

Figure 1. AQCL500MA410DFN

FEATURES

- Maximum Input Voltage: 12V
- Output Voltage Range: -18V ~ -8V
- Maximum Output Current: 500mA
- Ultra Low Noise: 0.5µA_{p-p}@0.1Hz ~ 10Hz
- Input Voltage Polarity Reverse Protection
- Under-Voltage Protection
- Current Limit
- Over-Temperature Protection
- High Absolute Accuracy: <0.1% @ 0°C~50°C ambient temperature
- High Stability: <20ppm/°C
- Control Loop Good Indication: LPGD
- Output Current Real Time Monitoring: LIO
- Complete Shielding
- Compact Size: 49.4mm(L)×45mm(W)×14mm(H)
- 100 % Lead (Pb)-Free and RoHS Compliant

APPLICATIONS

This QCL driver can be used to drive QCLs (Quantum Cascade Laser) for radar, medical diagnostics, spectroscopy, chemical analysis, general measurement systems, etc.

DESCRIPTION

AQCL500MA410DFN is a quantum cascade laser driver with differential analog input control and negative output voltage from -18V to -8V.

The AQCL500MA410DFN is a chassis mount electronic module designed for driving QCLs. It delivers ultra-low noise current and still preserves a wide modulation bandwidth. The AQCL500MA410DFN comes with protections for over-voltage, under-voltage, over current, and over temperature.

To monitor the working status of the laser driver, there is a control loop good indication pin, LPGD; and the output current monitor pin, LIO.

Figure 1 shows the photos of AQCL500MA410DFN.



Table 1. Terminal Block Connector 1 Pin Function Descriptions

Pin #	Pin Name	Port Type	Description
1	DATA-	Analog input	The negative node of differential input signal.
2	DATA+	Analog input	The positive node of differential input signal.
3	1.2VR	Analog output	Internal reference voltage.
4	GND	Signal ground	Signal ground. Connect this pin to the signal ground of ADCs, DACs, and the signal sources.
5	LPGD	Digital output	Loop good indication. When outputting a high logic level 5V, it indicates the control loop works properly, i.e. the output current equals the set-point value; outputting a logic low level indicates there is something wrong in the control loop, such as open circuit, output current equals zero, etc.
6	SBDN	Digital input	This is a duplex pin: when it is pulled down <0.4V, the controller is put into Shut-down Mode; when setting this pin to between 1.2V to 2.5V, the controller is set to Stand-by Mode. In this mode, the voltage reference is still working; when setting it to >2.64V to VPS voltage, the controller goes to On Mode. There is an internal 20MΩ pull up resistor tied to VPS.
7	GND	Signal ground	Signal ground. Connect this pin to the signal ground of ADCs, DACs, and the signal sources.
8	4VR	Analog output	Voltage Reference 4.096V output. It can be used by external POTs (Potentiometer), DACs and/or ADCs for setting the LIS. Under Stand-by Mode, this pin is still working.
9	ILM	Analog input	Laser current limit set. 0V to 4.096 V sets the laser current limit from 0 to 500mA linearly. The internal input impedance is 1M.
10	LIS	Analog output	Laser current setting indication. 0V to 4.096 V indicates the laser current is set from 0 to 500mA linearly.
11	LIO	Analog output	Laser current output indication. 0V to 4.096 V indicates the laser current from 0 to 500mA linearly.
12	TMO	Analog output	The controller internal temperature indication output. It can be used for sensing the actual temperature of the controller to avoid over-heating. 0V to 4V represents the controller temperature from -55°C to 125°C.

Table 2. Terminal Block Connector 4 Pin Function Descriptions

Pin #	Pin Name	Port Type	Description
1	LDA	Analog output	Laser diode anode. Connect it to the anode of the laser diode.
2	LDC	Analog output	Laser diode cathode. Connect it to the cathode of the laser diode. This pin is internally connected to PGND and GND, thus its voltage potential is zero.
3	GND	Signal ground	Signal ground. Connect this pin to the signal ground of ADCs, DACs, and the signal sources.
4	PGND	Power ground	Power ground pin. Connect it directly to power supply return rail.
5	VPS	Power input	Power supply voltage. The maximum input voltage is 12V.



SPECIFICATIONS

Table 3. Characteristics (T_A= 25°C)

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Units
Control SBDN Pin (# 6 of Terminal Block Connector 1)						
SBDN Voltage	V _{SBDN-ON}		2.64		V _{VPS}	V
	V _{SBDN-STANDBY}		1.2		2.5	V
	V _{SBDN-OFF}		0		0.4	V
	V _{SBDN-SB-HI} Going up from Standby to On threshold voltage		2.508		2.64	V
	V _{SBDN-SB-LOW} Going down from On to Standby threshold voltage		2.5		2.6	V
	V _{SBDN-OFF-HI} Going up from Off to Standby threshold voltage				1.2	V
	V _{SBDN-OFF-LOW} Going down from Standby to Off threshold voltage		0.4			V
Pull-up Resistor to VPS				20		MΩ
Current Setting LIS Pin (# 10 of Terminal Block Connector 1)						
Current Set Voltage			0		4.096	V
Output LDA Pin (# 1 of Terminal Block Connector 2)						
Output Voltage	V _{LDA}		-18		-8	V
Output Current	I _{LDA}		0		500	mA
Output Current Noise	I _{NLDA}	Peak-to-peak value, 0.1Hz to 10Hz		0.5		μA _{P-P}
Minimum Dropout Voltage	V _{VPS} - V _{LDA}			4		V
Operating Ambient Temperature Range	T _A		-40		65	°C
Large Signal Bandwidth	f _{lg}			1		MHz
Small Signal Bandwidth	f _{sm}			1		MHz
Small Signal Rise and Fall Times	t _{smr} , t _{smf}			350		ns
Large Signal Rise and Fall Times	t _{lgr} , t _{lgf}			350		ns
Power Supply Input VPS Pin (# 5 of Terminal Block Connector 2)						
Input Voltage Range	V _{VPS}		10		28	V
Input Current	I _{VPS}		0		600	mA

APPLICATIONS INFORMATION

Voltage can be input through Mini-USB or LIS. Figure 2 shows the connection for the Mini-USB. Figure 3 shows the pin locations of this QCL driver.

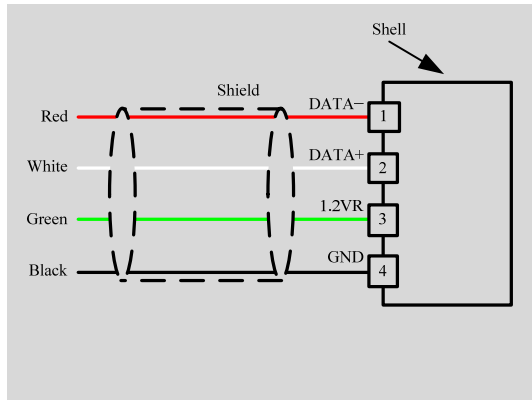
USB Differential Input


Figure 2. Connecting DAC Board to the QCL Driver AQCL500MA410DFN

Table 5. V_{IN+} , V_{IN-} & I_{OUT}

V_{IN+}	V_{IN-}	V_{LIS}	I_{OUT}
1.2V	0V	4.096V	500mA
0.6V	0.6V	2.048V	250mA
0V	1.2V	0V	0mA

$$V_{LIS} = \frac{2.048}{1.2} (V_{IN+} - V_{IN-}) + 2.048$$

$$I_{OUT} = \frac{V_{LIS}}{4.096V} \times 500mA$$

V_{LIS} : The voltage for setting the laser current.

V_{IN+} : The positive node of Mini-USB differential input signal.

V_{IN-} : The negative node of Mini-USB differential input signal.

I_{OUT} : The output current.

Insert the screwdriver into the upper card slot, and the lower card slot should be inserted with a power cord with a bare core ($\phi = 1.5mm \pm 0.2mm$; $L = 7.5mm \pm 0.2mm$).

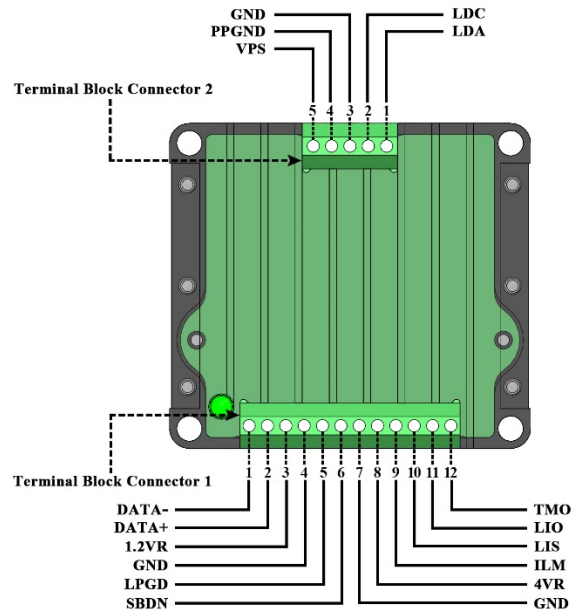


Figure 3. Top View of AQCL500MA410DFN

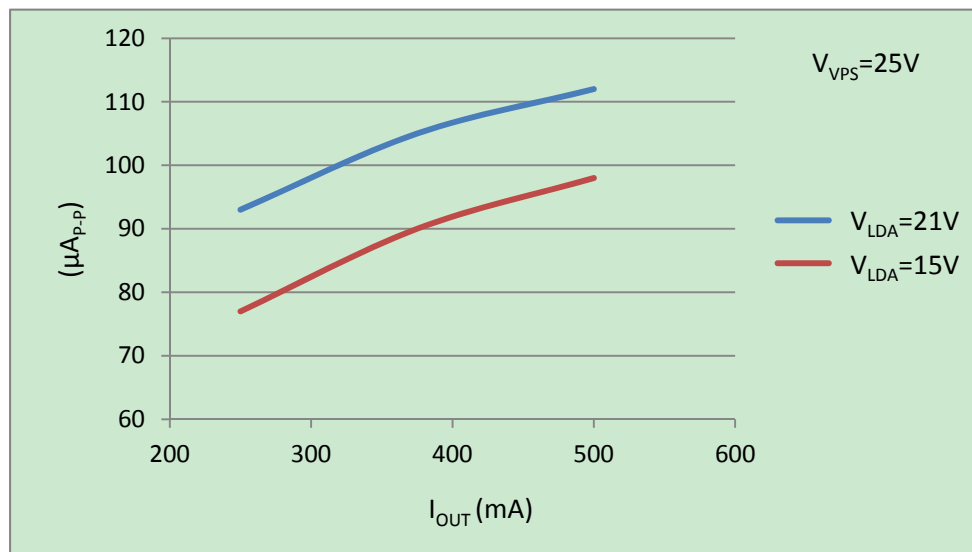


Figure 4. I_{OUT} vs. Output Current Noise@0.1Hz~10Hz

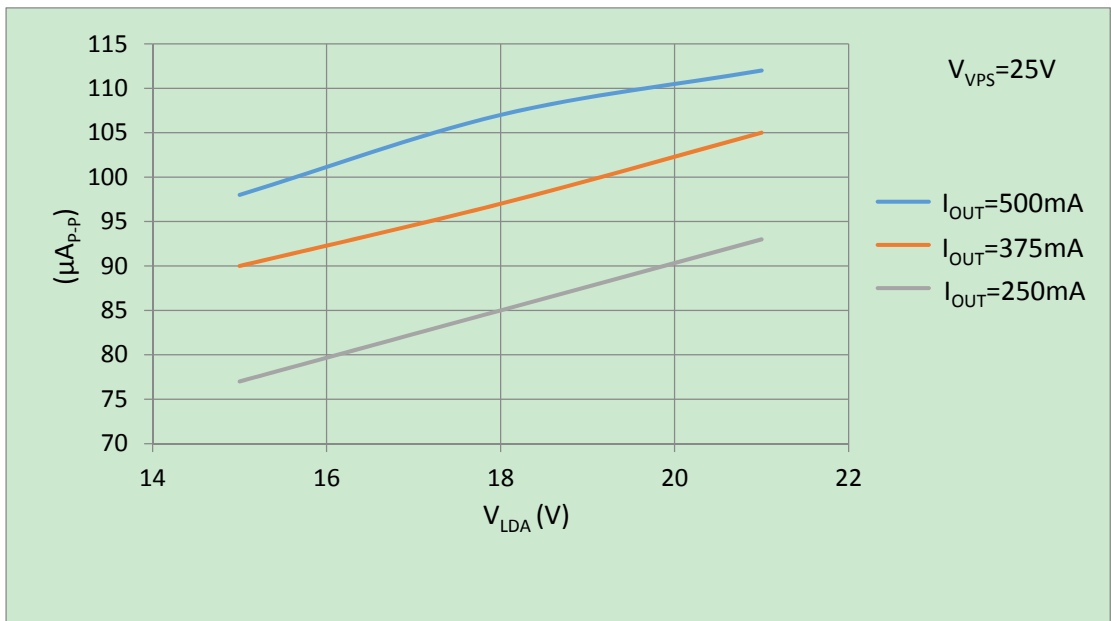


Figure 5. V_{LDA} vs. Output Current Noise@0.1Hz~10Hz

MECHANICAL DIMENSIONS

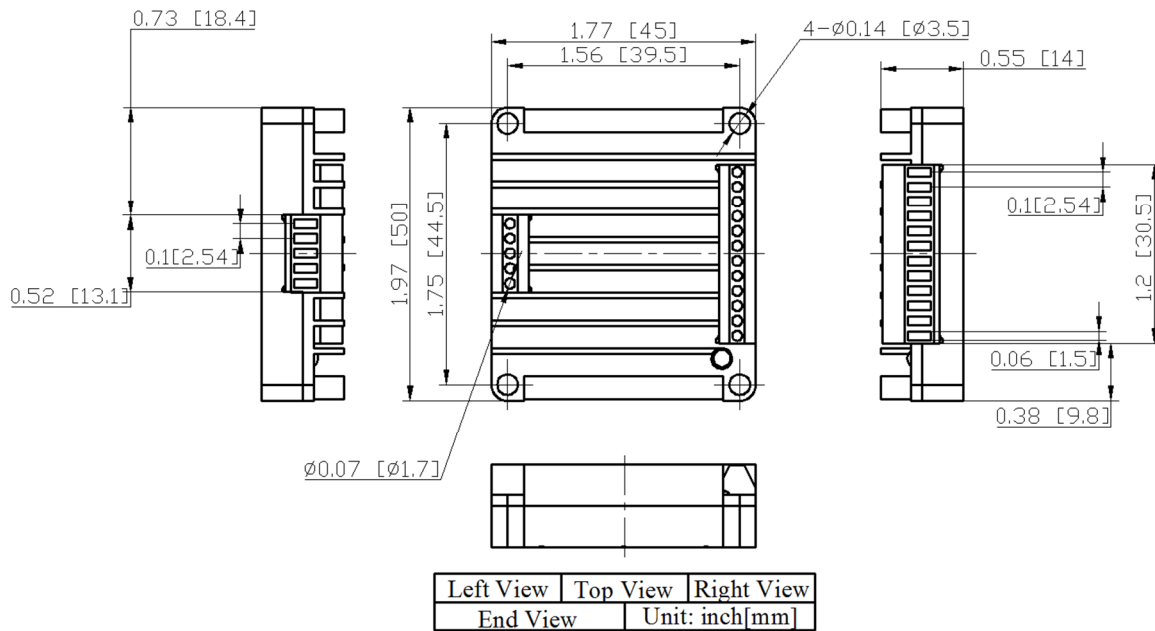


Figure 6. Dimensions of AQCL500MA410DFN



NOTICE

1. ATI warrants performance of its products for one year to the specifications applicable at the time of sale, except for those damaged by excessive abuse. Products found not meeting the specifications within one year from the date of sale can be exchanged free of charge.
2. ATI reserves the right to make changes to its products or to discontinue any product or service without notice, and advise customers to obtain the latest version of relevant information to verify, before placing orders, that information being relied on is current and complete.
3. All products are sold subject to the terms and conditions of sale supplied at the time of order acknowledgment, including those pertaining to warranty, patent infringement, and limitation of liability. Testing and other quality control techniques are utilized to the extent ATI deems necessary to support this warranty. Specific testing of all parameters of each device is not necessarily performed, except those mandated by government requirements.
4. Customers are responsible for their applications using ATI components. In order to minimize risks associated with the customers' applications, adequate design and operating safeguards must be provided by the customers to minimize inherent or procedural hazards. ATI assumes no liability for applications assistance or customer product design.
5. ATI does not warrant or represent that any license, either expressed or implied, is granted under any patent right, copyright, mask work right, or other intellectual property right of ATI covering or relating to any combination, machine, or process in which such products or services might be or are used. ATI's publication of information regarding any third party's products or services does not constitute ATI's approval, warranty or endorsement thereof.
6. IP (Intellectual Property) Ownership: ATI retains the ownership of full rights for special technologies and/or techniques embedded in its products, the designs for mechanics, optics, plus all modifications, improvements, and inventions made by ATI for its products and/or projects.