WAVELENGTH ELECTRONICS

Sept 2004

WLD3343

Ultrastable Driver for Laser Diodes

(BOTTOM VIEW)

GENERAL DESCRIPTION

The WLD3343 is a general-purpose analog hybrid circuit for use in ultrastable laser diode driver applications. The WLD3343 maintains precision laser diode current (constant current mode) or stable photodiode current (constant power mode) using electronics compatible with any laser diode type. Supply up to 2.2 Amps of current to your laser diode from a single +5 to +12 Volt power supply.

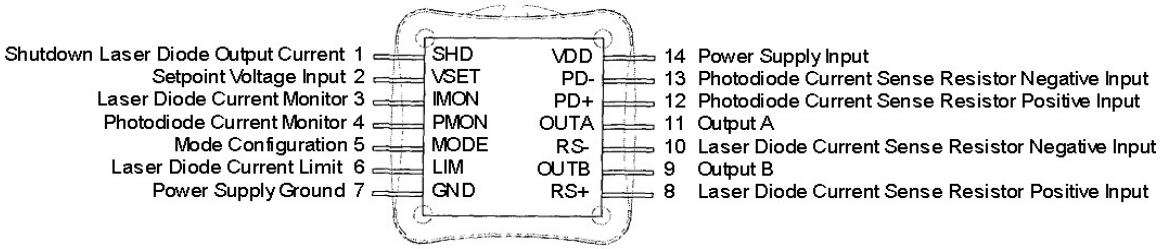
FEATURES

- Small Package (1.30" x 1.26" x 0.313")
- Slow Start Laser Diode Protection
- Optimize for Low and High Power Laser Diodes
- Drive Up to 2.2 Amps Output Current
- Constant Current or Constant Power Operation
- Operates with Any Type of Laser Diode
- Voltage Controlled Setpoint
- TTL Compatible Shutdown Pin
- Adjustable Current Limit
- 2 MHz Constant Current Bandwidth
- Over Temperature Shutdown

Figure 1

Top View Pin Layout and Descriptions

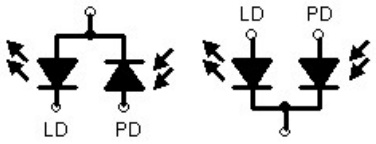
TOP VIEW



ABSOLUTE MAXIMUM RATINGS	SYMBOL	VALUE	UNIT
Supply Voltage (Voltage on Pin 14)	V_{DD}	+4.5 to +12.5	Volts DC
Output Current **(Refer to Datasheet SOA Chart)**	I_{OUT}	2.2	Amps
Operating Temperature, case	T_{OPR}	-40 to +85	°C
Storage Temperature	T_{STG}	-65 to +150	°C
Power Dissipation $T_{AMBIENT}$ = + 25 °C	P_{MAX}	9	Watts
Weight	WLD Chip	0.576	Ounces
	Heatsink	0.512	
	Fan	0.288	

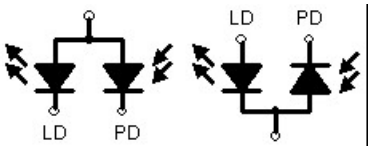
PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Current Stability, 24 Hour	$T_{AMBIENT}$ = 25°C	50		75	ppm
Power Stability, 24 Hour	$T_{AMBIENT}$ = 25°C	0.02		0.05	%
Constant Current Bandwidth	Sine or Square Wave		2		MHz
Rise Time	I_{LD} = 2.0 Amps		160		nsec
Fall Time	I_{LD} = 2.0 Amps		320		nsec
Output Current	Requires Heatsink and Fan	1.8	2.0	2.2	Amps
Compliance Voltage	Full. Temp Range, I_{OUT} = 2.0 Amps	$\|V_{DD}-2\|$			Volts
Supply Voltage, V_{DD}		4.5		12	Volts

TYPE A LASER DIODE



TYPE B LASER DIODE

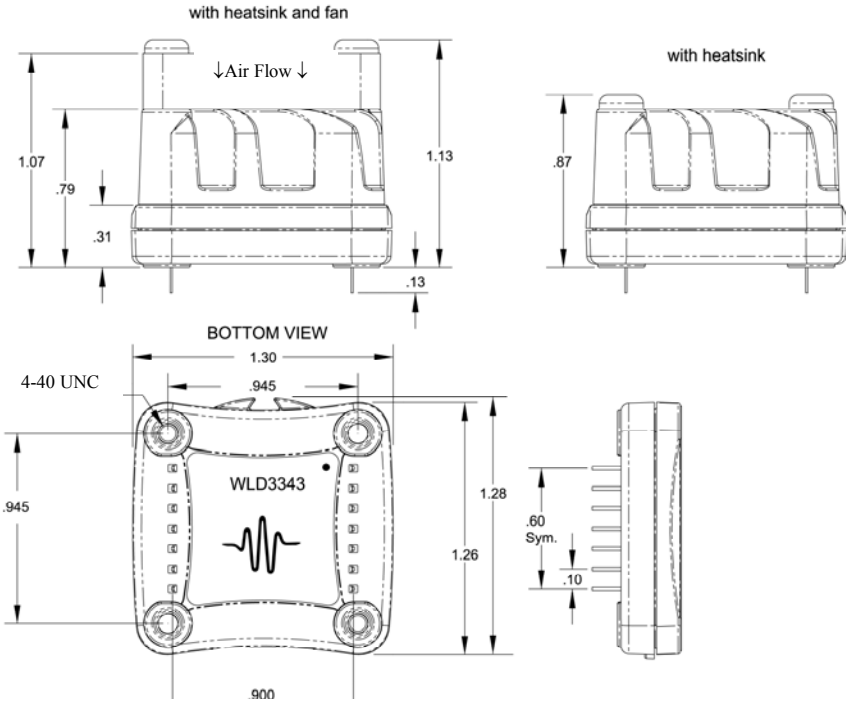
TYPE C LASER DIODE



PIN DESCRIPTIONS

PIN #	PIN	FUNCTION
1	SHD	Shutdown Laser Diode Output Current – Float or Zero Volts = Enable ; Greater than +3 Volts = Disable
2	VSET	Voltage Setpoint – Apply a voltage between pin 2 to pin 7 to adjust setpoint or input a modulation signal
3	IMON	Laser Diode Current Monitor – Monitor a voltage that is proportional to the laser diode forward current
4	PMON	Photodiode Current Monitor – Monitor a voltage that is proportional to the monitor photodiode current
5	MODE	Mode Configuration – Place a 1kΩ resistor from pin 5 to pin 6 for Constant Current Mode or a 0.1μF capacitor from pin 5 to pin 6 for Constant Power Mode
6	LIM	Laser Diode Current Limit – Place a resistor from pin 6 to pin 7 to limit the laser diode current
7	GND	Ground – Wire ground connections to pin 7 separately
8	RS+	Positive Laser Diode Current Sense – Connect to the positive side of the laser diode current sense resistor
9	OUTB	Output B – Connect separately to the positive side of the laser diode current sense resistor
10	RS-	Negative Laser Diode Current Sense – Connect to the negative side of the laser diode current sense resistor
11	OUTA	Output A – Type A/B Laser Diode = Connect to Laser Diode Cathode; Type C Laser Diode = Connect to V_{DD}
12	PD+	Positive Photodiode Current Sense – Connect to the positive side of the photodiode current sense resistor
13	PD-	Negative Photodiode Current Sense – Connect to the negative side of the photodiode current sense resistor
14	VDD	Power Supply Input – Connect +5V to +12V

MECHANICAL SPECIFICATIONS



Material Information

PIN DIAMETER: 0.028”
PIN LENGTH: 0.126”
PIN MATERIAL: Nickel Plated Steel
HEAT SPREADER: Nickel Plated Aluminum

PLASTIC COVER: LCP Plastic

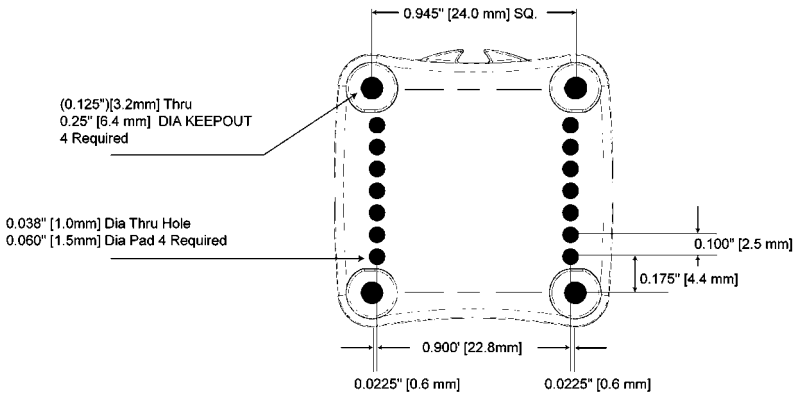
ISOLATION: 1200 VDC any pin to case

THERMAL WASHER: WTW002

HEATSINK: WHS302

FANS: WXC303 (+5VDC)
or WXC304 (+12VDC)

PCB FOOTPRINT



Caution:

Do not exceed the Safe Operating Area (SOA). Exceeding the SOA voids the warranty.

To determine if the operating parameters fall within the SOA of the device, the maximum voltage drop across the driver and the maximum current must be plotted on the SOA curves.

These values are used for the example SOA determination. These values are determined from the specifications of the laser diode:

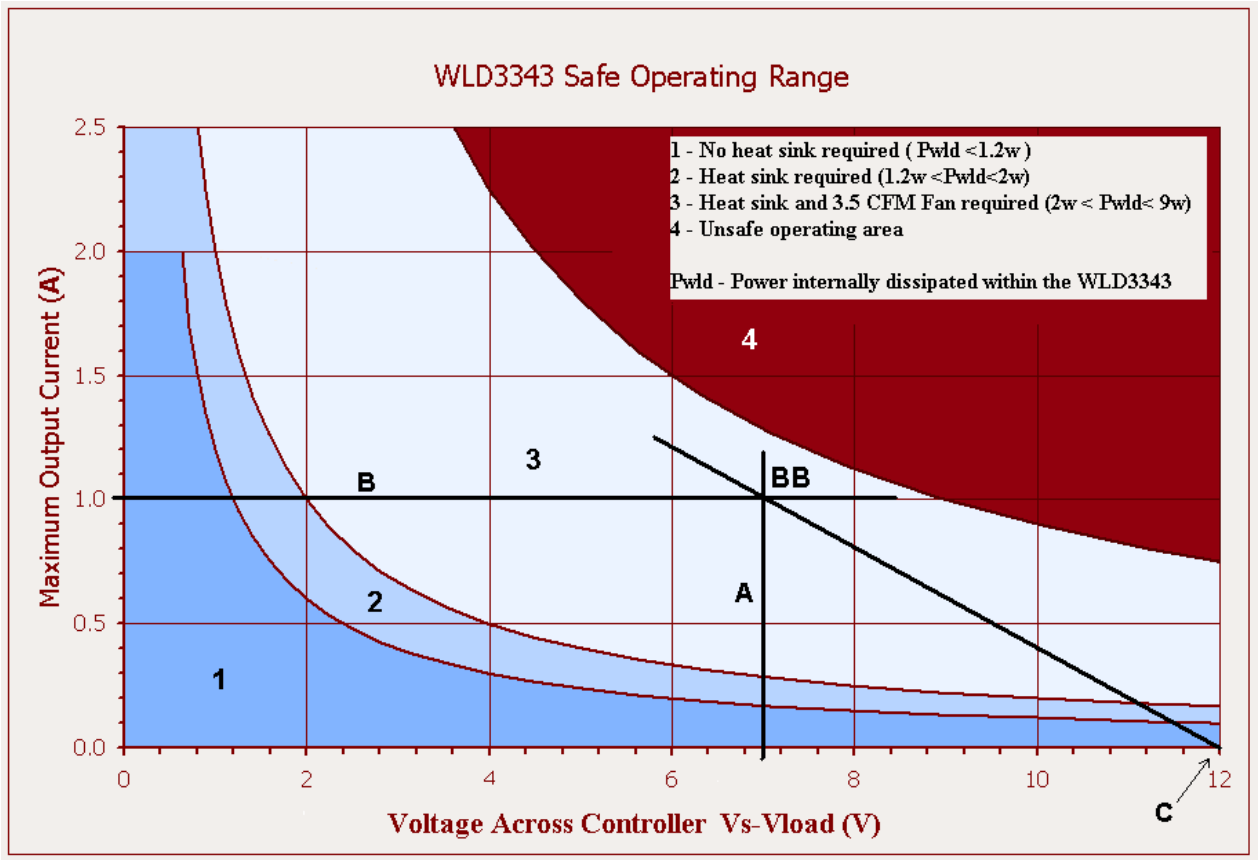
V_s= 12 volts
V_{load} = 5 volts
I_{Load} = 1 amp

Follow these steps:

1. Determine the maximum voltage drop across the driver, V_s-V_{load} (12 volts –5volts = 7 volts), and mark on the X axis. Mark a vertical line. (**line A**)
2. Determine the maximum current, I_{load}, through the driver and mark on the Y axis (1 amp). Mark a horizontal line(**line B**).
3. Mark V_s on the X axis (**point C**).
4. From the intersection of **line A** and **line B (BB)**, draw a straight line to **point C**. This is the LOAD LINE.

Refer to the chart shown below and note that the LOAD LINE is in the Unsafe Operating Areas for use with no heat sink., or the heat sink alone, but is outside of the Unsafe Operating Area for use with heat sink and fan.

The safe operating area is based on 25ºC Ambient and 75ºC Case temperature.



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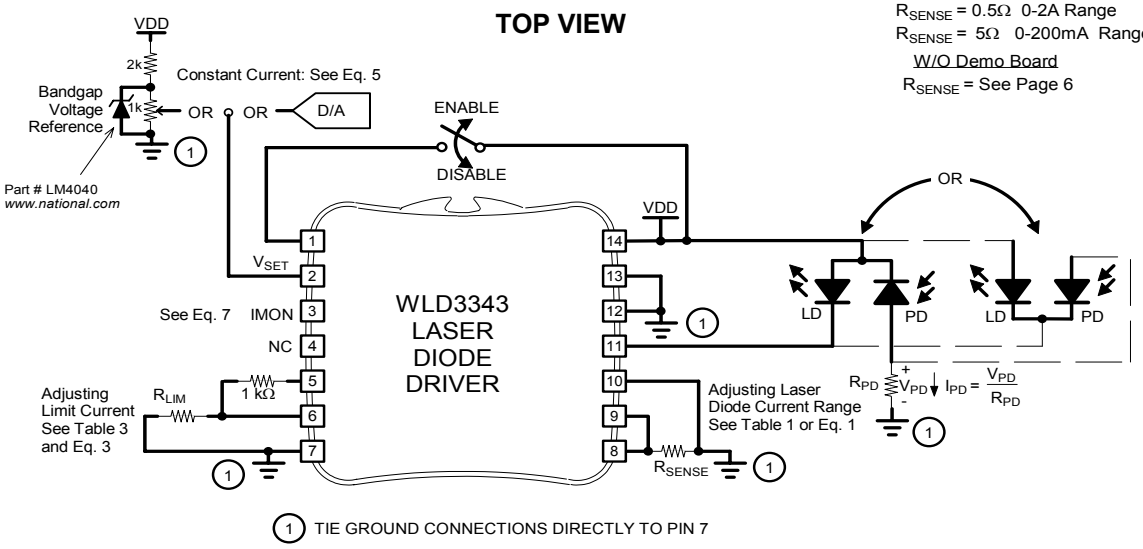
CONNECTION DIAGRAMS

TYPE A/B LASER DIODE -- CONSTANT CURRENT OPERATION

V_{SET} = (Desired I_{LD})*(2*R_{SENSE})

W/Demo Board
R_{SENSE} = 0.5Ω 0-2A Range
R_{SENSE} = 5Ω 0-200mA Range
W/O Demo Board
R_{SENSE} = See Page 6



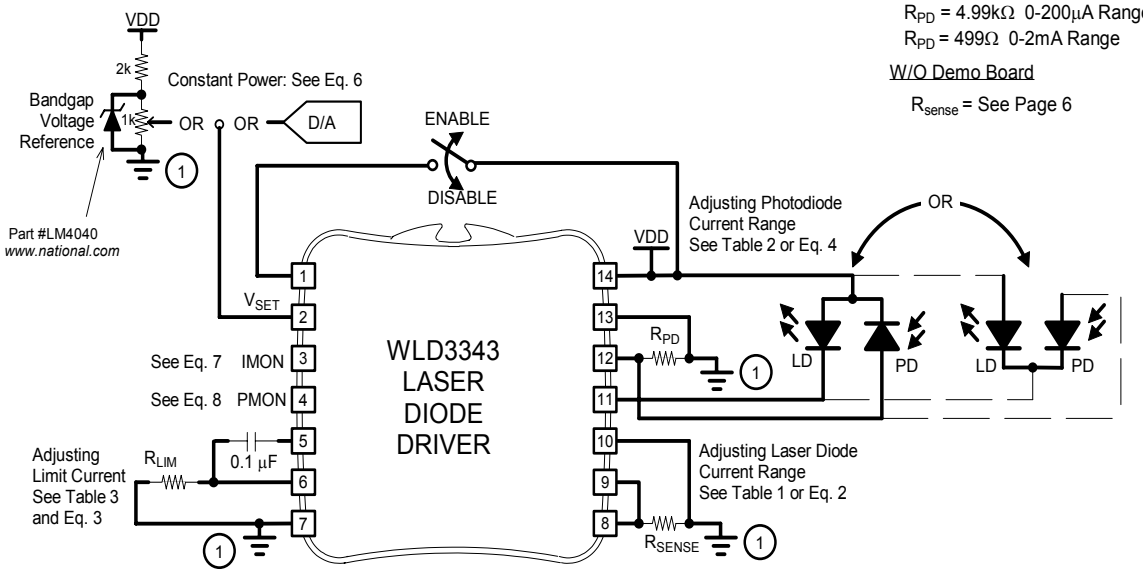
(1) TIE GROUND CONNECTIONS DIRECTLY TO PIN 7

design calculator → www.teamwavelength.com/tools/tools.asp

TYPE A/B LASER DIODE -- CONSTANT POWER OPERATION

V_{SET} =(Desired I_{PD})*(2*R_{PD})

W/Demo Board
R_{PD} = 4.99kΩ 0-200μA Range
R_{PD} = 499Ω 0-2mA Range
W/O Demo Board
R_{sense} = See Page 6

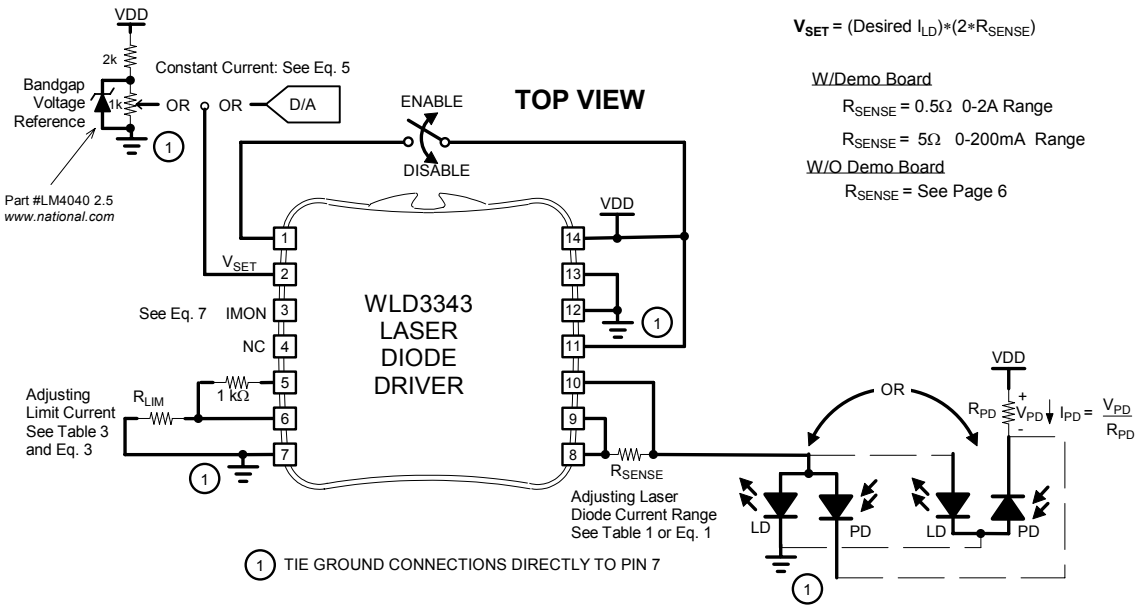


(1) TIE GROUND CONNECTIONS DIRECTLY TO PIN 7

design calculator → www.teamwavelength.com/tools/tools.asp

CONNECTION DIAGRAMS

TYPE C LASER DIODE -- CONSTANT CURRENT OPERATION



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TYPE C LASER DIODE -- CONSTANT POWER OPERATION

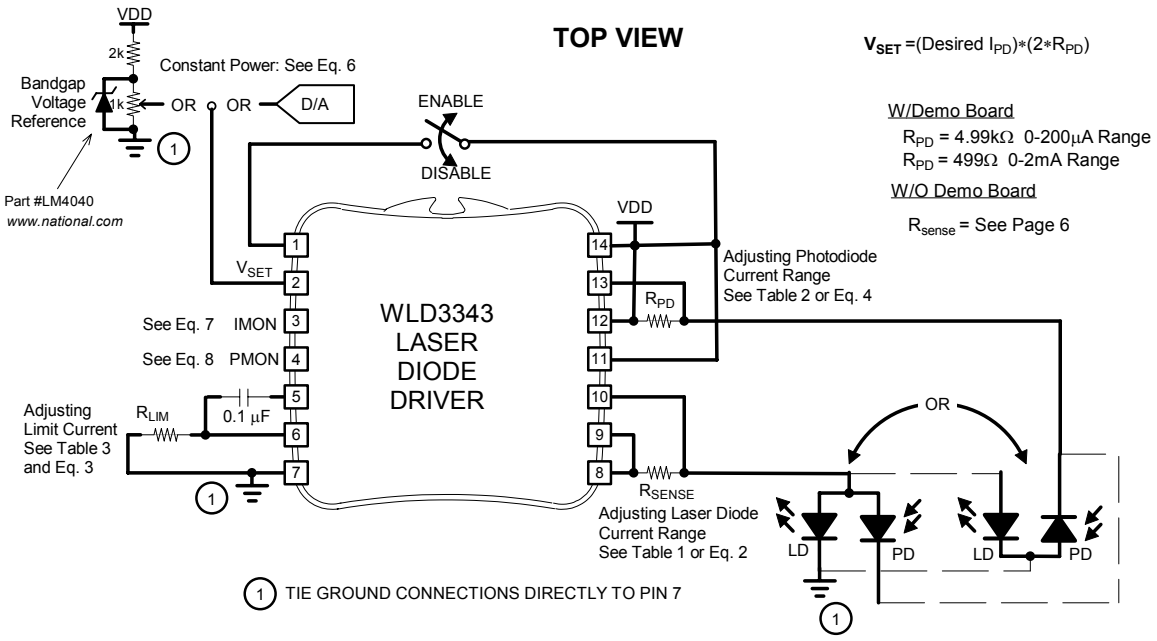

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Table 1 – Laser Diode Current Sense Resistor R_{SENSE} vs Maximum Laser Diode Current I_{LDMAX}

Maximum Output Current, I_{LDMAX}	Constant Power Sense Resistor, R_{SENSE}	Constant Current Sense Resistor, R_{SENSE}
50 mA	25.00 Ω	20.00 Ω
125 mA	10.00 Ω	8.00 Ω
250 mA	5.00 Ω	4.00 Ω
500 mA	2.50 Ω	2.00 Ω
1.25 Amps	1.00 Ω	0.80 Ω
2.50 Amps	0.50 Ω	0.40 Ω

Table 2 – Monitor Photodiode Sense Resistor R_{PD} vs Maximum Photodiode Current I_{PDMAX}

Maximum Photodiode Current, I_{PDMAX}	Monitor Photodiode Current Sense Resistor, R_{SENSE}
20 μA	50 kΩ
200 μA	5 kΩ
2 mA	500 Ω
20 mA	50 Ω

Table 3 – Current Limit Set Resistor R_{LIM} Coefficients

Laser Diode Type – Mode of Operation	α	β
Type A/B – Constant Current	282	2.85
Type A/B – Constant Power	350	3.35
Type C – Constant Current	290	2.93
Type C – Constant Power	385	3.57

Equation 1
Calculating R_{SENSE} in Constant Current Mode

$$R_{SENSE} = \frac{1.00}{I_{LDMAX}} [\Omega]$$; I_{LDMAX} = Maximum Laser Diode Current

Power rating for $R_{SENSE} = 2(I_{LDMAX})^2 R_{SENSE}$

Equation 2
Calculating R_{SENSE} in Constant Power Mode

$$R_{SENSE} = \frac{1.25}{I_{LDMAX}} [\Omega]$$; I_{LDMAX} = Maximum Laser Diode Current

Power rating for $R_{SENSE} = 2(I_{LDMAX})^2 R_{SENSE}$

Equation 3
Calculating R_{LIM}

$$R_{LIM} = \frac{\alpha\left(\frac{I_{LDLIM} R_{SENSE} + 1}{\beta}\right)}{\left[1 - \left(\frac{I_{LDLIM} R_{SENSE} + 1}{\beta}\right)\right]} [\Omega]$$; I_{LDLIM} = Limit Current

Equation 4
Calculating R_{PD}

$$R_{PD} = \frac{1.00}{I_{PDMAX}} [\Omega]$$; I_{PDMAX} = Max Photodiode Current

Equation 5
Calculating Constant Current Setpoint

$$I_{LD} = \frac{Vset}{2 * R_{SENSE}} [A]$$; I_{LD} = Laser Diode Current

Equation 6
Calculating Constant Power Setpoint

$$I_{PD} = \frac{Vset}{2 * R_{PD}} [A]$$; I_{PD} = Photodiode Current

Equation 7
Calculating I_{MON} Measurement

$$I_{LD} = \frac{V_{PIN3}}{2 * R_{SENSE}} [A]$$; I_{LD} = Laser Diode Current

Equation 8
Calculating P_{MON} Measurement

$$I_{PD} = \frac{V_{PIN4}}{2 * R_{PD}} [A]$$; I_{PD} = Photodiode Current

design calculator → www.teamwavelength.com/tools/tools.asp

HELPFUL HINTS FOR CHOOSING R_{SENSE}

•Never use a carbon film resistor for R_{SENSE}.
•Avoid resistors with high parasitic inductance.
•Select a resistor with a low temperature coefficient (ppm/°C).
•Place R_{SENSE} as close to Pins 8 (RS+) and 10 (RS-) on the WLD3343 as possible to avoid parasitic resistance effects from the PCB layout.
•Use Equation 2 for determining the power rating of R_{SENSE}.
Note: Wavelength Electronics recommends a conservative power rating of 2 times normal maximum for R_{SENSE}.

HELPFUL HINTS FOR CHOOSING R_{PD}

•Never use a carbon film resistor for R_{PD}.
•Select a resistor with a low temperature coefficient (ppm/°C).
•Place R_{PD} as close to Pins 12 (PD+) and 13 (PD-) on the WLD3343 as possible to avoid parasitic resistance effects from the PCB layout when in constant power mode.

Reducing Noise

The WLD3343 case is isolated from ground. By grounding the case, the signal to noise ratio can be maximized.

If the fan is used to dissipate the heat produced by the WLD3343, the power supplies can be separated to eliminate the noise produced by the fan.

When operating the WLD3343 with a fan, use a separate power supply for the fan. This will help eliminate the noise produced by the fan.

Choose a power supply with the lowest ripple for its rated current.

Application Notes:

For more helpful information and application notes, go to our website at:

www.teamwavelength.com

CERTIFICATION:
Wavelength Electronics (WEI) certifies that this product met it's published specifications at the time of shipment. Wavelength further certifies that its calibration measurements are traceable to the United States National Institute of Standard and Technology, to the extent allowed by that organization's calibration facilities, and to the calibration facilities of other International Standards Organization members.

WARRANTY:
This Wavelength product is warranted against defects in materials and workmanship for a period of 90 days from date of shipment. During the warranty period, Wavelength will, at its option, either repair or replace products which prove to be defective.

WARRANTY SERVICE:
For warranty service or repair, this product must be returned to the factory. For products returned to Wavelength for warranty service, the Buyer shall prepay shipping charges to Wavelength and Wavelength shall pay shipping charges to return the product to the Buyer. However, the Buyer shall pay all shipping charges, duties, and taxes for products returned to Wavelength from another country.

LIMITATIONS OF WARRANTY:
The warranty shall not apply to defects resulting from improper use or misuse of the instrument or operation outside published specifications.

No other warranty is expressed or implied. Wavelength specifically disclaims the implied warranties of merchantability and fitness for a particular purpose.

EXCLUSIVE REMEDIES:
The remedies provided herein are the Buyer's sole and exclusive remedies. Wavelength shall not be liable for any direct, indirect, special, incidental, or consequential damages, whether based on contract, tort, or any other legal theory.

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SAFETY:
There are no user serviceable parts inside this product. Return the product to Wavelength Electronics for service and repair to assure that safety features are maintained.

LIFE SUPPORT POLICY:
As a general policy, Wavelength Electronics, Inc. does not recommend the use of any of its products in life support applications where the failure or malfunction of the Wavelength Electronics, Inc. product can be reasonably expected to cause failure of the life support device or to significantly affect its safety or effectiveness. Wavelength Electronics, Inc. will not knowingly sell its products for use in such applications unless it receives written assurances satisfactory to Wavelength Electronics, Inc. that the risks of injury or damage have been minimized, the customer assumes all such risks, and there is no product liability for Wavelength Electronics, Inc. Examples or devices considered to be life support devices are neonatal oxygen analyzers, nerve stimulators (for any use), auto transfusion devices, blood pumps, defibrillators, arrhythmia detectors and alarms, pacemakers, hem dialysis systems, peritoneal dialysis systems, ventilators of all types, and infusion pumps as well as other devices designated as "critical" by the FDA. The above are representative examples only and are not intended to be conclusive or exclusive of any other life support device.

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