ML4062-CNT-Gen2
Technical Reference
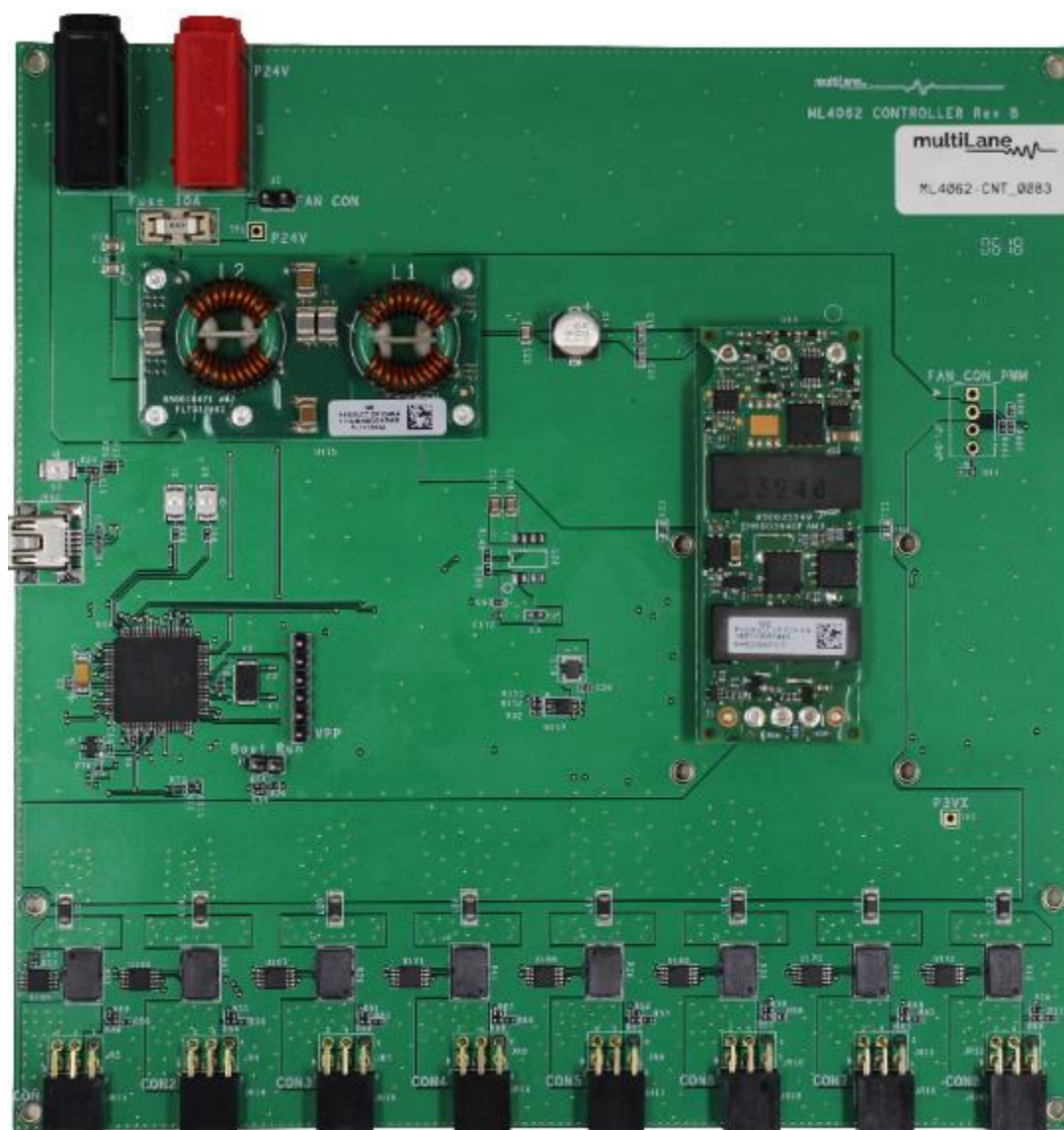
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1. Introduction

The ML4062-CNT-Gen2 is designed to provide an efficient and easy method of programming and testing the ML4062-TL2a-CON modules. It provides power and I2C communication to the modules, allowing the user to access any register in the memory through I2C bus, where user is able to control the power, monitor the voltage, temperature, etc...

2. Key Features

- ✓ Supports up to 150W in total
- ✓ Supports up to 19W/port maximum
- ✓ Eight interfaces allowing to operate eight modules simultaneously
- ✓ I2C master driven from on board microcontroller
- ✓ Current Sensor at each port
- ✓ User friendly GUI for I2C R/W commands and loading custom MSA memory maps
- ✓ USB interface

3. ML4062-CNT-Gen2 Hardware

The subsequent sections cover the essential parts in the hardware, for board operation and testing.

3.1 Power-Up

The ML4062-CNT-Gen2 host is powered up as following:

- Apply 36V input minimum, through banana plugs U6 and U7.
- Connect the host to your PC using a Type-B mini to Type-A USB cable.

3.2 Operating Conditions

The input voltage supply must follow the table below.

Parameter	Min	Typical	Unit
Vinput	36	48	V

Table 1: Voltage Operating Conditions

The ML4062-CNT-Gen2 includes eight ports, allowing to communicate with and configure all of the eight modules simultaneously. The ML4062-CNT-Gen2 allows to dissipate **19W/Port maximum**, for a total of 150W.

3.3 LED Indicators

The ML4062-CNT-Gen2 includes on-board LEDs, for quick debugging and monitoring purposes. LEDs are summarized below:

- LED D3 indicates whether a USB cable is plugged or not.
- LEDs D1 and D2, colored green and red, respectively, are used for diagnostic purposes:
  - ✓ If D1 is on: USB is locked and device is recognized by the USB driver
  - ✓ If D2 is on: USB is not connected or USB driver is not found
  - ✓ If both are off: board is not powered correctly or firmware is corrupted
  - ✓ If both are blinking: the board is in Bootloader mode

3.4 Low Speed Signals

The low speed signals circuit shown below shows the connection of these signals to the microcontroller and the pin header connector, for one of the modules ports, the others are similar.
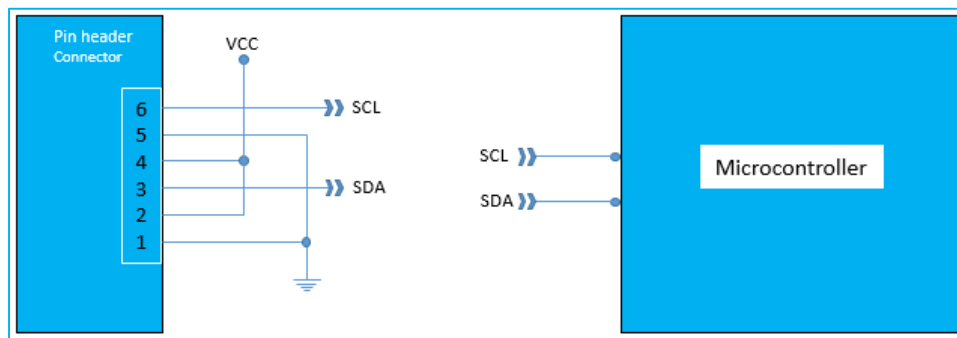

Figure 1: Low Speed Signals Diagram

4. ML4062-CNT-Gen2 Software

The ML4062-CNT-Gen2 is accessible and controlled through application software. This software provides a user-friendly interface to operate the board and access all its features. The communication between the ML4062-CNT-Gen2 board and the software is established through USB connection.

4.1 USB Driver

In order to be able to communicate with the board, user needs to install the USB driver of the ML4062-CNT-Gen2. This is available on the website under the following link (USB Driver icon):

https://multilaneinc.com/products/ml4062-cnt/

Below is a brief guide on how to install the USB Driver:
- Power up the board
- Connect the board to the PC through USB cable
- Download the USB driver file
- Go to "Device Manager"
- Find the target device that need to install the driver
- Right-click on the device and select Update Driver Software
- Select Browse my computer for driver software
- Browse you PC and select the driver file
- Click Next and wait until the driver is installed

4.2 GUI

For GUI installation and operation, refer to the link below. GUI user manual is available for detailed description.

https://multilaneinc.com/products/ml4062-cnt/

5. Hardware Revision

- **ML4062-Controller-RevA:** Initial Version
- **ML4062-Controller-RevB:**
  o Add capacitor at the current sense output
  o Fix the issue of the power switcher connection

6. Firmware Revision

- **ML4062Controller_V1.3**: latest FW revision, compatible with the ML4062-CNT-GEN2 RevB hardware.

7. Bootloader

Accessing in bootloader mode allows the user to reprogram the microcontroller, this is done as described below:

1. Connect a jumper on (J1) situated close to the microcontroller.
2. Connect a USB cable between the PC and Board.
3. Power up the board with a +3.3V supply.
4. LEDs (D1, D2) start blinking.
5. Remove jumper.
6. Open the software "Microchip USB HID Bootloader v2.3".
7. Click on "Open Hex File".
8. Choose the new FW to download.
9. Click on "Program/Verify".
10. Once the software finishes programming press on "Reset Device".
11. After reset the Firmware is successfully updated.

8. ML4062-TL2a-CON General Features

In the subsequent paragraphs, a description of main ML4062-Tl2a-CON features is present.

8.1 General Description

The ML4062-TL2a-CON module is connected to the controller board using the **ML4062-CNT-CBL-G2**. This cable provides the connectors mating between the module and the controller, power for the module and allows I2C communication with the controller board.

The module is always running in ModuleReady state on power up. User can force the module to run in ModuleLowPwr state, through register 26 bit 4 (ForceLowPwr) only. When this bit is set, the module is in low power mode, and all power spots are disabled. In order to re-activate power spots this bit should be cleared.

8.2 Temperature Monitor

The ML4062-TL2a-CON has 4 internal temperature sensors, two on the PCBA and two on the shell in order to continuously monitor the module temperature. Internally measured Module temperature are represented as a 16-bit signed two's complement value in increments of 1/256 degrees Celsius, yielding a total range of –127C to +128C that is considered valid between –40 and +125C.

Address	Bit	Name	Description	Type
14 Lower page	All	Temperature MSB	Internally measured TempSense4 (shell T.S.)	RO
15 Lower page	All	Temperature LSB	Internally measured TempSense4 (shell T.S.)	
150 Page 03	All	Temperature MSB	Internally measured TempSense1 (PCB Bottom)	
151 Page 03	All	Temperature LSB	Internally measured TempSense1 (PCB Bottom)	
152 Page 03	All	Temperature MSB	Internally measured TempSense2 (shell T.S.)	
153 Page 03	All	Temperature LSB	Internally measured TempSense2 (shell T.S.)	
154 Page 03	All	Temperature MSB	Internally measured TempSense3 (PCB Bottom)	
155 Page 03	All	Temperature LSB	Internally measured TempSense3 (PCB Bottom)	

The distribution of internal temperature sensors is shown in the figure below.
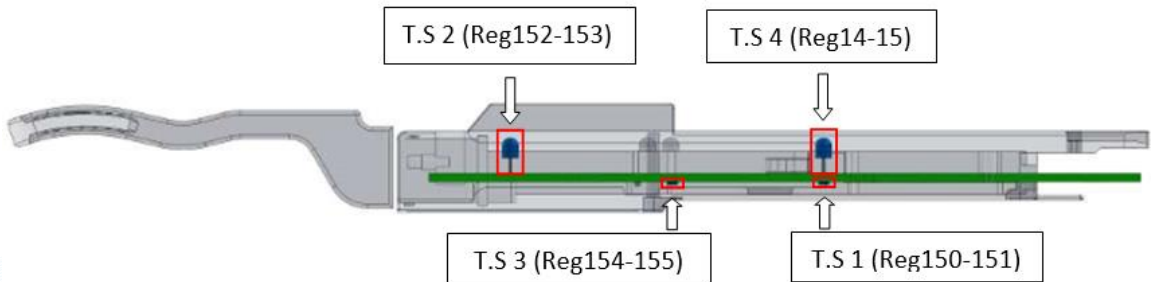

Figure 2: Temperature Sensors Location

8.3 Voltage Sense

A voltage sense circuit is available in the ML4062-TL2a-CON that allows to measure the internal module supplied voltage Vcc, with LSB unit is 0.1 mV.

Address	Bit	Name	Description	Type
16	All	Supply voltage MSB	Internally measured supply voltage	RO
17	All	Supply voltage LSB	Internally measured supply voltage	

8.4 Current Sense

A current sense circuit is available in the ML4062-TL2a-CON that allows monitoring the current consumption of the heaters that are distributed over ten power spots. The current sense is able to measure up to 6.665 Amps. Current is stored in low memory registers 24 and 25.
Note that the Max current consumption of the module is 7.1Amps, but the current sense can read only up to 6.665Amps.

Address	Bit	Name	Description	Type
24	All	Current Consumption MSB	Current consumption in mA	RO
25	All	Current Consumption LSB		

8.5 Programmable Power Dissipation and Thermal Emulation

The ML4062-TL2a-CON module contains ten thermal spots positioned as shown in the figure below, to allow the user to emulate the thermal behavior of an optical module.
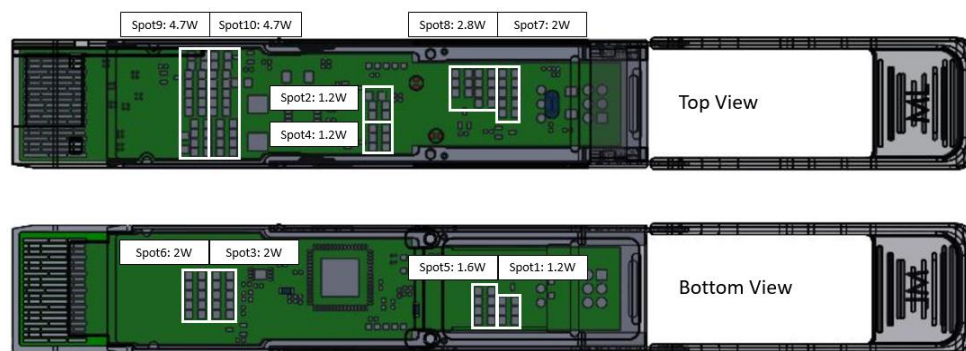

Figure 3: Power Spots Distribution

Where some of these spots are PWM controlled, others are ON/OFF controlled. The table below shows control type for each of these thermal spots.

Power Spot number	Control Type
1-3-5-6	PWM
2-4-7-8-9-10	ON/OFF

Registers 135, 136, 137, 138 and 140, page 03h are used to control thermal spots over I2C. They are 8-bit data wide registers.

The consumed power changes accordingly when the values of these registers are changed (only in high power mode). In Low power mode the module automatically turns off all power spots. The values written in these registers are permanently stored.

The control registers of the thermal spots are shown in the table below:

Power Spot	Register	Bit	Power Consumption	Control Type	Memory Type
1	135	7:0	1.2 W	PWM	
2	140	0	1.2 W	ON/OFF	
3	136	7:0	2 W	PWM	
4	140	1	1.2 W	ON/OFF	
5	137	7:0	1.6 W	PWM	
6	138	7:0	2 W	PWM	RW (NVR)
7	140	2	2 W	ON/OFF	
8	140	3	2.8 W	ON/OFF	
9	140	4	4.7 W	ON/OFF	
10	140	5	4.7 W	ON/OFF	

8.6 Cut-OFF Temperature

To avoid overheating the module, a Cut-Off Temperature is pre-defined.

The module is continuously monitoring the temperature and checking its value against the Cut-Off temperature. Once the module temperature reaches the cut-off temperature, all power spots will automatically turn off in order to prevent overheating. Once the temperature is 5 degrees below cut-off value, the PWM goes back to its previous value.

The maximum Cut-Off temperature for the ML4062-TL2a is $100°$C and it can be programmed to any value from register 134 of memory page 3. Its default value is $100°$C.

Revision History

Date	Revision	Description
3/3/2020	0.1	▪ Initial Version
9/2/2020	0.2	▪ Change Format ▪ Add introduction ▪ Add features ▪ Add LED indicator section ▪ Add low speed signals diagram ▪ Add HW and FW revision

North America
48521 Warm Springs Blvd. Suite 310
Fremont, CA 94539
USA
+1 510 573 6388

Worldwide
Houmal Technology Park
Askarieh Main Road
Houmal, Lebanon
+961 5 941 668

Asia
14F-5/ Rm.5, 14F., No 295
Sec.2, Guangfu Rd. East Dist.,
Hsinchu City 300, Taiwan (R.O.C)
+886 3 5744 591

multilaneinc.com