitor diode response parameters
GammaNom = 0.500 # Amperes/Watt
GammaTC1 = 0.000500
GammaTC2 = 0.000010

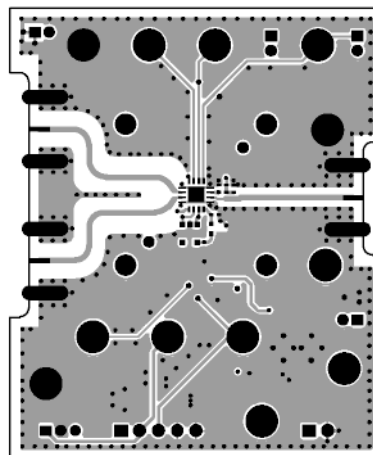
[Other Parameters]
Vk = 1.5 # Knee voltage, Volts
Ik = 0.001000 # Knee current, Amperes
ThetaJA = 35.0 # Thermal resistance of the LTC5100, Degrees C/Watt
```

Figure 17. Default Contents of the LaserParams.ini File

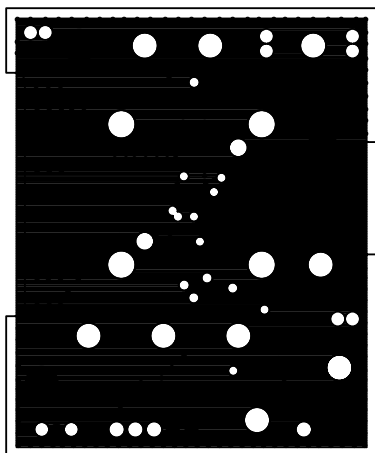
PCB LAYOUT AND FILM (DC499)



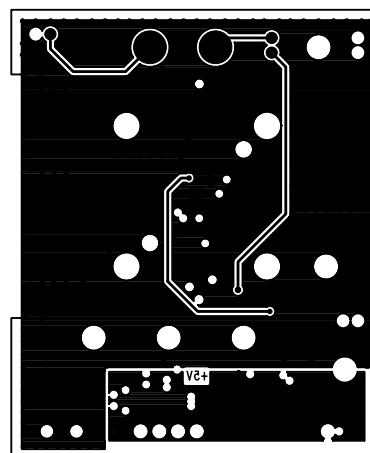
Component Side Silkscreen



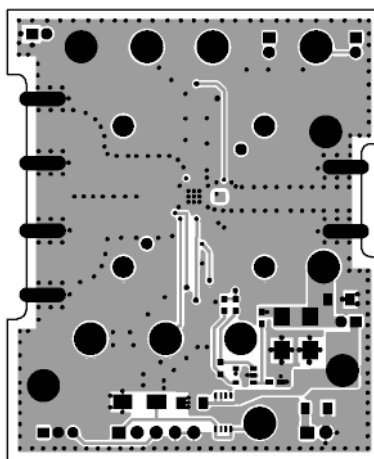
Component Side Copper (Layer 1)



Internal Copper (Layer 2)



Internal Copper (Layer 3)

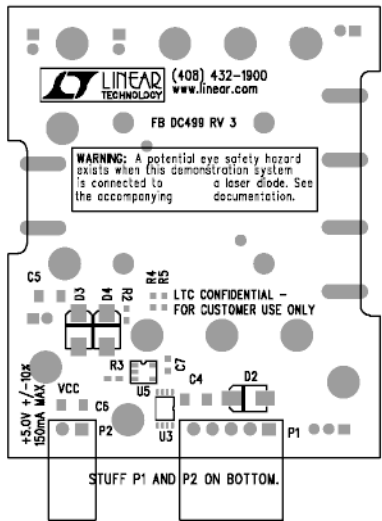


Bottom Side Copper (Layer 4)

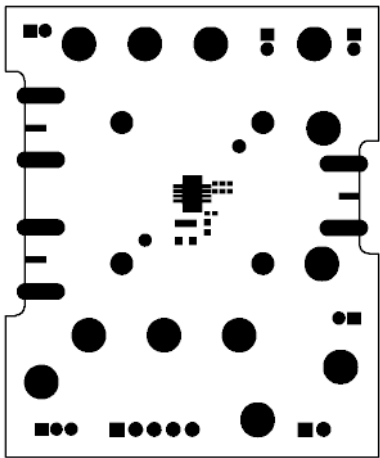
DEMO MANUAL DC499

VCSEL DRIVER BOARD

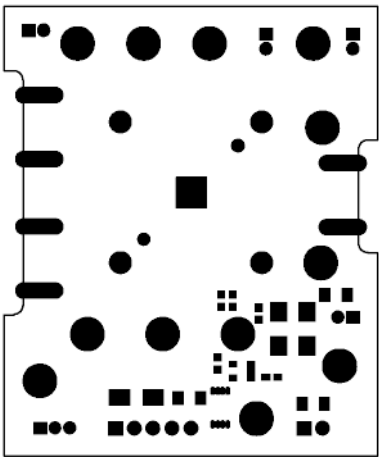
PCB LAYOUT AND FILM (DC499)



Bottom Side Silkscreen

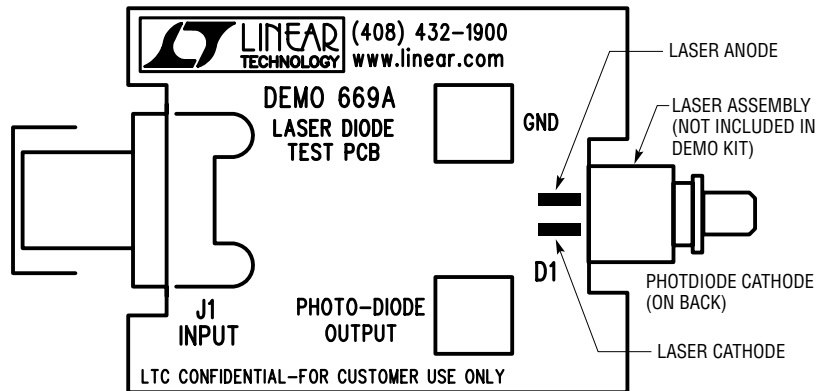


Component Solder Mask

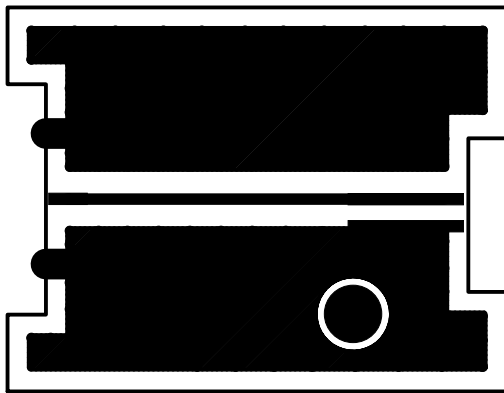


Bottom Side Solder Mask

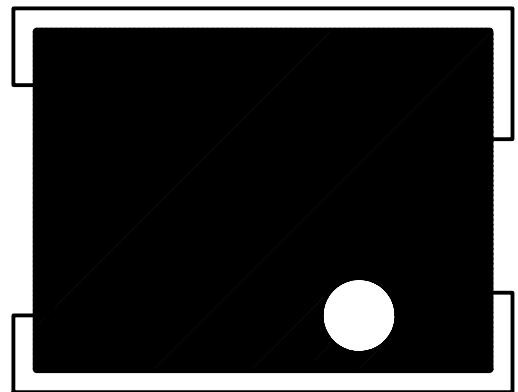
PCB LAYOUT AND FILM (DC669)



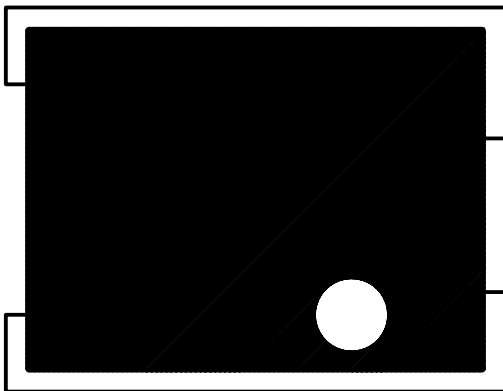
Component Side Silkscreen



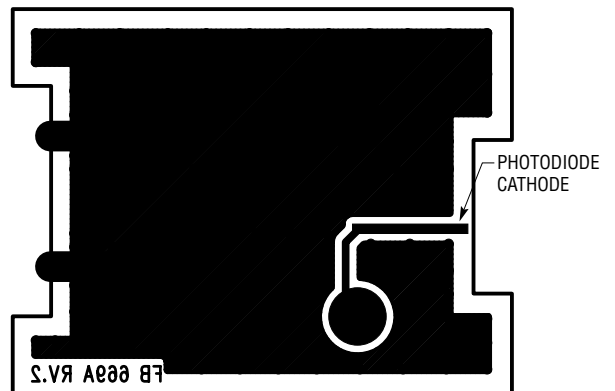
Component Side Copper (Layer 1)



Internal Copper (Layer 2)

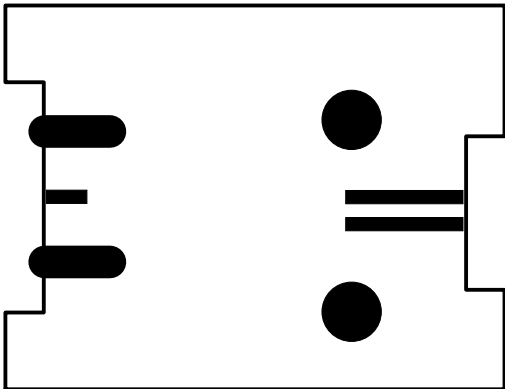


Internal Copper (Layer 3)

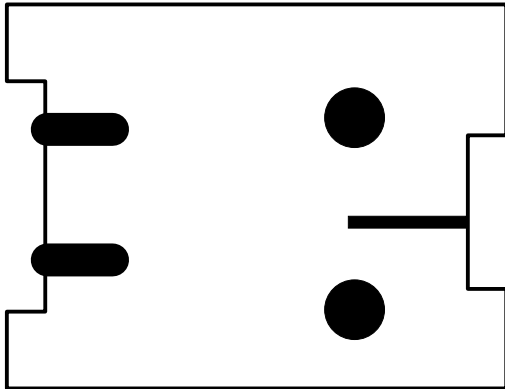


Bottom Side Copper (Layer 4)

PCB LAYOUT AND FILM (DC669)



Component Solder Mask

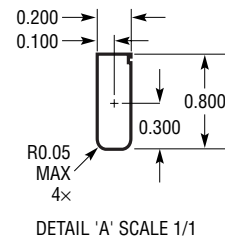
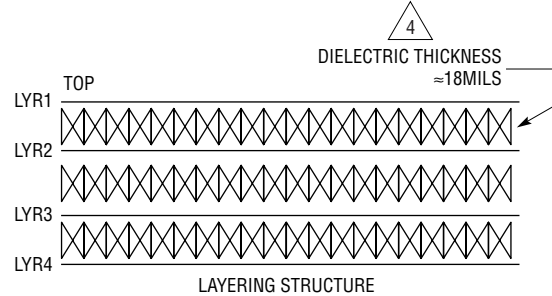
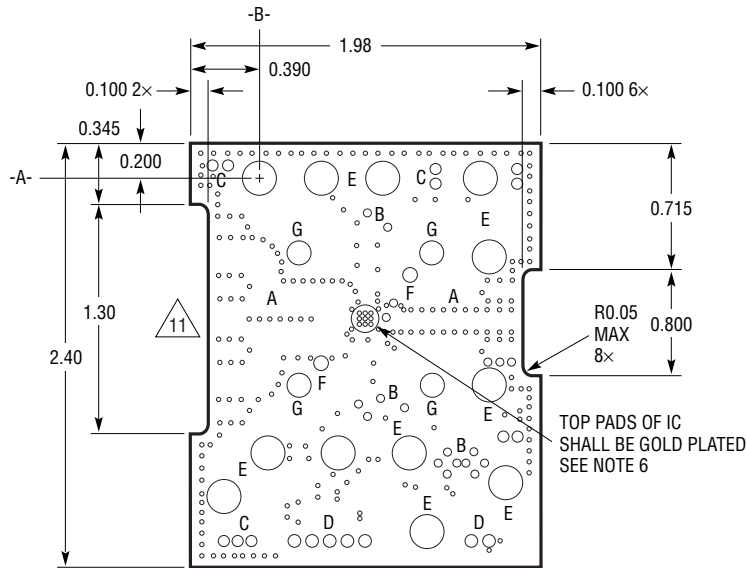


Bottom Side Solder Mask

DEMO MANUAL DC499

VCSEL DRIVER BOARD

PC FAB DRAWING (DC499)



SYMBOL	DIAMETER	NUMBER OF HOLES	PLATED
A	10 ±0.003	271	PLTD
B	15 ±0.003	18	PLTD
C	35 ±0.005	11	PLTD
D	43 ±0.005	7	PLTD
E	95 ±0.005	12	PLTD
F	62 ±0.01	2	NPLTD
G	113 ±0.01	4	NPLTD
TOTAL HOLES		325	

NOTES: UNLESS OTHERWISE SPECIFIED

- ARTWORK PN DC499A REV 3
- FAB PER IPC-A-600
- MATERIAL: GETEK, FINISHED THICKNESS TO BE 0.062 ±0.005 INCH WITH 2 OZ COPPER ON TWO OUTER LAYERS AND 1 OZ COPPER ON TWO INTERNAL LAYERS.
FLAMMABILITY RATING: 94 V-0 MINIMUM
OUTER DIELECTRIC THICKNESS: TARGET 50Ω USING 30 MIL TRACE.
CONTROLLED 50Ω IMPEDANCE LAYER 1 TO LAYER 2
TO BE FINALIZED BY MANUFACTURER.
- SIZE: CUT TO DIMENSIONS AND TOLERANCES SHOWN
-A- AND -B- ARE PRIMARY DATUMS
- BOARD: SELECTIVE PLATED BOARD, SOLDER
A. MASK OVER BARE COPPER
B. WHITE TIN BOTH SIDES
C. GOLD PLATING: (FOR IC PADS ONLY)
GOLD PLATING SHALL BE IN ACCORDANCE WITH ANSI/IPC-6000, SECTION 4.0. "SURFACE PLATING ACCEPTABILITY REQUIREMENTS."
GOLD PLATING SHALL MEET ANSI/IPC-A-6000, SECTION 4.0, CLASS 3
MINIMUM PLATING THICKNESS REQUIREMENTS (50μm/1.3μm THICK, MINIMUM)
GOLD PLATING SHALL BE HARD GOLD, TYPE 1 (99.7% GOLD MINIMUM)
GRADE C (KNOOP HARDNESS 130-200), CLASS 1 (50μm/1.3μm THICK, MINIMUM)
IN ACCORDANCE WITH MIL-G-45204C.
- SOLDER MASK TYPE: WET PHOTO-IMAGABLE, THE PC COLOR: GREEN
- SILKSCREEN COMPONENT SIDE WITH WHITE NON-CONDUCTIVE INK
- PLATE THRU ALL HOLES WITH COPPER MIN PLATING THICKNESS: 1 OZ EXCEPT WHERE PLATING NOT REQUIRED
- DRILL: ALL HOLES SHALL BE DRILLED ±0.003 INCH WITH RESPECT TO CENTER OF DRILLED PAD. ALL HOLES FINISHED SIZE AFTER PLATING
- DROP ALL UNUSED PADS ON INNER LAYERS
- DO NOT ALTER ARTWORK e.g., TO ADD LOGO OR DATE CODE
- CONTROLLED 50Ω IMPEDANCE (AT 2.5GHz FREQ) FOR LAYER 1-2

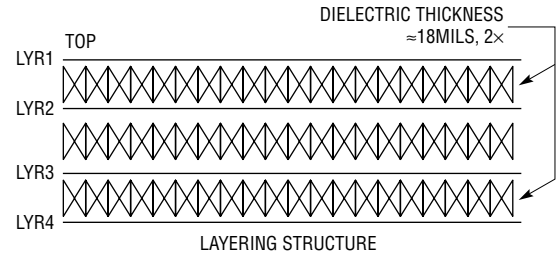
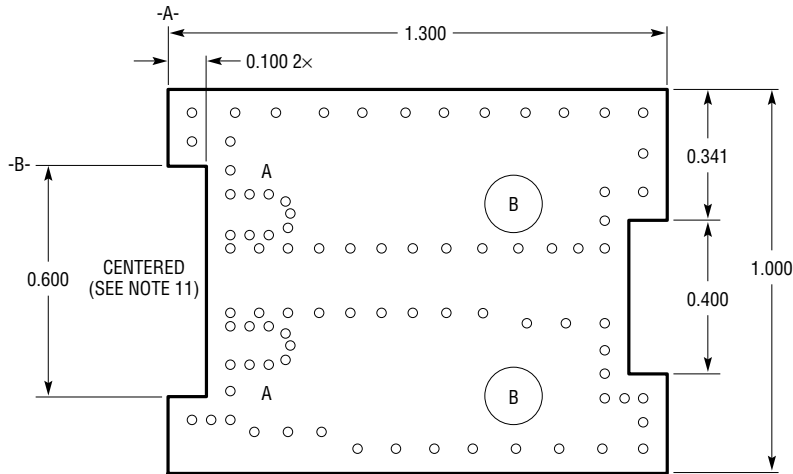


INNER AND OUTER LAYER COPPER SHALL BE EXPOSED IN TWO INSET AREAS ALONG BOARD EDGES

DEMO MANUAL DC499

VCSEL DRIVER BOARD

PC FAB DRAWING (DC669)



SYMBOL	DIAMETER	NUMBER OF HOLES	PLATED
A	0.010 ±0.003	83	PLTD
B	0.093 ±0.003	2	PLTD
TOTAL HOLES		85	

NOTES: UNLESS OTHERWISE SPECIFIED

- ARTWORK PN DC669A REV 1
- FAB PER IPC-A-600
- MATERIAL: EPOXY FIBERGLASS, NEMA GRADE FR-4
FINISHED THICKNESS TO BE 0.047 ±0.005 INCH WITH 2 OZ COPPER ON TWO OUTER LAYERS AND 1 OZ COPPER ON TWO INTERNAL LAYERS.
FLAMABILITY RATING: 94 V-0 MINIMUM
- OUTER DIELECTRIC THICKNESS: TARGET 50Ω USING 30 MIL TRACE.
SEE STACKUP DIAGRAM
- SIZE: CUT TO DIMENSIONS AND TOLERANCES SHOWN
-A- AND -B- ARE PRIMARY DATUMS
- DRILLING: DRILL HOLES PER SCHEDULE. PLATE THROUGH HOLES WITH COPPER 0.001 INCH THICK MIN. ALL HOLE SIZES ARE SPECIFIED AFTER PLATING.
HOLE LOCATION TOLERANCES ARE ±0.003 INCH IN RELATION TO CENTER
- FINISH: SMOBC USING LPI BOTH SIDES, GREEN PREFERABLE. SILKSCREEN BOTH SIDES WITH WHITE NONCONDUCTIVE INK.
- DROP ALL UNUSED PADS ON INNER LAYERS.
- DO NOT ALTER ARTWORK, e.g., TO ADD LOGO OR DATE CODE.
- INNER AND OUTER LAYER COPPER SHALL BE EXPOSED IN INSET AREA ALONG BOARD EDGES.
- SCORING:

