



- Two versions; stand alone MOT705\_OEM and MOT705M\_OEM (micro control with LabVIEW GUI)
- Supports MOT700x and MOT300-25 TEC Controller modules
- Very small footprint (72 x 45mm)
- 3V to 5V operation
- Complete evaluation and verification solution
- Fully RoHs compliant



### Introduction:

The MOT705\_OEM has all the functionality of the MOT701\_OEM in a smaller footprint (72 x 44 mm). It also includes component footprint for a variable power supply for the Object board. This feature is not implemented normally unless it is requested when ordered.

The Object board can be used for test mounting the TEC, which includes a temperature feedback thermistor and diodes which can be driven by MOT705\_OEM to generate heat, simulating dissipation from a laser diode or other heat generating elements of the target system.

The MOT705\_OEM is designed to allow the user to quickly evaluate and implement a Thermoelectric Cooler (TEC) design based on the MOT700x and MOT3000 series TEC controller modules.

It can be used standalone (MOT705\_OEM) utilizing on-board potentiometers to set target temperature and monitor object temperature, TEC current and temperature alarm status.

The micro control version MOT705M\_OEM allows this TEC controller to be connected to a PC using USB interface. The various parameters can be controlled through a graphical user interface (GUI). The GUI will be described in full later in this document.

This User's Guide describes the various functions of the board, how to set it up and how to use it in a system.

**Please also refer to the MOT700x & MOT3000-25 series datasheet for further description of the module functionality.**



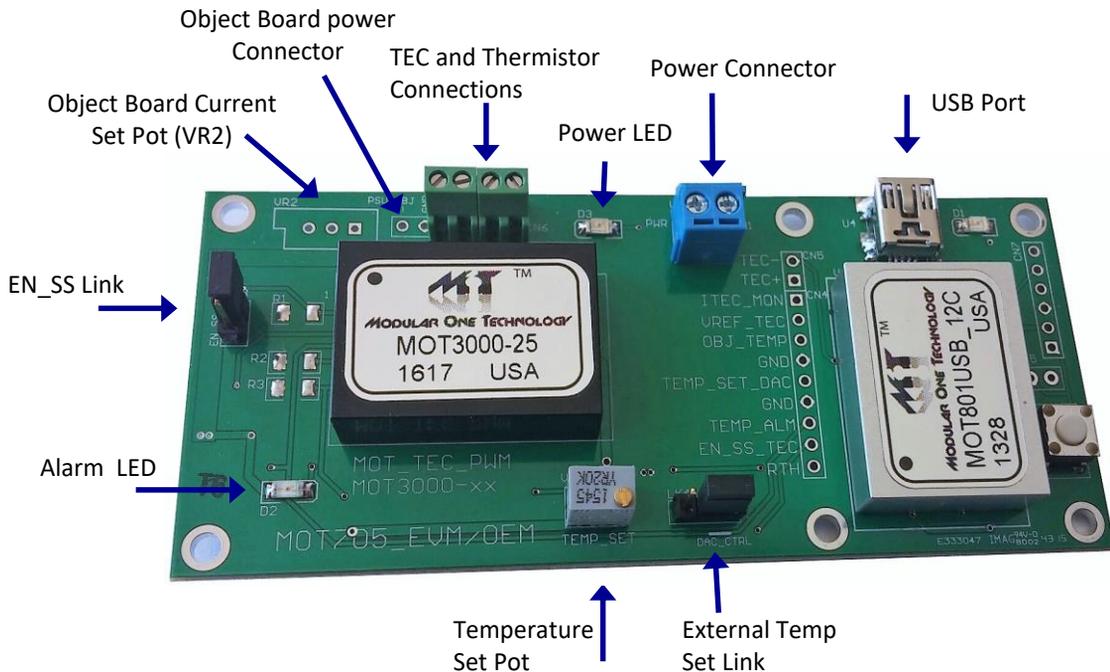
*Before applying power to the EVM please ensure that jumpers are set and that VMAX, IMAXP, and IMAXN is limited if required for your TEC. (see following pages)*



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### Component Identification



In MOT705\_OEM The Micro control section has been removed.



### Quick Start

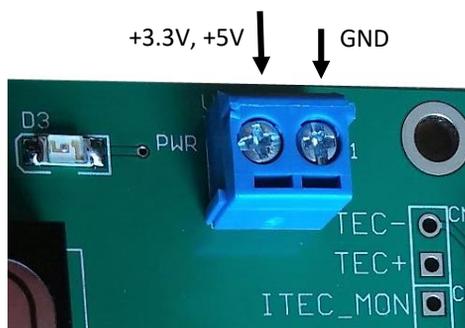
1. Verify the jumper settings:  
LK1: Leave open to enable the module  
LK2: In the default position uses VR2 to set temperature. Only move to the optional position if micro is to control the TEC controller.
3. Add R1 if necessary (default is open for maximum output voltage).
4. Add R2 and R3 if necessary (default is open for maximum positive & negative current)
5. Connect the TEC and thermistor and/or Object Board.
6. Attach the power supplies (*be sure to observe correct polarity – see below*) and **GO!**

*Note: The Alarm LED will light until the object temperature reaches the set value at which time the LED will go out – typically within 30 seconds*

### FUNCTIONAL DESCRIPTIONS

#### Power Supply

An appropriate power supply should be connected to CN1. The supply voltage may be from 3.3V to 5V as required. When supply voltage is present D3 will illuminate green



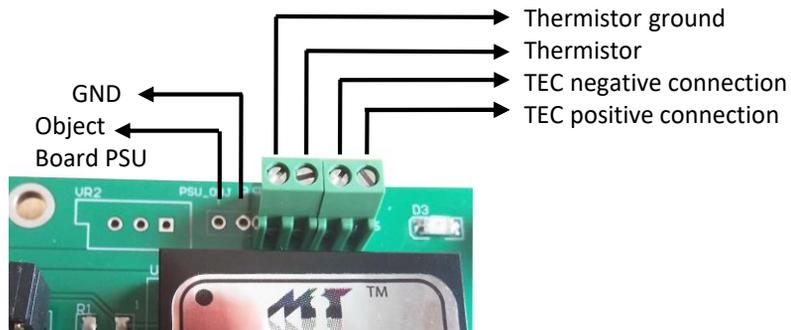


### TEC Connection

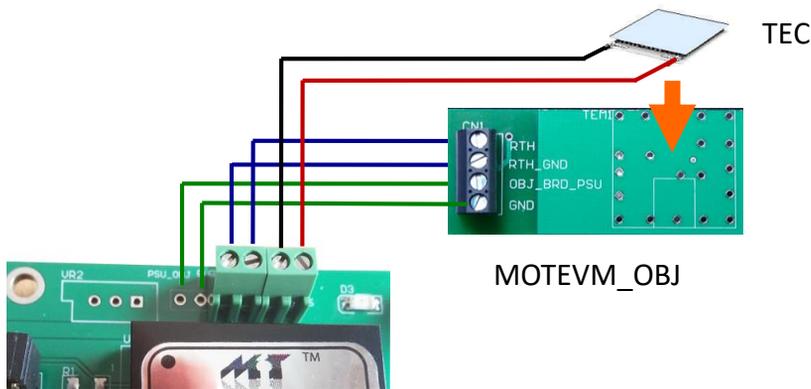
The TEC is connected via CN2. A temperature feedback thermistor connected to the object being controlled is also connected to CN2.

If the MOTEVM\_OBJ board is being used the thermistor is already installed on the board. In addition, series diodes on the board can be used as a dummy heat source.

The current through these diodes is set by VR2 and the connection to them is via CN2. (see MOTEVM\_OBJ Object Board)



### Connection to MOTEVM\_OBJ board



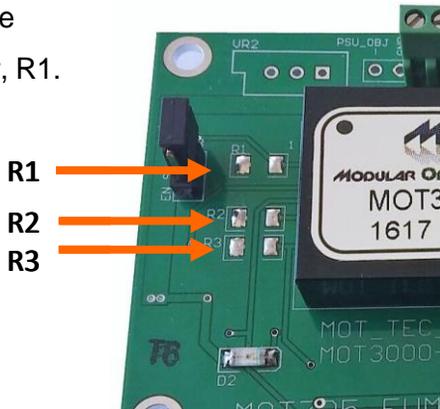
*Be sure to observe the correct polarity for connections to the TEC and the load diodes on the MOTEVM-OBJ board.*

*To verify TEC polarity monitor the voltage on the RTH terminal and the center pin on LK2 ( $V_{TEMP\_SET}$ ). The voltage at RTH should be moving towards  $V_{TEMP\_SET}$ . If it is moving away, towards 0V or 1.5V, then the connections are reversed.*



### Maximum Output Voltage

By default the MOT705\_OEM ships with the VMAX\_SET pin 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, R1.



See the MOT700x data sheet for calculating values for R1, R2, and R3.

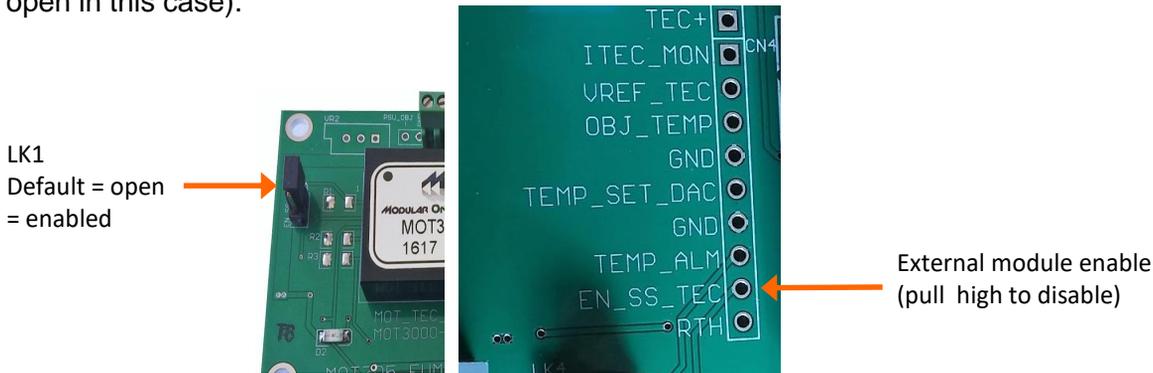
### Maximum Output positive & negative currents

By default the MOT705\_EVM ships with the IMAXP\_SET & IMAXN\_SET pin 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 a resistors, R2 and R3.

### Module Enable

By default the module will power up when a supply voltage is applied (an internal pull-up means the pin may be left open for normal operation). If it is desired to disable the module the EN\_SS pin should be connected to GND, which can be accomplished by closing LK1. When the link is removed the module will perform a soft start and resume operation.

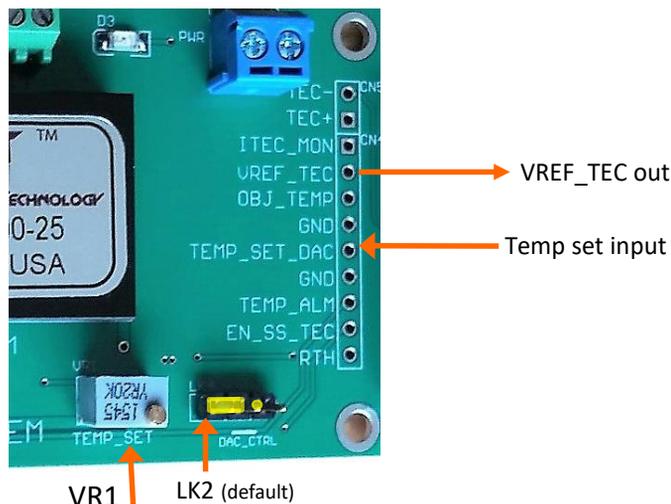
The EN\_SS signal line is also available on CN4 (inverted) if external control is required (LK1 must be open in this case).





### Temperature Setting

The required object temperature can be adjusted by means of VR1. LK2 should be set to the default position for this mode.



Alternatively the object temperature can be set by an external voltage applied to TEMP\_SET\_DAC on CN4. The reference voltage, VREF\_TEC, is also available on CN4 and can be used as a reference for an external DAC. In this mode LK2 should be altered to the optional position.

*Notes: Refer to the MOT700x data sheet for relationship between control voltage and object temperature.  
If no control voltage is applied to TEMP\_SET\_DAC internal biasing will set the temperature to approximately 25°C.*

### Temperature Alarm

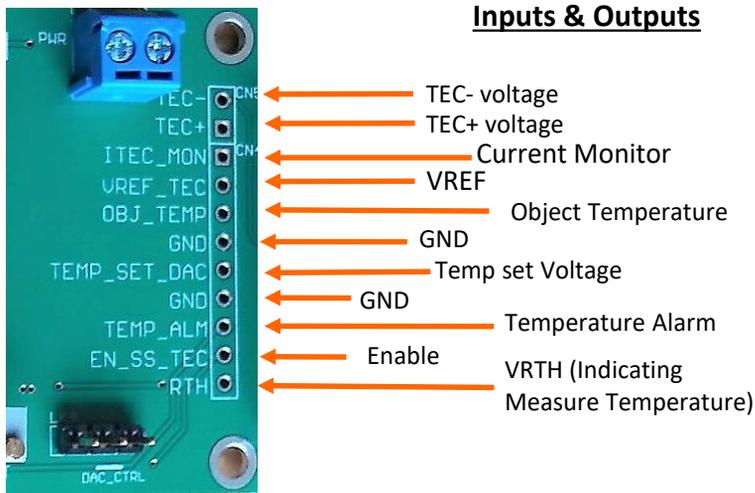
Internal circuitry monitors the object temperature and will set an alarm flag when the temperature deviates by more than +/- 1.5° C. D2 will illuminate red when the alarm is set. The alarm status can also be monitored via TEMP\_ALM at CN4.

Once the temperature returns to within limits the flag will automatically reset (D2 will go off).



### 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 TEC controller module is connected to a host controller. For convenience these are grouped together on CN4.



#### Current Monitor

An analog voltage representing the output current to the TEC.

#### VREF\_DAC

Reference voltage output (1.5V).

#### Object Temperature

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

#### Temperature Set Voltage

An analog voltage to set the object temperature. Values from 0 – 1.1V may be applied.

*Note: The actual “usable” range of voltage will be somewhat less according to the desired set temperature and module characteristics – see MOT700x / MOT3000-25 data sheet.*

#### Temperature Alarm

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

#### Enable / Softstart

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



### MOT705M\_OEM

This version of the TEC controller board incorporates our USB to I2C converter Module (MOT801USB\_I2C) which allows a LabVIEW GUI to control the TEC controller. Through this interface you can set the object Temperature, monitor TEC current, TEC



Voltage, and measure the object temperature. The set temperature can be programmed into an integrated EEPROM. This feature allows power cycling whilst maintaining the last programmed temperature setting. The temperature setting DAC is powered through the main board power supply in order to maintain the set temperature when the USB is disconnected.

**MOT705M\_OEM GUI**      USB PORT: USB0:

**TEC Module Control**

- Enable TEMP\_SET
- 25 TEMP\_SET (deg C)
- Write TEMP\_SET to EEPROM
- Disable Module Output

**Thermistor Characteristics**

- Modify Thermistor Data
- Ro = 10000
- B = 3380
- To = 298.15
- R = 1E+4

**Measured Results**

- 24.562 ACTUAL TEMP SET (deg C)
- 24.562 TEMP\_MEASURED (deg C)
- 2.747 TEC+ (V)
- 2.45 TEC- (V)
- 0.297 TEC Diff (V)
- 1.509 VREF TEC (V)

+/- 1.5 deg C TEMP WINDOW ALARM

**EXIT PROGRAM**



### GUI descriptions:

#### USB Port Selection

A drop down menu allows selection of the USB port.

#### Thermistor Data:

Thermistor data required to be input to The GUI. The resistance and temperature characteristics of a thermistor can be approximated by following equation.

$$R=R_o \exp \{B(1/T-1/T_o)\}$$

R = Resistance at absolute temperature T (K).

R<sub>o</sub> = Resistance at 25°C temperature T<sub>o</sub> (K)

B = B value

$$T(K)= t(^{\circ}C)+273.15$$

#### Set Temperature:

The required object temperature is set in °C . This set temperature is communicated through the GUI and used to set a DAC value. The DAC output will appear at the “TEMP\_SET\_DAC” pin of the TEC controller module. This output is slightly different from the temperature intended to be set due to inaccuracies in the DAC. The actual temperature set at the DAC output is measured and presented as “Actual TEMP SET” in the GUI.

#### Measured Results:

Presented in this section are; actual TEMP\_SET, object temperature, TEC+,TEC- and the differential voltage across the TEC. Reference voltage is also measured and presented in this section.

Following the set up of thermistor parameters and required temperature, the output has to be enabled to start the GUI.

A +/-1.5 °C alarm window will be illuminated if the measured temperature is outside this window.

This alarm will go off within a few second as the object temperature reaches the actual set temperature.

#### GUI files and set up:

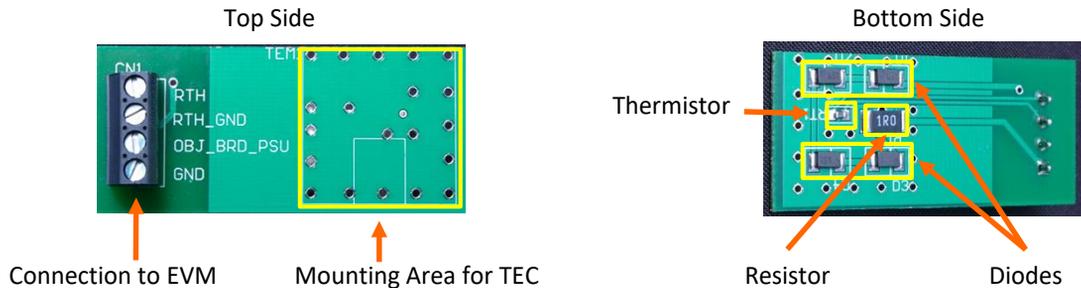
The files and installation instructions will be provided following the purchase of MOT705M\_OEM.



### MOTEVM\_OBJ Object Board

This board is provided as a convenient way to evaluate system characteristics when using a MOT700x TEC Controller module with an appropriate Thermoelectric Module (TEC).

The board includes an area for mounting a TEC, and immediately underneath a 10K thermistor for temperature sensing. To simplify evaluation of system performance under various temperature / power dissipation conditions a series of diodes and a resistor on the board act as a heat source.



Designed to easily interface to the MOT705\_EVM (see page 4), the current through the diodes and resistor, and hence power dissipation, can be conveniently adjusted via VR2.

For 3.3v operation:

Min current = 34mA, power dissipation = 43mW

Max current = 205mA, power dissipation = 336mW

For 5V operation:

Min current = 60mA, power dissipation = 80mW

Max current = 370mA, power dissipation = 707mW

*Note: For further information on using the Object Board please refer to application brief MOT7000ABr7, "Thermal Considerations when using the MOTEVM\_OBJ Object Board"*





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