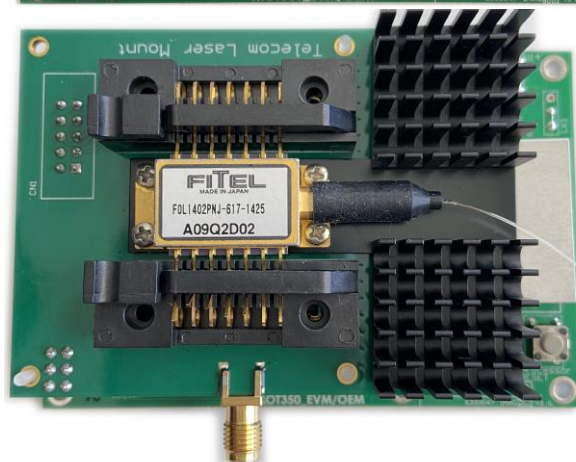




### -----Features

- Supports all variants of the Integrated TEC and Laser driver modules
- Includes power supply sequencing circuit for the dual supply laser drivers (GA versions).
- Includes supply filtering for low noise applications.
- Standalone or host-controlled.
- LabVIEW interface (MOT350M)
- SMA connector with Bias-T for HF modulations.
- On-board dummy laser load
- Complete solution for OEM applications.
- Complete evaluation and verification solution
- Allows butterfly laser mount to be mounted on top of the driver board.



### Introduction

The MOT350\_EVM/OEM and MOT350M\_EVM/OEM is a small board (66mm x 63.5mm) designed to be used with integrated TEC and Laser driver modules. All variants of laser configurations are supported with laser currents up to 1.25A. The TEC controller provide up to  $\pm 3A$ .

A LabVIEW GUI allows control and monitoring of both laser driver and TEC controller by using an USB connection to the board.

This board incorporates power supply sequencing for dual supply laser drivers. This feature allows any of the supplies to be turned on and off first with no problem.

Extensive supply filtering ensures low noise operation with little cross talk between the TEC controller and laser driver sections.

MOT350 board uses 2oz copper allowing good heat sinking ability for thermal management of the overall system design.

***Please also refer to the appropriate Module datasheets for further description of the module functionality.***



*Before applying power to the EVM please ensure all jumpers are configured correctly! (see following pages)*

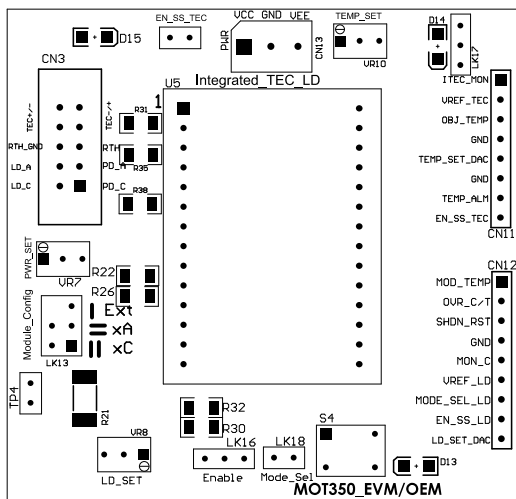


**Standard available Part numbers:**

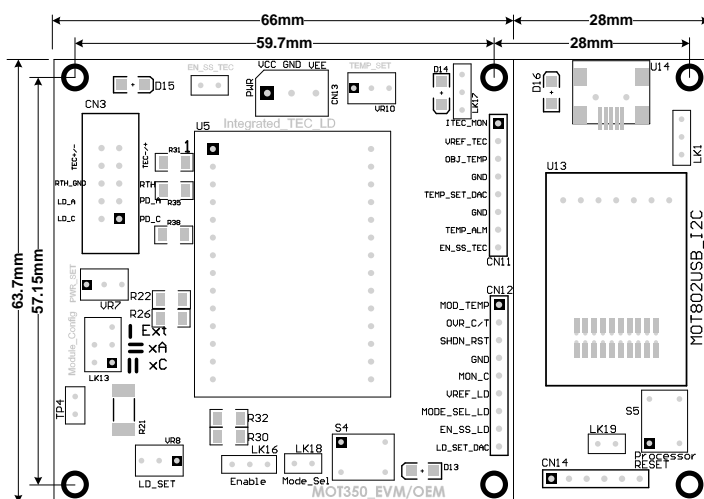
OEM products Part #s	Descriptions
MOT350_2525GC*	±2.5A TEC controller Plus 250mA GC Laser driver
MOT350_2550GC	±2.5A TEC controller Plus 500mA GC Laser driver
MOT 350_25100GC	±2.5A TEC controller Plus 1000mA GC Laser driver
MOT350_3525GC	±3A TEC controller Plus 250mA GC Laser driver
MOT350_3550GC	±3A TEC controller Plus 500mA GC Laser driver
MOT350_35100GC	±3A TEC controller Plus 1000mA GC Laser driver

\* For other Laser configurations replace GC with your require configurations.  
 i.e. for GA (grounded Anode) the part number will be MOT350\_2525GA  
 Customer specific requirements also can be implemented. Please contact us with your requirements.

**Board Layout & Components identification:**



MOT350\_EVM/OEM



MOT350M\_EVM/OEM include USB interface with LabVIEW GUI

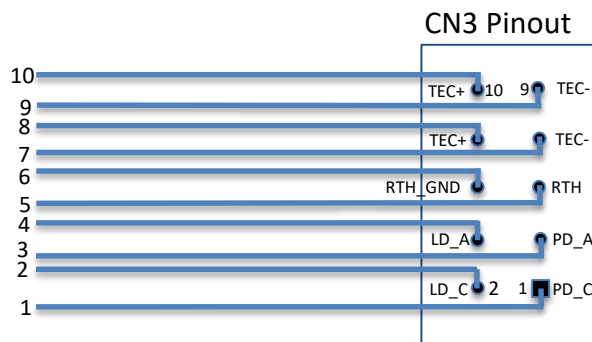


**Configuration Links, Connectors, and Potentiometers:**

The following table describe, links, Connectors, and potentiometers functions.

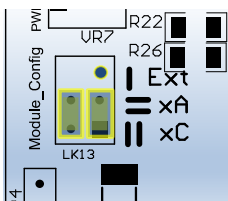
Refer to the board layout and components identification picture on page 2.

Component	Function	Default	Alternate
<b>TEC Controller Section</b>			
CN13 (PWR)	Power connector	VCC, GND, VEE	
EN_SS_TEC	TEC Enable/disable	Enabled	Insert Link to disable
TEMP_SET (VR10)	Temperature set		
LK17	DAC/VR10 potentiometer	Factory set for on board potentiometer (VR10)	External DAC
R31	Limits TEC voltage	Open for Maximum voltage	
R35	Limits Positive current	Open for maximum current	
R38	Limits Negative current*	Open for maximum current	
D15	Power LED	Illuminates when power is connected	
D14	Fault LED	Illuminates if the object temperature is outside $\pm 1.5^{\circ}\text{C}$	
CN3	Output connector	See drawing below	

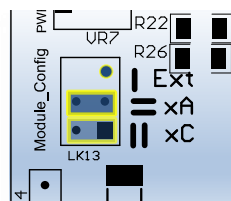




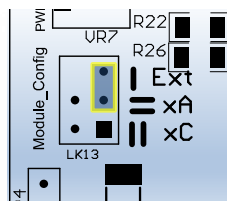
Component	Function	Default	Alternate
<b>Laser Driver section</b>			
R30/R32	Select whether Laser current is set using VR8 (LD_SET) or External DAC	R32 Is installed for using VR8	R30 is used for using External DAC
R22/R26	Select either GC or GA modules (factory installed)	R22 Is installed for GC modules (only applies to dual mode drivers)	R26 is installed for GA modules (Only applies to dual mode drivers)
LK13 (module Config.)	Select either to use dummy load or external laser.	Refer to diagrams below.	
TP4	Test point to measure the laser current across R21, when using dummy load		
VR8 (LD_SET)	Use to set laser current (Power)		
LK16 (Enable)	LD Enable/Disable	No link is enabled. Link to the left disable. Refer to diagram below.	Link to the right is external control through CN12.
LK18 (Mode_Sel)	Mode Select, Constant Current or Constant power mode	No link Constant current	Link installed Constant power mode
S4 PB switch	Shut down Reset		
D13	Fault LED	Illuminates when module is shut down due to Over Current or Over temperature	



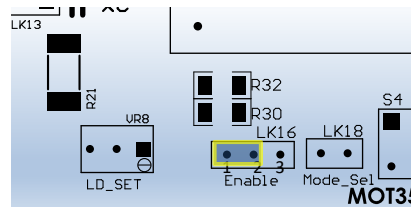
LK13 is configured for Dummy load & GC



LK13 is configured for Dummy load & GA



LK13 is configured for External Laser



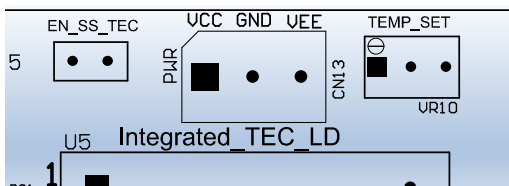
Link 1 & 2 to disable  
Link 2 & 3 to control using CN12



### FUNCTIONAL DESCRIPTIONS

#### Power Supply

An appropriate power supply should be connected to CN13. All modules require a positive (VCC) supply connection, a negative supply (VEE) is also required for CA, CC and GA modules. For GC modules no negative supply is required. The power supply should be capable of sourcing sufficient current as shown in the datasheet for the module being used, plus an additional 15mA for the current drawn by the indicator LEDs. The supply voltage may be anywhere in the range from 3.3V to 5V nominal. When dual supplies are used the voltages should be symmetrical. When supply voltage is applied the power LED, D15, will illuminate green.



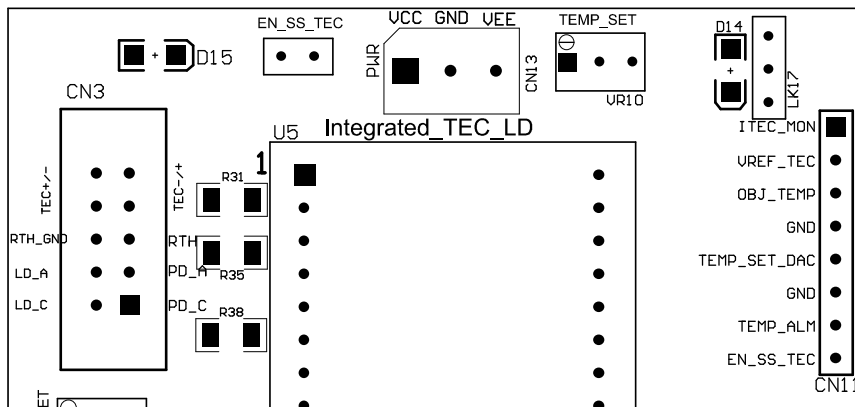
*Note: For dual supply modules a sequencing circuit is used so that any supply (positive or negative) could be applied or removed first.*

#### TEC controller section:

The following picture shows the upper section of the MOT350\_OEM board.

Components controlling the TEC controller are:

- VR10: sets the object temperature
- EN\_SS\_TEC: Enable & disable TEC controller. No link enables the controller.
- R31: Limits the TEC maximum voltage.
- R35, R38: Limit the positive & negative currents to the TEC.
- D15: Power supply indicator.
- D14: Fault Indicator.





### Maximum Output Voltage

By default the MOT350\_OEM ships with R31 being open, resulting in maximum output voltage swing. In some applications it may be desired to reduce the maximum voltage and this can be accomplished by the addition of a single resistor, R31.

The formula for calculating R31 and VMAX is:  $V_{MAX} = 6 R / (39K + R)$

### Maximum Output positive & negative currents

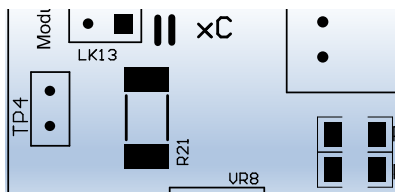
By default the MOT350\_OEM ships with R35 and R38 being open, resulting in maximum output currents. In some applications it may be desired to reduce the maximum currents and this can be accomplished by the addition of resistors, R35 and R38

Max. Positive & Negative Currents	Resistor R35 & R38 (kΩ)
-	-
+/-2.5	Open
+/-2.0	157
+/-1.5	59

### Laser connection

For quick initial evaluation the on-board dummy load can be used in place of a real laser. The dummy load consists of 3 series-connected diodes (diodes are underneath the board) and a resistor (R21). which approximate to an actual laser diode. Link LK13 is used to ensure the correct polarity for the module configuration being used. In this configuration only Constant Current mode can be used (see LK18) since there is no feedback mechanism for measuring power.

R21 Dummy Load Resistor = 1R  
(Measure current across TP4)



### Operating Mode

The MOT350\_OEM can be operated in either Constant Current or Constant Power modes. Selection of mode is accomplished using LK18, by default (no link) it is set to the CC (Constant Current) mode. The module can be forced into the CP mode, by simply installing a jumper on LK18:

Alternatively, with no link the control line can be accessed via Mod\_SEL\_LD at CN12. This node should be pulled high for Constant Power mode, and released, or pulled down, for Constant Current mode. (an internal pull-down inside the module sets Constant Current as the default mode).





### Laser Current / Power Setting

Control of the laser output power (in CP mode) or current (in CC mode) is accomplished by adjusting VR8 potentiometer (LD\_SET). This applies a control voltage to the module in the range 0V to ~ 2V.

### Constant Power Mode

In Constant Power mode a real laser should be attached to the MOT350 board using CN3 connector. Power supply to the MO350 must be turned off at this time.

### Important note:

***Before connecting a laser to MOT350 make sure that the laser maximum current rating is compatible with the laser driver module you are using. Always use a laser with current rating greater than the laser driver module. Applying current greater than the laser maximum rating shall destroy the laser permanently.***

Before attaching the laser, set VR7 to its maximum (fully clockwise), and set LK13 to external. R22 is installed for GC & CA modules. R26 is installed for GA & CC modules.

Connect the laser to CN3 making sure correct terminals have been identified and connected according to the module being used. CN3 pinout has been given on page 3.

### Important note:

**Lasers must be handled by qualified personnel having full understanding of laser safety principles and procedures.**

Connect the laser pigtail optical connector to a suitable optical power meter. The power meter must be capable of handling high power if you are using high power lasers.

1). Set the mode to constant current (CC) using LK18 (no link) and set VR8 for minimum current (fully clockwise).

Turn on the power supply to the MOT350. Increase the laser current using VR8 (turning anti-clockwise) - by increasing the voltage at the LD\_SET pin. The optical power meter should now be reading corresponding power and increasing as the LD\_SET voltage is being increased. Set LD\_SET to approximately 1.75V and note optical power as well as the laser current for this LD\_SET value.

2). Change the mode to constant power mode using LK18 (insert Link). You will notice that the laser current as well as the laser power decreases. Increase the laser current (power) using VR7 (turn anti-clockwise) until laser power reaches approximately 1dB less than the power you noted in step 1. Keep VR7 at this setting.

The laser power can now be changed using VR8 (LD\_SET). It is now possible to change mode from CC to CP and vice versa with no transients.



### Shutdown functionality

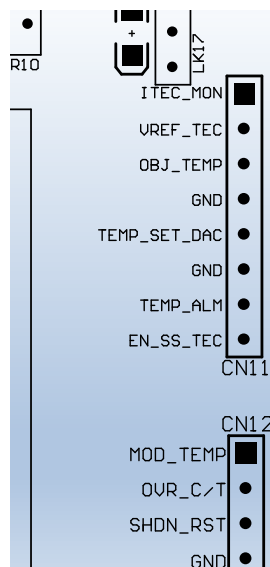
If over-current or over-temperature conditions are detected the module will shutdown and D13 will illuminate red. The module will remain shutdown until reset by pressing S4. If the fault conditions have been cleared the module will resume operation after performing a soft start. If a fault persists the module will not restart and D13 will illuminate once more when S4 is released.

The shutdown functionality can also be monitored and restarted externally:

1. In shutdown the OVR\_C/T connection on CN12 will be pulled low.
2. A reset can be initiated by pulling the SHDN\_RST pin on CN12 low

### External Monitoring and Control

A number of system parameters are available for monitoring, along with several control signal inputs, which would be used when the MOT350 is connected to an external microcontroller using CN11 and CN12



#### TEC controller Interface Pin descriptions (CN11):

##### **Current Monitor (TEC\_MON)**

An analog voltage representing the output current to the TEC.

##### **VREF**

Reference voltage output (1.5V).

##### **Object Temperature (OBJ\_TEMP)**

An analog voltage representing the temperature of the object being monitored.

##### **Temperature Set Voltage (TEMP\_SET\_DAC)**

An analog voltage to set the object temperature. Values from 0.3V – 1.05V may be applied.

##### **Temperature Alarm (TEMP\_ALM)**

This pin is pulled low when the temperature falls outside a +/-1.5° C window.

##### **Enable / Soft start (EN\_SS\_TEC)**

A low level voltage puts the module in standby. When releases the module resumes normal operation.





**Laser driver Interface pin descriptions:**

**MOD\_TEMP (Module Temperature)**

An analog voltage representing the internal temperature of the module (0.744V = 25 C)

**OVR\_C/T (Over Current / Temperature) flag – see “Shutdown Functionality”**

This pin is pulled low when a fault has caused shutdown.

**SHDN\_RST– see “Shutdown Functionality”**

Pull this pin low to reset the device

**MON\_C (Output Current Monitor)**

An analog voltage representing laser current. Values from 0 – 2.6V correspond to output current from zero to the specified maximum.

**VREF\_LD (Laser driver Precision Reference)**

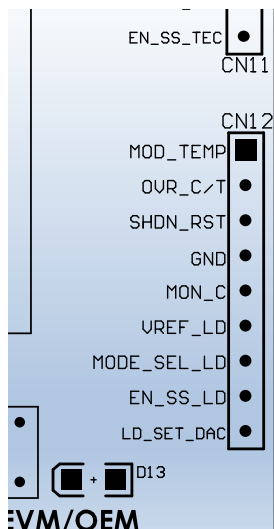
A 2.5V reference voltage, stable over temperature and voltage.

**MODE\_SEL\_LD (Mode Select) – see “Operating Mode”**

**EN\_SS\_LD (Enable / Soft start)– see “Module Enable”**

**LD\_SET\_DAC**

An analog voltage ranging from 0-2.3V sets the laser current from ~0mA to the specified maximum for each module.



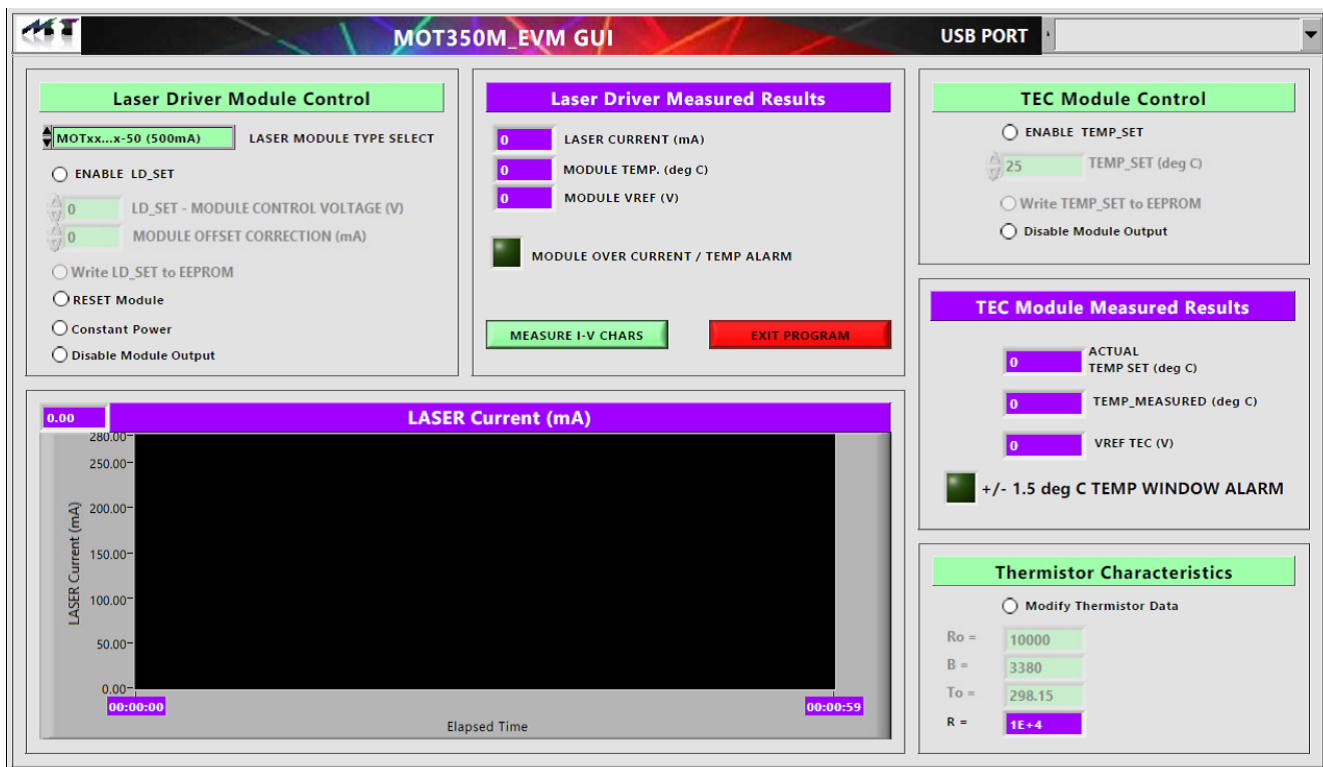


### LabVIEW GUI interface:

The LabVIEW GUI allows customers to set and control parameters effecting operation of the laser and TEC being used. It also, measures and display laser current and TEC temperature.

The MOT350M graphical interface has been arranged into distinct panels for easy navigation.

The following paragraphs give descriptions of each section.



**USB PORT:** At the upper right corner of the Interface a drop down menu you can select the USB port that the module has been connected to. This has to be selected before the GUI becomes operational.

### Laser driver module control:

**Laser module type select:** A drop down menu allows you to select one of the three options according to the module being used in the product purchased; 250mA, 500mA, or 1000mA

**Enable LD\_SET:** In order to enter a value for the laser current, this option has to be enabled.

**LD\_SET:** A voltage ranging from 0v to 2.3v sets the laser current from 0mA to the maximum according to the laser type, that is 250mA, 500mA, and 1000mA.

**Module offset correction:** Due to tolerances in electronic components there are always some current reading when LD\_SET is set to 0v. In “Laser driver Measured results panel” note the value for laser current measured when LD\_SET=0v and insert this value with opposite sign into Module Offset correction box.

**Write LD\_SET to EEPROM:** This feature allows you to operate the laser driver while disconnecting the USB cable from the module. It enables you to set and operate a number of modules using one USB interface. After each module has been set, the USB cable can be disconnected and used with a second module, and so on. A second benefit of this feature is to remove the ground noise of the host computer from the module after it has been configured.



**RESET MODULE:** After a shutdown of the module due to over current or over temperature, it can be rest using this radio button.

**Constant Power:** Dual mode laser drivers can be configured in Constant current (CC) or constant power (CP). To change from CC (default mode) to CP use this radio button.

**Disable Module Output:** The laser current can be disabled using this button.

### Laser Driver Measured Results:

**Laser Current (mA):** The laser current measured is displayed here.

**Module Temperature (°C):** The internal temperature of the module in degrees C is displayed here. This is not the laser temperature, it is internal temperature of the driver electronics.

**Module VREF:** An accurate reference voltage is generated internally (2.5V). This is measured and displayed here.

**Module Over current / over temperature:** This LED is illuminated when the laser current exceeds the maximum value according to the laser type being used. Also, when the internal temperature exceeds 120 °C.

**Laser Current Display:** Laser current is displayed against time in this section.

**MEASURE I-V CHARS:** A current versus LD\_SET voltage panel will be launched by activating this button.

**Exit program:** This terminates the GUI.

### TEC module control Panel:

TEC controller can be configured and monitored through this panel.

**Enable TEMP\_SET:** In order to enter a value for the TEC temperature, this option has to be enabled.

**TEMP\_SET (degrees C):** A temperature value from 0°C to 65°C can be set here.

**Write TEMP\_SET to EEPROM:** after the temperature has been set and stabilized, this can be written to the internal EEPROM, the same way as in laser driver section.

**Disable Module Output:** The module output can be enabled and disabled using this radio button.

### TEC Module Measured Results:

TEC controller measured results are given in this section.

**Actual TEMP\_SET (degrees C):** The value for TEM\_SET entered in the above section will be converted to a voltage according to the sensor used and a DAC is used to set this voltage at the input pin of the module. This voltage is then used to reverse measure its corresponding temperature. This is now is termed as the actual TEMP\_SET. There would be some slight difference as it is shown.

**TEMP\_Measured (degrees C):** Temperature measured using the voltage returned from the sensor.

**VREF\_TEC:** Reference voltage for TEC controller section measured (1.5V)

### Thermistor Characteristics Panel:

**Modify thermistor data:** Use this radio button to enable modifying thermistor characteristics data.

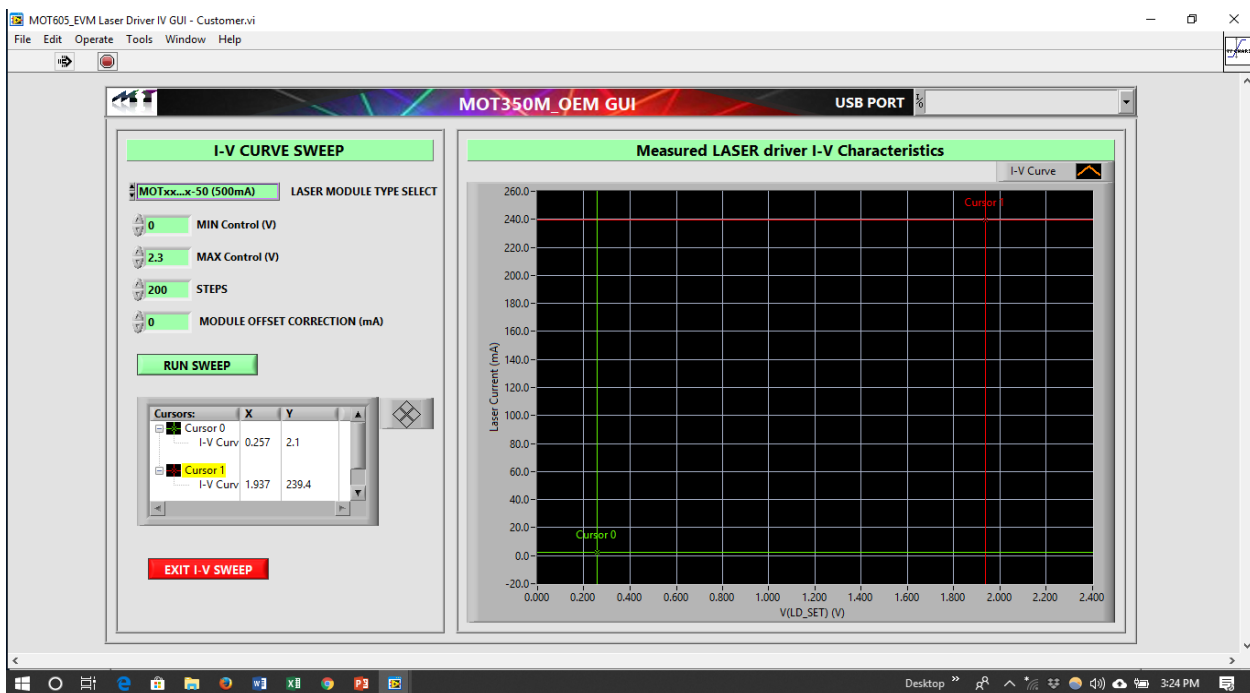
Enter the values for R0, B, and T0.

R will be updated according to the data being used and the set temperature.



### I-V characteristics Measurement Panel:

This panel will be presented when “MEASURE I\_V CHARS” button is activated.



**LASER MODULE TYPE:** The module type will be carries from the previous panel.

**MIN Control Voltage:** The minimum voltage for sweep span, typically 0V.

**MAX Control Voltage:** The Maximum voltage for sweep span, could be up to 2.25V.

**STEPS:** Number of steps for the sweep span, typically 300-500 points.

**MODULE OFFSET CORRECTION (mA):** This will be carried from the previous panel.

**Cursors:** there are two cursors which could be used to spot check at different points of the curves.

**EXIT I-V SWEEP:** This will take you back to the previous panel.



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