

Figure 1. AQCL3A410DFN

**FEATURES**

Input Voltage Range: 10V~28V

Output Voltage Range: -18V ~ -8V

Maximum Output Current: 3A

Ultra Low Noise: 3.75 $\mu$ A<sub>p-p</sub>@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**

AQCL3A410DFN is a quantum cascade laser driver with differential analog input control and negative output voltage from -18V to -8V.

The AQCL3A410DFN is a chassis mount electronic module designed for driving QCLs. It delivers ultra-low noise current and still preserves a wide modulation bandwidth. The AQCL3A410DFN 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 AQCL3A410DFN.



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 3A 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 3A linearly.
11	LIO	Analog output	Laser current output indication. 0V to 4.096 V indicates the laser current from 0 to 3A 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 driver works from 10V to 28V.



**SPECIFICATIONS**

Table 3. Characteristics (T<sub>A</sub>= 25°C)

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Units
Control SBDN Pin (#6 of Terminal Block Connector 1)						
SBDN Voltage	V <sub>SBDN-ON</sub>		2.64		V <sub>VPS</sub>	V
	V <sub>SBDN-STANDBY</sub>		1.2		2.5	V
	V <sub>SBDN-OFF</sub>		0		0.4	V
	V <sub>SBDN-SB-HI</sub> Going up from Standby to On threshold voltage		2.508		2.64	V
	V <sub>SBDN-SB-LOW</sub> Going down from On to Standby threshold voltage		2.5		2.6	V
	V <sub>SBDN-OFF-HI</sub> Going up from Off to Standby threshold voltage				1.2	V
	V <sub>SBDN-OFF-LOW</sub> 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 1)						
Output Voltage	V <sub>LDA</sub>		-18		-8	V
Output Current	I <sub>LDA</sub>		0		3	A
Output Current Noise	I <sub>NLDA</sub>	Peak-to-peak value, 0.1Hz to 10Hz		0.5		μA <sub>P-P</sub>
Minimum Dropout Voltage	V <sub>VPS</sub> - V <sub>LDA</sub>			4		V
Output LDA Pin (# 1 of Terminal Block Connector 1)						
Operating Ambient Temperature Range	T <sub>A</sub>		-40		65	°C
Large Signal Bandwidth	f <sub>lg</sub>			1		MHz
Small Signal Bandwidth	f <sub>sm</sub>			1		MHz
Small Signal Rise and Fall Times	t <sub>smr</sub> , t <sub>smf</sub>			350		ns
Large Signal Rise and Fall Times	t <sub>lgr</sub> , t <sub>lgf</sub>			350		ns
Power Supply Input VPS Pin (# 1 of Terminal Block Connector 2)						
Input Voltage Range	V <sub>VPS</sub>		10		28	V
Input Current	I <sub>VPS</sub>		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.

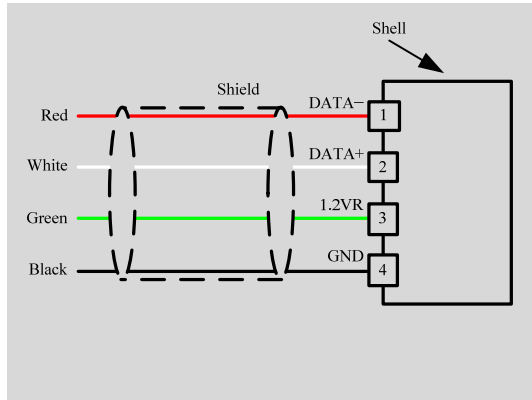
**USB Differential Input**


Figure 2. Connecting DAC Board to the QCL Driver AQCL3A410DFN

Table 4.  $V_{IN+}$ ,  $V_{IN-}$  &  $I_{OUT}$

$V_{IN+}$	$V_{IN-}$	$V_{LIS}$	$I_{OUT}$
1.2V	0V	4.096V	3A
0.6V	0.6V	2.048V	1.5A
0V	1.2V	0V	0A

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

$$I_{OUT} = \frac{V_{LIS}}{4.096V} \times 3A$$

$V_{LIS}$ : 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 ( $\phi = 1.5mm \pm 0.2mm$ ;  $L = 7.5mm \pm 0.2mm$ ).

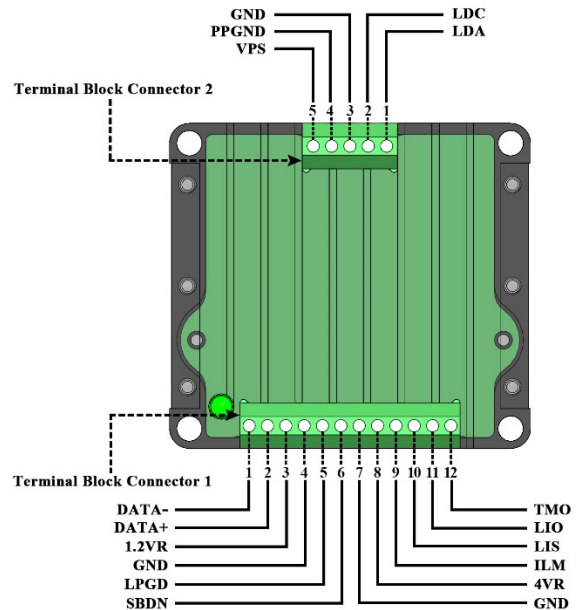


Figure 3. Top View of AQCL3A410DFN



MECHANICAL DIMENSIONS

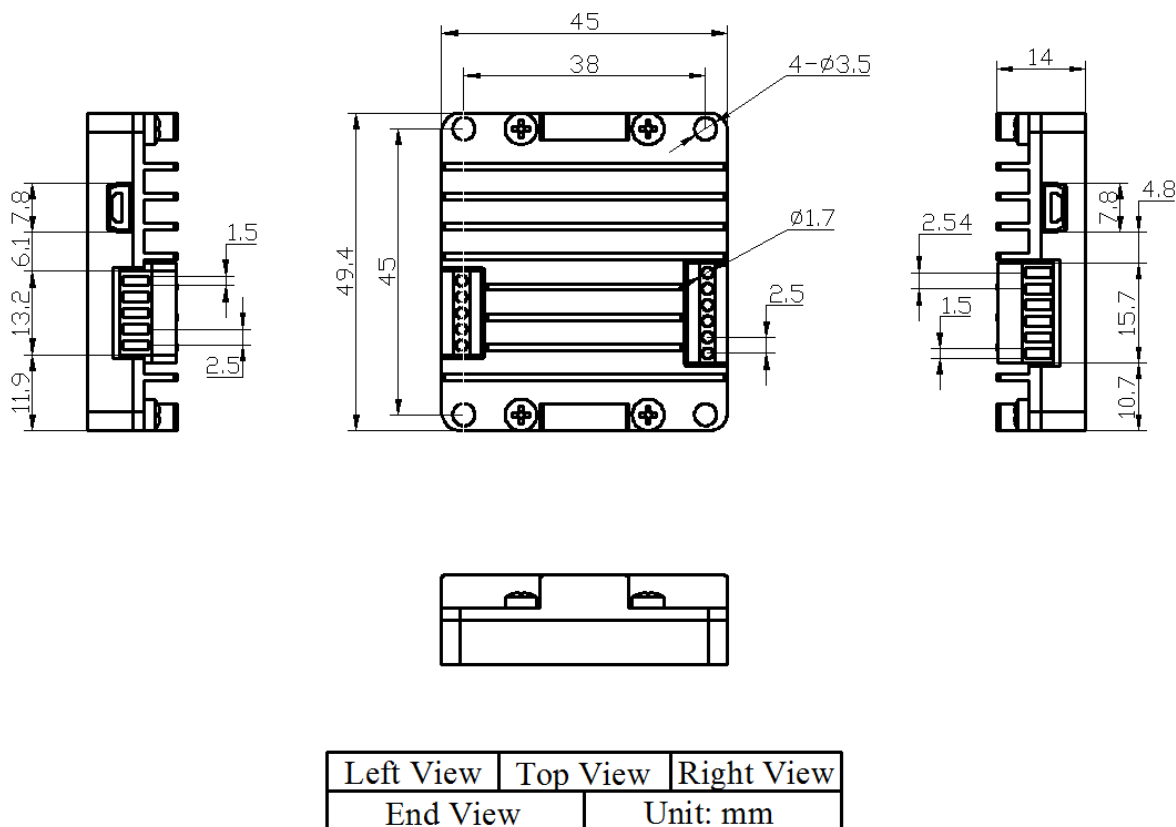


Figure 4. Dimensions of AQCL3A410DFN

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