

ARTISAN®
TECHNOLOGY GROUP

Your **definitive** source for quality pre-owned equipment.

Artisan Technology Group
(217) 352-9330 | sales@artisantg.com | artisantg.com

Full-service, independent repair center
with experienced engineers and technicians on staff.

We buy your excess, underutilized, and idle equipment
along with credit for buybacks and trade-ins.

Custom engineering
so your equipment works exactly as you specify.

- Critical and expedited services
- In stock / Ready-to-ship
- Leasing / Rentals / Demos
- ITAR-certified secure asset solutions

Expert team | Trust guarantee | 100% satisfaction

All trademarks, brand names, and brands appearing herein are the property of their respective owners.

Visit our website - *Click HERE*

LAB BUDDY

USER MANUAL

Model: DSC50S-HLPD

Serial Number: 502265



Discovery Semiconductors, Inc.®
We Chip the Future®

119 Silvia Street
Ewing, NJ 08628 USA

Phone: 609-434-1311 Fax: 609-434-1317
Web: www.discoverysemi.com

Specifications are subject to change without notice.
Confidential and Proprietary -- ©2010 Discovery Semiconductors, Inc.
All Rights Reserved

TABLE OF CONTENTS

INTRODUCTION	5
UNPACKING	6
WARRANTY	6
FEATURES	7
INSTALLATION AND OPERATION	10
DRIVER INSTALLATION	11
LAB BUDDY GUI	14
COMMAND SET	15
TE COOLING FAILSAFE	16
HELP DISPLAY	18
LAB BUDDY GUI REQUIREMENTS	19
APPENDIX	
TEST REPORT	20
DATA SHEET	22
NOTES	33

Specifications are subject to change without notice.
Confidential and Proprietary -- ©2010 Discovery Semiconductors, Inc.
All Rights Reserved

Specifications are subject to change without notice.
Confidential and Proprietary -- ©2010 Discovery Semiconductors, Inc.
All Rights Reserved

INTRODUCTION

The Discovery Semiconductors Inc. thermo-electrically cooled Highly Linear Photodiode (HLPD®) Lab Buddy is a Turn-Key state-of-the-art instrument that allows the customer not only to monitor but also control the bias voltage as well as the temperature of the HLPD®, either from the front panel or a remote serial computer interface. It also monitors the average DC photocurrent of the HLPD®. The Lab Buddy is powered from a power supply module supplied by Discovery Semiconductors, Inc. It provides a regulated +12 VDC voltage to the Lab Buddy. The Lab Buddy eliminates the possibility of an accidental damage to the thermo-electrically cooled Highly Linear Photodiode (HLPD®).

DIMENSIONS OF THE LAB BUDDY

- Height: 3.50 in (8.90 cm)
- Width: 8.25 in (12.95 cm)
- Length: 10.75 in (27.30 cm)
- Weight: 5.00 lb (2.50 kg)



Specifications are subject to change without notice.
Confidential and Proprietary -- ©2010 Discovery Semiconductors, Inc.
All Rights Reserved

UNPACKING

Examine your Lab Buddy for any signs of shipping damage. Should any damage be apparent, notify the carrier immediately. Retain all damaged cartons. Liability for shipping damage rests with the carrier.

WARRANTY

The Lab Buddy is supplied with a limited 3 month warranty. During this time, Discovery Semiconductors, Inc. at its discretion will repair and replace any parts that have been found to be defective. Please contact Discovery Semiconductors, Inc. for prompt assistance in resolving any issues relating to the warranty or operation of the Lab Buddy.

This warranty does not cover those situations involving product modification, tampering, misuse, or failure to follow the precautions as given in this instruction manual.

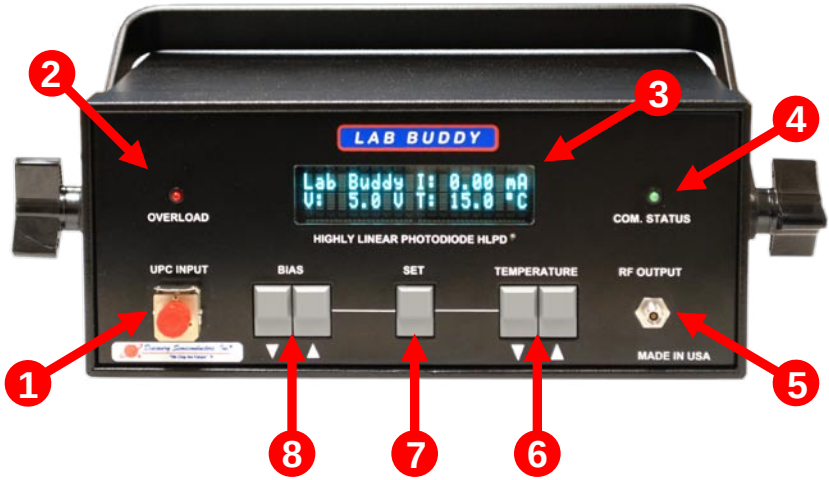
SAFETY PRECAUTION:

For reliable operation, the Lab Buddy should be powered before applying the optical input.

If optical power is applied without the Lab Buddy fully powered, serious damage may result to the HLPD®.

Specifications are subject to change without notice.
Confidential and Proprietary -- ©2010 Discovery Semiconductors, Inc.
All Rights Reserved

FRONT PANEL DESCRIPTION



1. **Optical Input:** The digital front panel is fitted with a detachable DIAMOND optical connector for the device input fiber. The device input fiber end face is either polished flat or angled as selected by the customer. The DIAMOND connector can be easily removed without tools to allow quick and effortless cleaning of the input fiber end face.

   Tip: To prevent wear and tear of the optical connector, please use a patch cord between the Lab Buddy and your optical source.

2. **Overload LED:** The red color LED will blink when there is optical power overload on Lab Buddy or in other words, an excessive optical power is applied to the device. In case of overload, attenuate the optical power that is being applied to the device installed in your Lab Buddy.

3. **Digital Display:** The Lab Buddy front panel is equipped with a vacuum fluorescent display to display the actual bias, temperature, and photocurrent as well as the corresponding set points for the specific HLPD® device installed in the Lab Buddy. The bias voltage, temperature, and average DC photocurrent are

Specifications are subject to change without notice.
Confidential and Proprietary -- ©2010 Discovery Semiconductors, Inc.
All Rights Reserved

displayed in the units of Volt (V), degree Celsius (ºC), and milliampere (mA), respectively.

4. **Communication Status:** The green LED on the front panel of Lab Buddy indicates the remote computer interface status and is illuminated whenever there is an on-going serial communication between the Lab Buddy and computer.

5. **RF Output:** A type K_1 or V_2 RF output connector is provided on the digital front panel. Exercise special care when making a RF connection to this connector since over tightening may damage the connector permanently.

   Tip: A firm finger tight connection is sufficient for your tests and measurements.

6. **UP/DOWN Temperature Push-Buttons:** The UP/DOWN temperature push-buttons set the HLPD® temperature. These UP/DOWN push-buttons work only when the SET push-button is simultaneously pressed.

   - Temperature Range: +10 ºC to +35 ºC
   - Temperature Resolution: 0.1 ºC

7. **SET Push-Button:** The SET push-button not only allows the customer to view the set points but also allows the customer to change the set points for HLPD® bias as well as its temperature. In addition, pressing this button for more than 4 seconds will result in a Help Display. See the Appendix for further details.

8. **UP/DOWN Bias Push-Buttons:** The UP/DOWN bias push-buttons set the HLPD® bias voltage. These UP/DOWN push-buttons work only when the SET push-button is simultaneously pressed.

   - Bias Voltage Range: ~+4 VDC to ~+9 VDC
   - Bias Voltage Resolution: 0.05 VDC

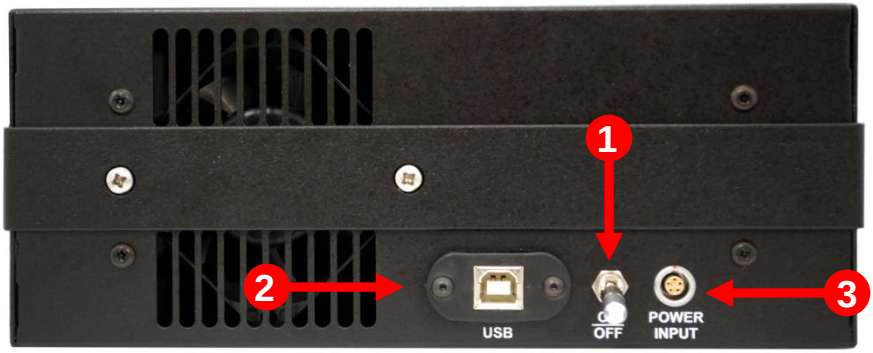
---

[1] The K-connector is a trademark of Anritsu Company.
Barrel diameter is 2.92 mm. (compatible with 3.5 mm SMA).

[2] The V-connector is a trademark of Anritsu Company.
Barrel diameter is 1.85 mm. (compatible with 2.4 mm from Agilent).

Specifications are subject to change without notice.
Confidential and Proprietary -- ©2010 Discovery Semiconductors, Inc.
All Rights Reserved

REAR PANEL DESCRIPTION



1. **Power Switch:** The power switch is located on the rear panel of the Lab Buddy. It is a special locking type toggle switch that is designed to minimize the risk of an accidental removal of power during operation. To toggle this switch, simply pull the handle outward, and then change the switch position. Upon releasing, the switch will automatically lock in the new position.
2. **USB Connector:** The USB connector (Type B) is provided to remotely operate the Lab Buddy through the serial computer interface (RS-232C via virtual COM port). The virtual COM port driver software is included in the package along with a USB Type A to Type B cable of 3 Feet (~1 m) in length.
3. **Power Supply Input:** The LEMO power supply connector consists of a special locking mechanism for establishing power connection to the Lab Buddy. This prevents accidental removal of the power cord during operation.

Specifications are subject to change without notice.
Confidential and Proprietary -- ©2010 Discovery Semiconductors, Inc.
All Rights Reserved

POWER SUPPLY



The Lab Buddy includes a power supply that will operate from your main AC outlet. Its specifications are as follows:

- Voltage Rating: 100 − 240 VAC
- Rating: 12V @ 2.5 A
- Frequency: 50/60 Hz

INSTALLATION AND OPERATION

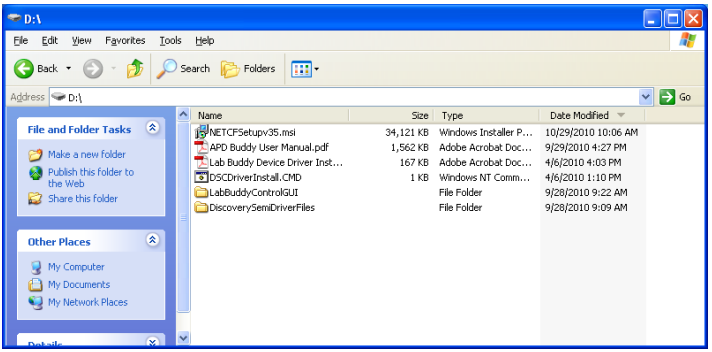
1. Make sure power switch is in the OFF position.
2. Connect power supply cord to the rear panel, and plug it into a main AC outlet.
3. Make the necessary RF connection of your test setup.
4. Turn ON the power switch on the rear panel. Ensure that the Lab Buddy boots up and does the power on self test (~ 10 seconds), and that the digital front panel is active.
5. Make the necessary connection of your optical test setup.
6. Turn the optical power on in your test setup.
7. To power down, remove the optical power and then perform the above steps in reverse order.

Specifications are subject to change without notice.
Confidential and Proprietary -- ©2010 Discovery Semiconductors, Inc.
All Rights Reserved

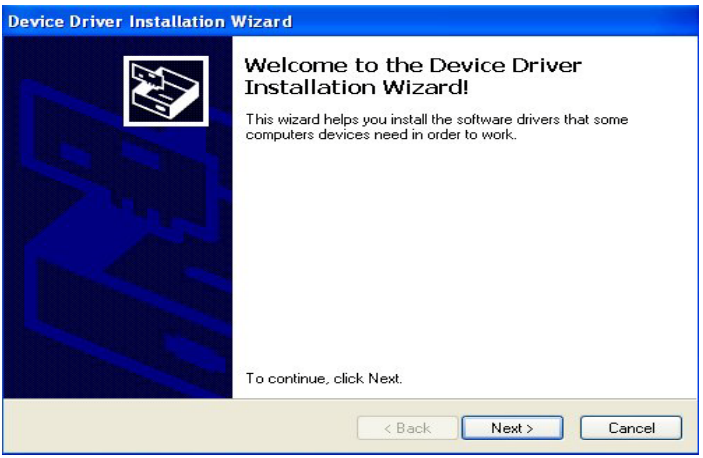
DRIVER INSTALLATION

The Discovery Semiconductors, Inc. Lab Buddy controller is equipped with a standard RS-232C interface that is implemented in hardware as a Virtual Communication Port (VCP) over the universal serial bus (USB). This section shows how to preinstall the corresponding USB device driver on your computer before connecting the Lab Buddy to your computer.

1. Insert the included Flash Disk into one of the PC's USB ports. The "DSCDriverInstall.CMD" file is located in the root directory of your Flash Disk drive as shown below:



Double click on the "**DSCDriverInstall.CMD**" file. The following dialog box should appear:



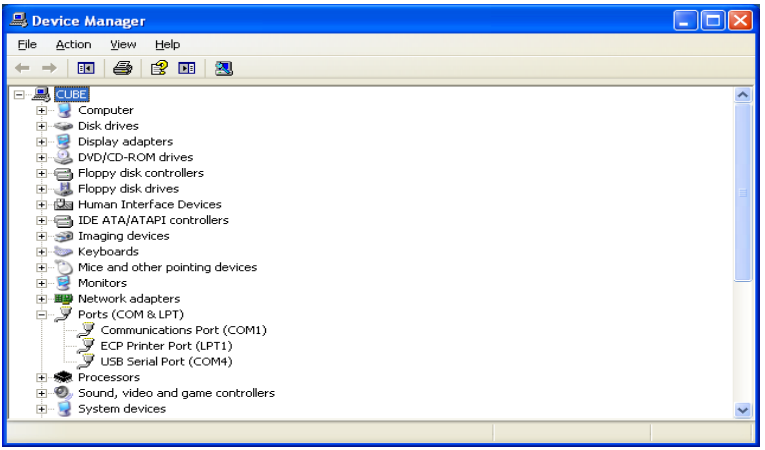
Specifications are subject to change without notice.
Confidential and Proprietary -- ©2010 Discovery Semiconductors, Inc.
All Rights Reserved

2. When prompted, click “Next” to continue with the installation. The appropriate driver files will be installed on your computer as shown below:



3. Click “Finish” to complete the driver installation.
4. Lab Buddy device driver installation is now completed.
5. At this point, please connect your Lab Buddy to the PC using the USB cable provided in the package.
6. The Virtual COM Port address through which the Lab Buddy is now connected to your computer can be identified using the Windows Device Manager utility. To see the Virtual COM Port’s address, click to open the Ports (COM & LPT) section as shown below. The corresponding RS-232C port will be identified as a “USB Serial Port”. In this particular example, Lab Buddy has been installed on the COM4 port. The actual COM port address to be used for communication will vary depending on what other devices are installed on your computer using RS-232C interface. This COM Port address is required for programming your Lab Buddy.

Specifications are subject to change without notice.
Confidential and Proprietary -- ©2010 Discovery Semiconductors, Inc.
All Rights Reserved



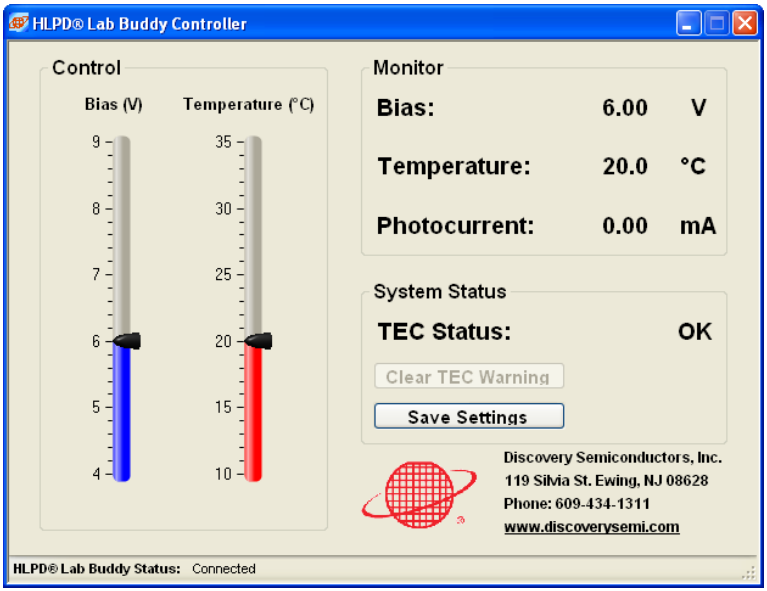
The specifications of the implemented remote serial interface (RS-232C) are as follows:

- Baud Rate: 57600 Baud
- Start Bit: 1
- Stop Bit: 1
- Parity: none
- Flow Control: none

Specifications are subject to change without notice.
Confidential and Proprietary -- ©2010 Discovery Semiconductors, Inc.
All Rights Reserved

LAB BUDDY GUI

The LabBuddyControl software can be used to remotely control the HLPD® Lab Buddy. The software is passive – it does not attempt to change any experiment parameters unless commanded to do so by the user. On startup, LabBuddyControl will query the HLPD® Lab Buddy for its current settings and adjust its display accordingly. At this point, the software can be used for monitoring the status of the bias, temperature and photocurrent. Monitoring occurs at a rate of 1 Hz; temperature and bias can be changed at any time via the use of a slider. The status of the USB connection is also continuously monitored. LabBuddyControl can also be used to change the bias and temperature. Default power up settings can be modified via the "Save Settings" button.



1. Temperature Control slider – use to set the Lab Buddy Temperature between 10 and 35 °C.

2. Bias Control slider – use to set the Lab Buddy Bias between the minimum and maximum values as specified in the device data sheet (typically 4-9 VDC).

Specifications are subject to change without notice.
Confidential and Proprietary -- ©2010 Discovery Semiconductors, Inc.
All Rights Reserved

3. Lab Buddy Communication status – shows the status of the Lab Buddy's USB connection.

4. Lab Buddy Monitoring – continuous 1 Hz update of Lab Buddy bias, temperature and photocurrent.

5. TEC status – shows the status of the TEC lock. If the TEC goes out of lock, the Lab Buddy will automatically adjust to a safe operating region. At this point, the status will show "Warning", the Lab Buddy display will blink the temperature field and the "Clear TEC Warning" button will become active. Clicking on the "Clear TEC Warning" button or on the "Set" button on the Lab Buddy will clear the temperature warning.

6. Save Settings button – when pressed will cause the Lab Buddy to save its current temperature and bias settings to EEPROM. The saved settings will become the new power on default values.

COMMAND SET

The Lab Buddy command set includes commands for querying the device ID, set points, and corresponding actual values. It also allows users to modify the set points for HLPD® bias as well as its temperature. The following instruction set allows users to communicate with the Lab Buddy.

1. *IDN? This command returns the device identity as a string of characters. In this case, the string will be "DSC, HLPD Lab Buddy".

2. MEAS:IDC? This command returns the DC photocurrent in mA as a string of characters in the form XXXX.

3. MEAS:BIAS? This command returns the actual bias voltage in Volts as a string of characters in the form XX.XX.

4. MEAS:TEMP? This command returns the actual temperature in ºC as a string of characters.

Specifications are subject to change without notice.
Confidential and Proprietary -- ©2010 Discovery Semiconductors, Inc.
All Rights Reserved

5. INP:BIAS XX.XX This command sets the HLPD® bias voltage in volts, where XX.XX is the real number represented as a string of characters. The voltage resolution is 0.05V.

6. INP:TEMP XX.X This command sets the HLPD® temperature in ºC, where XX.X is the real number represented as a string of characters.

7. INP:BIAS? This command returns the bias voltage set point in Volts as a string of characters.

8. INP:TEMP? This command returns the temperature set point in ºC as a string of characters.

9. INP:BIAS:SAVE This command will cause the Lab Buddy to save the current bias setting to EEPROM. The saved value will become the new power up default setting.

10. INP:TEMP:SAVE This command will cause the Lab Buddy to save the current temperature setting to EEPROM. The saved value will become the new power up default setting.

11. INP:TEC? This command returns the TEC status as a character. A '0' indicates that the TEC is locked; a '1' indicates a TEC warning condition.

12. INP:TEC This command clears the flashing Lab Buddy temperature warning.

TE COOLING FAILSAFE

A "Peltier Effect" Thermo Electric Cooler 'TEC' is a temperature differencing device. With a given applied current, the maximum temperature differential between the TEC cold side and TEC hot side is limited. A typical TEC will be specified with a maximum temperature differential at a maximum set current. For this instrument box, this maximum set current is well above one ampere.

The maximum amount of power in watts that can be transferred from the cold side is also specified. For a given operating current, the maximum temperature differential and maximum power transfer specifications cannot be simultaneously met. The TEC

Specifications are subject to change without notice.
Confidential and Proprietary -- ©2010 Discovery Semiconductors, Inc.
All Rights Reserved

maximum power transfer occurs with a minimum temperature differential, while the maximum temperature differential occurs with minimum power transfer (minimum heat load.)

The circuitry for the temperature control loop receives a reference temperature setting. The loop drives the TEC to this temperature. The internal temperature sensor along with appropriate loop filter component selection and precision OpAmp maintain stable temperature control on the order of millidegrees. The internal electronics are cooled with a temperature speed controlled fan.

The firmware allows the user to select an HLPD® temperature between +10ºC to +35ºC. If the hot side gets too hot the loop will run out of drive and the temperature of the device will not be controlled. The real time read out on the front panel or PC GUI will show a slow departure from the selected temperature setting if there is an out of lock issue.

If the Lab environment is too warm, or the fan input slots on the rear panel and/or the ventilation exit slots on the side become blocked, thermal run away can occur. **The New Lab Buddy with adjustable temperature setting for the HLPD® has the following failsafe to prevent thermal runaway.**

The failsafe within the firmware uses a smart monitor of the set point and actual temperature by disregarding normal locking times. If the actual temperature diverges from the set temperature by more than a preset amount, then, after a predetermined time, the firmware will automatically select the set point higher by 5ºC and attempt a temperature relock. If the relock still cannot be obtained, another set point 5ºC higher will be tried. This will continue until a temperature loop lock will be obtained. The operation of this routine can be observed on the front panel and PC GUI. Since this out of temperature relock could randomly happen, the front panel display will blink the new actual temperature after the new temperature lock occurs. This alerts the user that the original set temperature has been automatically changed. **At this point please check that no air flow obstruction has occurred.**

Simply pressing the SET button, or clicking on the **Clear TEC Warning** button on the PC GUI will cancel the alert (blinking

Specifications are subject to change without notice.
Confidential and Proprietary -- ©2010 Discovery Semiconductors, Inc.
All Rights Reserved

temperature). At this point, the user has two choices. The first choice is to let the unit operate at this new setting. The second choice is to change the temperature to a new set point. Usually, after the out of lock routine occurs and the unit has been checked to be clear of air flow obstruction, internal temperatures may have settled to reasonable values. For example, after about 10 minutes the temperature setting can be tried a few degrees above the user's original selection. If there was no air flow obstruction, the lab environment may just be too warm for the coolest temperature selection. These features allow the user to operate the unit near the coolest temperature for the environment with the confidence that thermal run away issues are accounted for automatically.

HELP DISPLAY

Pressing and holding the Front Panel SET button for 4 or more seconds will cause the Lab Buddy firmware to show a Help Display. The Help Display contains the following Lab Buddy information:

- Model Number
- Serial Number
- Optical Input Type (APC or UPC)
- Firmware Revision
- Fiber Type (Single Mode or Multi Mode)

To access the Help Display:

1. Press and hold the SET button for 4 seconds or more
2. Release the SET button
3. Use the Up and Down arrow buttons to scroll through the information fields
4. Press the SET button again to exit the Help Display

Specifications are subject to change without notice.
Confidential and Proprietary -- ©2010 Discovery Semiconductors, Inc.
All Rights Reserved

LAB BUDDY GUI REQUIREMENTS

The LabBuddyControl software has been tested on both 32 and 64 bit versions of Windows 7 and Windows XP.

System Requirements:

- Operating System: Windows 7 or Windows XP (32 or 64 bit)
- Microsoft .NET 3.5 Note 1
- Processor: 400 MHz Pentium processor or equivalent (Minimum); 1 GHz Pentium processor or equivalent (Recommended)
- RAM: 96 MB (Minimum); 256 MB (Recommended)
- Display: 800x600, 256 colors (Minimum); 1024x768 high color, 32 bit (Recommended)

Note 1: An installer for .NET 3.5 is included with the Lab Buddy utility Flash Disk.

Specifications are subject to change without notice.
Confidential and Proprietary -- ©2010 Discovery Semiconductors, Inc.
All Rights Reserved

APPENDIX

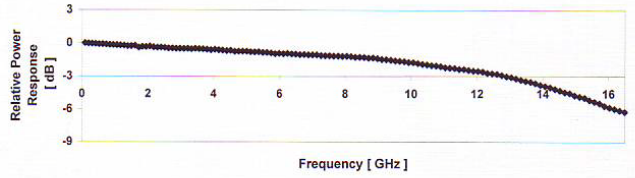
Discovery Semiconductors, Inc.
119 SILVIA STREET, EWING, NJ 08628, USA
PHONE: (609) 434-1311 FAX: (609) 434-1317

Test Data Report

Customer:	Northrop Grumman Space Technology	Date:	12/14/2010
Part number:	DSC50S-HLPD-39-FC/APC-K-2	PO :	BStarkR12144
Description:	InGaAs Optical Detector	WO :	3713
Tested by:	Omer Ahmad	Serial number:	**502265**
		Witnessed by:	

Parameter	Specification	Measured Value	Units
-3dB Bandwidth @ V_{bd} = + 5 V	Min: 10	12.9	GHz
Coupled DC Responsivity @ 1550 nm	Min: 0.60	0.62	A/W
Detector Dark Current @ + 5 V	Max: 100	5	nA
Optical Return Loss @ 1550 nm	Min: 27	38	dB

Frequency Response Curve



Remarks:

(1) For specifications, please refer to the datasheet for the model of photodiode installed in the Lab Buddy.

(2) Please clean optical and coaxial connectors before attaching.

➢ALWAYS switch on Lab Buddy first, then apply optical signal.
➢ALWAYS remove optical signal first, then switch off the Lab Buddy.

CAUTION:
When connecting to the RF Output connector, finger tightening is enough for most applications.

Any modifications to this device will void the warranty.

Confidential and Proprietary -- ©2010 Discovery Semiconductors, Inc., all rights reserved

Specifications are subject to change without notice.
Confidential and Proprietary -- ©2010 Discovery Semiconductors, Inc.
All Rights Reserved

NOTES

Specifications are subject to change without notice.
Confidential and Proprietary -- ©2010 Discovery Semiconductors, Inc.
All Rights Reserved

Discovery Semiconductors, Inc.
We Chip the Future

High Optical Power Handling Highly Linear Photodiode (HLPD®) Lab Buddy to 22 GHz

Description:

The HLPD® Lab Buddy is a stand-alone remotely accessible instrument for O/E applications. It incorporates Discovery Semiconductor's state-of-the-art highly linear photodiode with high power handling capability. The HLPD® Lab Buddy has a programmable bias voltage source that allows for highly linear operation at high input power and a built-in temperature controller for increased reliability. The bias and temperature can be set either from the front panel or via a remote computer interface. The HLPD® Lab Buddy monitors its bias, temperature, and average photocurrent in real-time.



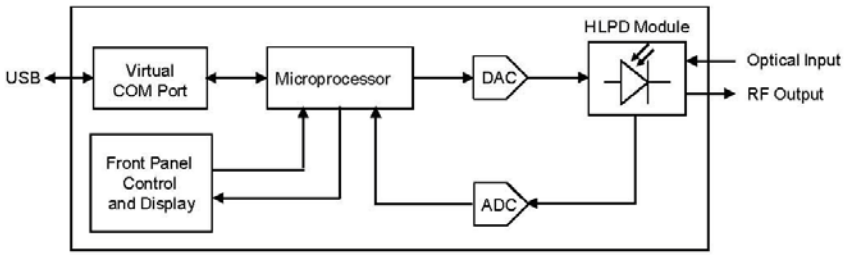
Salient Features:

- O/E Bandwidth up to 22 GHz
- RF Output > 1.5 V, OIP2 > 55 dBm, OIP3 > 45 dBm
- Phase Linearity < 5 rad/W
- Programmable Bias: 4 V to 9 V with ± 0.1 V Resolution
- Programmable Temperature: +5 °C to +35 °C with ± 0.1 °C Resolution
- Built-in Photocurrent Monitor with 50 µA Resolution
- Remote Computer Interface
- Wavelength Range: 1064 - 1650 nm

Applications:

- Test and Measurement
- RF-over-Fiber
- Antenna Remoting
- Optoelectronic Microwave Oscillators
- Ultra-Fast Photonic Analog-to-Digital Converters
- RF Arbitrary Waveform Generators

Block Diagram:



Confidential and Proprietary -- ©2010 Discovery Semiconductors, Inc.
All Rights Reserved

Specifications are subject to change without notice.
Confidential and Proprietary -- ©2010 Discovery Semiconductors, Inc.
All Rights Reserved

Table of Contents:

Description 1
Salient Features 1
Applications 1
Block Diagram 1
Table of Contents 2
List of Figures 2
List of Tables 2
List of Acronyms 3
Optical / Electrical Specifications 4
Absolute Maximum Ratings 4
Optical Input / Output Specifications 4
Mechanical / Temperature Specifications 4
Amplitude & Phase Linearity of 20 GHz HLPD® Lab Buddy 5
Power Handling of 20 GHz HLPD® Lab Buddy 7
HLPD® Lab Buddy Software 8
Remote Computer Interface 8
HLPD® Lab Buddy RS-232 Specifications 9
HLPD® Lab Buddy Front Panel Description 9
HLPD® Lab Buddy Rear Panel Description 10
HLPD® Lab Buddy Power Supply 10
Ordering Information 10
Regulatory Compliance Notice 11

List of Figures:

Fig. 1: Impulse Response Test Setup 5
Fig. 2: Impulse Response of 20 GHz HLPD® Lab Buddy 5
Fig. 3: Peak RF Amplitude of the Impulse Response 6
Fig. 4: Full Width Half Maximum (FWHM) of the Impulse Response 6
Fig. 5: Continuous-Wave Test Setup 7
Fig. 6: RF Output Power: 1 dB Compression Photocurrent 7
Fig. 7: HLPD® Lab Buddy Graphical User Interface 8
Fig. 8: HLPD® Lab Buddy Front Panel 9

List of Tables:

Table 1: HLPD® Lab Buddy Command Set 8

Confidential and Proprietary -- ©2010 Discovery Semiconductors, Inc.
All Rights Reserved

Specifications are subject to change without notice.
Confidential and Proprietary -- ©2010 Discovery Semiconductors, Inc.
All Rights Reserved

List of Acronyms:

ADC	Analog-to-Digital Converter	MEAS	Instrument Measurement Command
APC	Angled Physical Contact	mW	Milliwatt
°C	Degrees Celsius	MZM	Mach-Zehnder Delay Interferometer
COM	Communication	O/E	Optical-to-Electrical
CW	Continuous Wave	OIP3	Third Order Output Intercept Point
DAC	Digital-to-Analog Converter	ORL	Optical Return Loss
dB	Decibel	PC	Physical Contact
DC	Direct Current	PDL	Polarization Dependent Loss
EAR	Export Administration Regulations	ps	Picoseconds
EDC	Electronic Dispersion Compensation	RF	Radio Frequency
EDFA	Erbium Doped Fiber Amplifier	RoHS	Restriction of Hazardous Substances
FC	Flat Connector	RZ	Return to Zero Encoding
FWHM	Full Width at Half Max	SC	Square Connector
GHz	Gigahertz	SMF	Single Mode Fiber
GUI	Graphical User Interface	TE	Thermo-Electric
HLPD	Highly Linear Photodiode	TEC	Thermo Electric Cooler
IDC	DC Photocurrent	TEMP	Temperature
INP	Instrument Control Command	UPC	Ultra Physical Contact
ITAR	International Traffic in Arms Regulations	USB	Universal Serial Bus
LED	Light Emitting Diode	V	Volts
nm	Nanometer	VAC	Volt-Alternating-Current
NRZ	Non Return to Zero Encoding	VOA	Variable Optical Attenuator
mA	milliamperes		

Confidential and Proprietary -- ©2010 Discovery Semiconductors, Inc.
All Rights Reserved

Specifications are subject to change without notice.
Confidential and Proprietary -- ©2010 Discovery Semiconductors, Inc.
All Rights Reserved

Optical / Electrical Specifications:

Parameter		Min	Typical	Max	Units
Responsivity	@ 1550 nm	0.60	0.70	-	A / W
	@ 1310 nm	0.60	0.70	-	
Ripple (1)		-	+/- 1	-	dB
Logic Sense / Coupling		Positive Non-Inverting / DC 50 Ω			
Group Delay (2)		-	± 7	-	ps
3 dB Bandwidth	50S	10	12	-	GHz
	40S	14	16	-	
	30S	18	22	-	
Power Dissipation (= V_{bd} * I_{bd})	50S, 40S	-	-	360	mW
	30S	-	-	270	
Dark Current @ 25 °C, 5 V		-	10	100	nA
Optical Return Loss		27	30	-	dB
Wavelength Response Range		1064	-	1650	nm
Bias Voltage		+ 4	-	+ 9	V
Temperature		+ 5	-	+ 35	°C
1 dB small signal compression	50S @ 5 V	-	45	50	mA
	40S @ 5 V	-	35	40	
	30S @ 5 V	-	25	30	
OIP3 @ 9 V		45	50	-	dBm
Power-to-Phase Conversion @ 9 V(4)		-	5	10	rad/W
PDL @ 1550 nm		-	0.05	0.12	dB

Absolute Maximum Ratings:

Optical Input Power Damage Threshold (3)	50S, 40S	+ 17	dBm
	30S	+ 16	

Optical Input / Output Specifications:

Fiber Type	Connector	Polish
SMF	FC	PC, UPC or APC
	SC	
	others by request	

Mechanical / Temperature Specifications:

Parameter	Min	Typical	Max	Units
Weight	-	2.1	-	kg
	-	4.8	-	lbs
Dimensions	-	27.3 x 12.9 x 8.9	-	cm
Operating temperature	- 15*	-	+ 30*	°C
Storage temperature	- 20*	-	+ 70*	°C

*For any extreme operating/storage temperature range, please contact the factory.

(1) Flatness – DC to 70% of the 3 dB bandwidth.
(2) Group Delay – DC to 70% of the 3 dB bandwidth.
(3) Assumes NRZ with 50% duty cycle. Note that peak RZ or narrow pulse width will hit peak limit at lower average optical input powers than observed with 50% duty cycle data.
(4) 1 GHz repetition rate and peak voltage < 1.5 V.

Confidential and Proprietary -- ©2010 Discovery Semiconductors, Inc.
All Rights Reserved

Specifications are subject to change without notice.
Confidential and Proprietary -- ©2010 Discovery Semiconductors, Inc.
All Rights Reserved

Amplitude & Phase Linearity of 20 GHz HLPD® Lab Buddy:

The nonlinear transfer function of a photodiode manifests itself as amplitude compression as well as temporal (phase) distortions arising from RF pulse broadening at high optical power levels. These distortions can be quantified by using the impulse response test setup shown below. This setup utilizes a 1550 nm wavelength mode locked laser that emits 2.5 ps wide optical pulses at 1 GHz repetition rate. The laser output is amplified using an Erbium Doped Fiber Amplifier (EDFA) and fed to the HLPD® Lab Buddy through a Variable Optical Attenuator (VOA). The RF response is recorded at different reverse bias and average optical power levels using a 50 GHz sampling oscilloscope. Typical impulse response results at 5°C to 35°C temperature range for 20 GHz bandwidth HLPD® Lab Buddy along with key parameters, namely peak RF amplitude and full-width half-maximum (FWHM), are shown in Figs. 2 – 4.

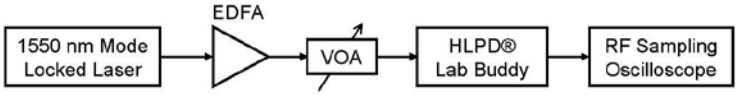


Fig. 1: Impulse response test setup for characterizing linearity of the HLPD® Lab Buddy.

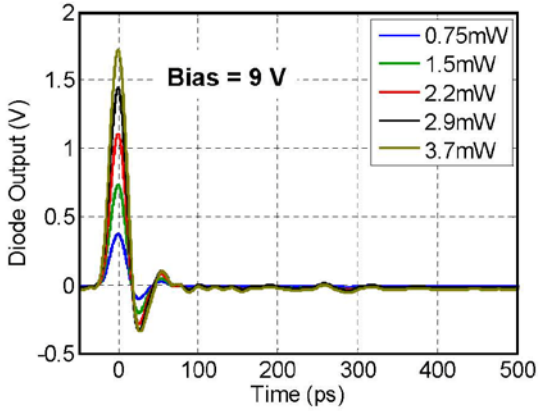


Fig. 2: Impulse response of 20 GHz HLPD® Lab Buddy at 9 V reverse bias for various average optical power levels.

Confidential and Proprietary -- ©2010 Discovery Semiconductors, Inc.
All Rights Reserved

Specifications are subject to change without notice.
Confidential and Proprietary -- ©2010 Discovery Semiconductors, Inc.
All Rights Reserved

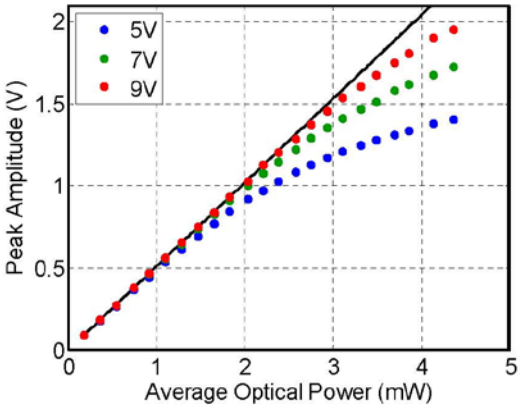


Fig. 3: Peak RF amplitude of the impulse response as a function of average optical power at various reverse biases. The solid black line indicates ideal linear response with no nonlinear distortions.

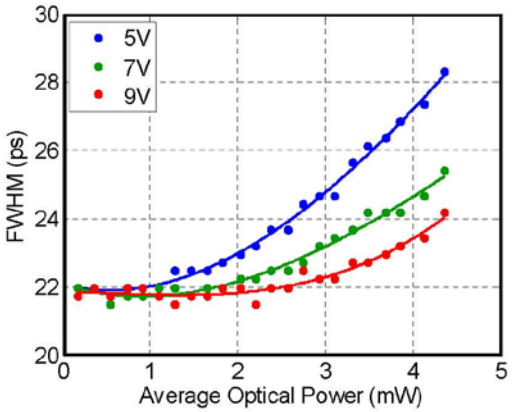


Fig. 4: Full-Width Half-Maximum (FWHM) of the impulse response as a function of average optical power at various reverse biases.

Confidential and Proprietary -- ©2010 Discovery Semiconductors, Inc.
All Rights Reserved

Specifications are subject to change without notice.
Confidential and Proprietary -- ©2010 Discovery Semiconductors, Inc.
All Rights Reserved

Power Handling of 20 GHz HLPD® Lab Buddy:

Suppressing a photodiode's amplitude & phase nonlinearity simultaneously results in high power handling capability. This is defined by the photocurrent at which the RF output power is compressed with respect to the ideal linear relationship by 1 dB in Continuous-Wave (CW) operation. The power handling test setup, shown in Fig. 5, utilizes a Mach-Zehnder Modulator (MZM) to impose a sinusoidal RF modulation on a 1550 nm wavelength CW laser. The modulator output is amplified using an EDFA and fed to the HLPD® Lab Buddy through a variable optical attenuator . The photodiode's output power is measured at different DC photocurrents (i.e. optical power levels) by using an RF power meter.

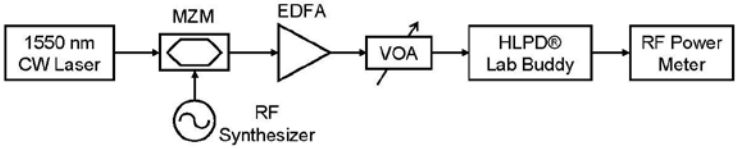


Fig. 5: Continuous-Wave test setup for characterizing power handling of the HLPD® Lab Buddy.

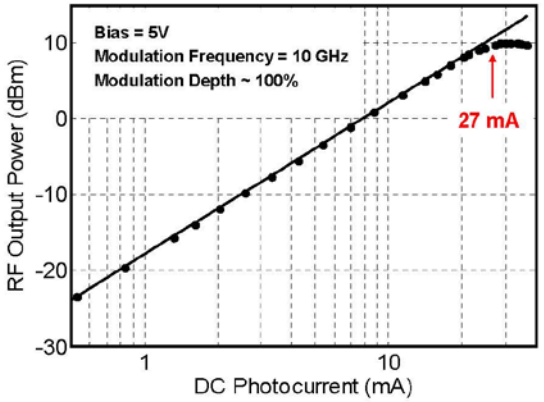


Fig. 6: RF output power as a function of DC photocurrent at 5 V reverse bias. The 1 dB compression photocurrent with respect to the ideal linear response (solid black line) is also annotated.

Confidential and Proprietary -- ©2010 Discovery Semiconductors, Inc.
All Rights Reserved

Specifications are subject to change without notice.
Confidential and Proprietary -- ©2010 Discovery Semiconductors, Inc.
All Rights Reserved

HLPD® Lab Buddy Software:

Discovery Semiconductors supplies a Graphical User Interface (GUI) that can be used for control and monitoring of the HLPD® Lab Buddy instrument. For those wishing to write their own software, please refer to the subsequent sections containing the programming specifications.

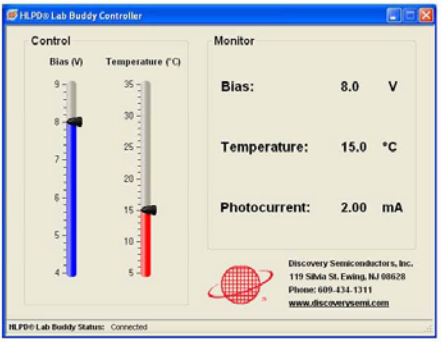


Fig. 7: HLPD® Lab Buddy Graphical User Interface

Remote Computer Interface:

The HLPD® Lab Buddy command set includes commands for querying the device ID, set points, and corresponding actual values. The following instruction set allows users to communicate with the Lab Buddy through RS232-over-USB interface.

Table 1: HLPD® Lab Buddy Command Set

Command Syntax	Description
*IDN?	Queries the instrument identity; Returns serial number string beginning with "DSC, HLPD, Lab Buddy".
MEAS:IDC?	Query for Photocurrent value; Returns photocurrent in milliamperes as a string of the form X.XX; Read back resolution is 0.05 mA
MEAS:BIAS?	Returns actual bias in volts as a string of the form XX.X; Read back resolution is 0.1 V
MEAS:TEMP?	Returns actual temperature in °C as a string of the form XX.X; Read back resolution is 0 .1 °C.
INP:BIAS_XX.X	Setting of Bias voltage; Bias is represented as a string of the form XX.X with allowable values in the range of 4.0 V to 9.0 V
INP:TEMP_XX.X	Setting of HLPD® temperature; Temperature is represented as a string of the form XX.X with allowable values in the range of 5.0 °C to 35.0 °C
INP:BIAS?	Query of bias set point; Return value is a string of the form XX.X in volts.
INP:TEMP?	Query of temperature set point. Return value is a string of the form XX.X in °C.
INP:BIAS:SAVE	Saves the current bias setting to internal memory for recall on the next Lab Buddy power up.
INP:TEMP:SAVE	Saves the current temperature setting to internal memory for recall on the next Lab Buddy power up.

Confidential and Proprietary -- ©2010 Discovery Semiconductors, Inc.
All Rights Reserved

Specifications are subject to change without notice.
Confidential and Proprietary -- ©2010 Discovery Semiconductors, Inc.
All Rights Reserved

HLPD® Lab Buddy RS-232 Specifications:

- Bits per second: 57600
- Start Bits: 1
- Data Bits: 8
- Stop Bits: 1
- Parity: None
- Flow Control: None

HLPD® Lab Buddy Front Panel Description:



Fig. 8: HLPD® Lab Buddy Front Panel

1. **Optical Input:** The digital front panel is fitted with a detachable DIAMOND optical connector for the device input fiber. The device input fiber end face is either polished flat or angled as selected by the customer. The DIAMOND connector can be easily removed without tools to allow quick and effortless cleaning of the input fiber end face.

2. **Overload LED:** The red color LED will blink when there is optical power overload on the HLPD® Lab Buddy or in other words, an excessive optical power is applied to the device. In case of overload, attenuate the optical power that is being applied to the device installed in your HLPD® Lab Buddy.

3. **Digital Display:** The HLPD® Lab Buddy front panel is equipped with a vacuum fluorescent display to display the actual bias, temperature, and photocurrent as well as the corresponding set points for the specific HLPD® device installed in the Lab Buddy. The bias voltage, temperature, and average DC photocurrent are displayed in the units of Volt (V), degree Celsius (ºC), and milliampere (mA), respectively.

4. **Communication Status:** The green LED on the front panel of HLPD® Lab Buddy indicates the remote computer interface status and is illuminated whenever there is an on-going serial communication between the HLPD® Lab Buddy and the computer.

5. **RF Output:** A type K* RF output connector is provided on the digital front panel. Exercise special care when making an RF connection to this connector since over tightening may damage the connector permanently.

6. **UP/DOWN Temperature Push-Buttons:** The UP/DOWN temperature push-buttons set the HLPD® temperature. These UP/DOWN push-buttons work only when the SET push-button is simultaneously pressed. The temperature setting controls the TEC which controls the temperature of the photodiode, minimizing non-linearities produced from temperature variations.
    - Temperature Range: +5 ºC to +35 ºC
    - Temperature Resolution: 0.1 ºC

*K connector is a trademark of Anritsu Company; K connectors are 2.92 mm coaxial (compatible with 3.5 mm SMA).

Confidential and Proprietary -- ©2010 Discovery Semiconductors, Inc.
All Rights Reserved

Specifications are subject to change without notice.
Confidential and Proprietary -- ©2010 Discovery Semiconductors, Inc.
All Rights Reserved

7. **SET Push-Button:** The settings can be changed while the SET push-button is depressed as well. The actual bias voltage, temperature and average DC photocurrent are displayed when the SET push-button is not depressed.
8. **UP/DOWN Bias Push-Buttons:** The UP/DOWN bias push-buttons set the HLPD® bias voltage. These UP/DOWN push-buttons work only when the SET push-button is simultaneously pressed. The bias setting adjusts the reverse bias of the photodiode.
    - Bias Voltage Range: +4 VDC to +9 VDC
    - Bias Voltage Resolution: 0.1 VDC

HLPD® Lab Buddy Rear Panel Description:

1. **Power Switch:** The power switch located on the rear panel of the HLPD® Lab Buddy. It is a special locking type toggle switch that is designed to minimize the risk of an accidental removal of power during operation. To toggle this switch, simply pull the handle outward, and then change the switch position. Upon releasing, the switch will automatically lock in the new position.

2. **USB Connector:** The USB connector (Type B) is provided to remotely operate the HLPD® Lab Buddy through the serial computer interface (RS-232C via virtual COM port). The virtual COM port driver software is included in the package along with a USB Type A to Type B cable of 3 Feet (~1 m) in length.

3. **Power Supply Input:** The power supply connector consists of a special locking mechanism for establishing power connection to the HLPD® Lab Buddy. This prevents accidental removal of the power cord during operation.

HLPD® Lab Buddy Power Supply:

The HLPD® Lab Buddy includes a power supply that will operate from 100 VAC to 240 VAC, 50/60 Hz, 0.4 A without the need for switching line voltages.

Ordering information:

Parts should be ordered as DSCXXS-HLPD-Y9-ZZ/UUU-K-2 where the code characters:

XX	are replaced by the desired model digits, e.g. 40 for the DSC40S device,
Y	specifies '3' for standard optical return loss, '5' for >40 dB ORL, or '8' for PM fiber,
ZZ	specifies the fiber optic connector (FC, SC, LC),
UUU	specifies the ferrule finish (PC, UPC, APC),

Confidential and Proprietary -- ©2010 Discovery Semiconductors, Inc.
All Rights Reserved

Specifications are subject to change without notice.
Confidential and Proprietary -- ©2010 Discovery Semiconductors, Inc.
All Rights Reserved

Regulatory Compliance:
This product is EU directive 2002/95/EC (RoHS) compliant, with exemptions.
This product is subject to the International Traffic in Arms Regulations (ITAR) of the Export Administration Regulations (EAR). Export of these items to foreign persons or foreign entities inside or outside of the United States may require written authorization by the U.S. Department of Commerce or a valid export license by the U.S Department of State, Directorate of Defense Trade Controls. Violations of these export regulations may be subject to severe criminal penalties.

Discovery Semiconductors, Inc. is an ISO 9001:2000 and ISO 14001:2004 certified company.

Notice: This document contains technical data that is subject to the International Traffic in Arms Regulations (ITAR) of the Export Administration Regulations (EAR). Export of this technical data to foreign persons or foreign entities inside or outside of the United States may require written authorization by the U.S. Department of Commerce or a valid export license by the U.S Department of State, Directorate of Defense Trade Controls. Violations of these export regulations may be subject to severe criminal penalties.

This information is confidential and proprietary to Discovery Semiconductors, Inc. – all rights reserved. This information shall not be duplicated or disclosed, in whole or in part, by any means, person or organization, for any purpose, without express written permission by Discovery Semiconductors. Neither receipt nor possession of this data, from any source, constitutes such permission. Infringement of these data rights may result in criminal and/or civil liability.

For additional information, please contact the following:

INTERNET: www.discoverysemi.com
ADDRESS: Discovery Semiconductors, Inc.
119 Silvia Street, Ewing, NJ 08628, USA,
Tel: +(609) 434-1311, Fax: +(609) 434-1317

Specifications are subject to change without notice.
Confidential and Proprietary -- ©2010 Discovery Semiconductors, Inc.
All Rights Reserved

NOTES

Specifications are subject to change without notice.
Confidential and Proprietary -- ©2010 Discovery Semiconductors, Inc.
All Rights Reserved

Specifications are subject to change without notice.
Confidential and Proprietary -- ©2010 Discovery Semiconductors, Inc.
All Rights Reserved

Specifications are subject to change without notice.
Confidential and Proprietary -- ©2010 Discovery Semiconductors, Inc.
All Rights Reserved

Regulatory Compliance:
This product is EU directive 2002/95/EC (RoHS) compliant, with exemptions.
This product is subject to the International Traffic in Arms Regulations (ITAR) of the Export Administration Regulations (EAR). Export of these items to foreign persons or foreign entities inside or outside of the United States may require written authorization by the U.S. Department of Commerce or a valid export license by the U.S Department of State, Directorate of Defense Trade Controls. Violations of these export regulations may be subject to severe criminal penalties.

Discovery Semiconductors, Inc. is an ISO 9001:2008 and ISO 14001:2004 certified company.

Notice: This document contains technical data that is subject to the International Traffic in Arms Regulations (ITAR) of the Export Administration Regulations (EAR). Export of this technical data to foreign persons or foreign entities inside or outside of the United States may require written authorization by the U.S. Department of Commerce or a valid export license by the U.S Department of State, Directorate of Defense Trade Controls. Violations of these export regulations may be subject to severe criminal penalties.

This information is confidential and proprietary to Discovery Semiconductors, Inc. – all rights reserved. This information shall not be duplicated or disclosed, in whole or in part, by any means, person or organization, for any purpose, without express written permission by Discovery Semiconductors. Neither receipt nor possession of this data, from any source, constitutes such permission. Infringement of these data rights may result in criminal and/or civil liability.

For additional information, please contact the following:

INTERNET: www.discoverysemi.com
ADDRESS: Discovery Semiconductors, Inc.
119 Silvia Street, Ewing, NJ 08628, USA,
Tel: +(609) 434-1311, Fax: +(609) 434-1317

Specifications are subject to change without notice.
Confidential and Proprietary -- ©2010 Discovery Semiconductors, Inc.
All Rights Reserved

Artisan Technology Group is an independent supplier of quality pre-owned equipment

Gold-standard solutions

Extend the life of your critical industrial, commercial, and military systems with our superior service and support.

We buy equipment

Planning to upgrade your current equipment? Have surplus equipment taking up shelf space? We'll give it a new home.

Learn more!

Visit us at **artisantg.com** for more info on price quotes, drivers, technical specifications, manuals, and documentation.

Artisan Scientific Corporation dba Artisan Technology Group is not an affiliate, representative, or authorized distributor for any manufacturer listed herein.

We're here to make your life easier. How can we help you today?

(217) 352-9330 | sales@artisantg.com | artisantg.com

ARTISAN® TECHNOLOGY GROUP