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## EVAL-L99H02QF and EVAL-L99H02XP GUI

### Introduction

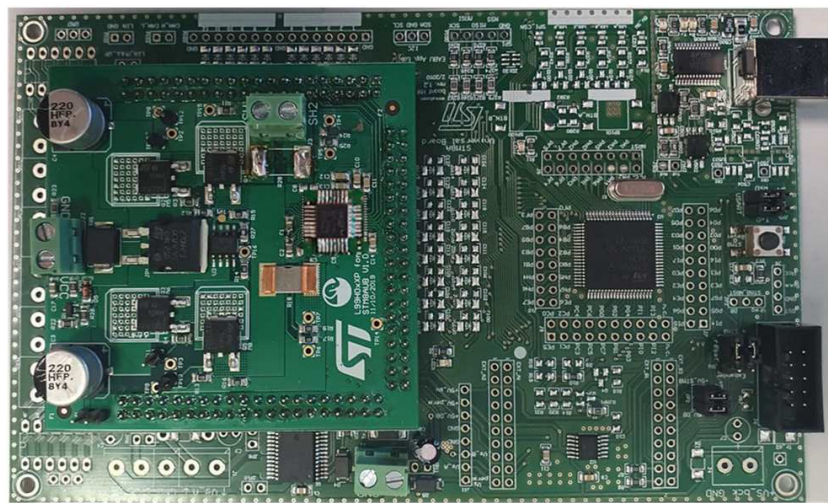
The EVAL-L99H02QF and the EVAL-L99H02XP are two evaluation boards designed to control 4 external N-channel MOS transistor in bridge configuration for DC-motor driving in automotive applications.

## 1 EVAL-L99H02QF and EVAL-L99H02XP boards

The EVAL-L99H02QF and EVAL-L99H02XP are composed by a motherboard and a daughterboard on which is pre-assembled the L99H02QF (LQFP32, see the [Figure 1](#)) or L99H02XP (PowerSSO-36, see the [Figure 2](#)). The system features an enhanced power management power supply functionality including various standby modes. The motherboard, based on STM8 microcontroller, provides the logic section for monitoring and driving the L99H02 assembled in the daughterboard.

With the aim to make the board usage and setting simpler, STM provides a dedicated Graphic User Interface (GUI). This enables the user to set L99H02 parameters and at the same time it shows real time device information.

**Figure 1. EVAL-L99H02QF**



**Figure 2. EVAL-L99H02XP**

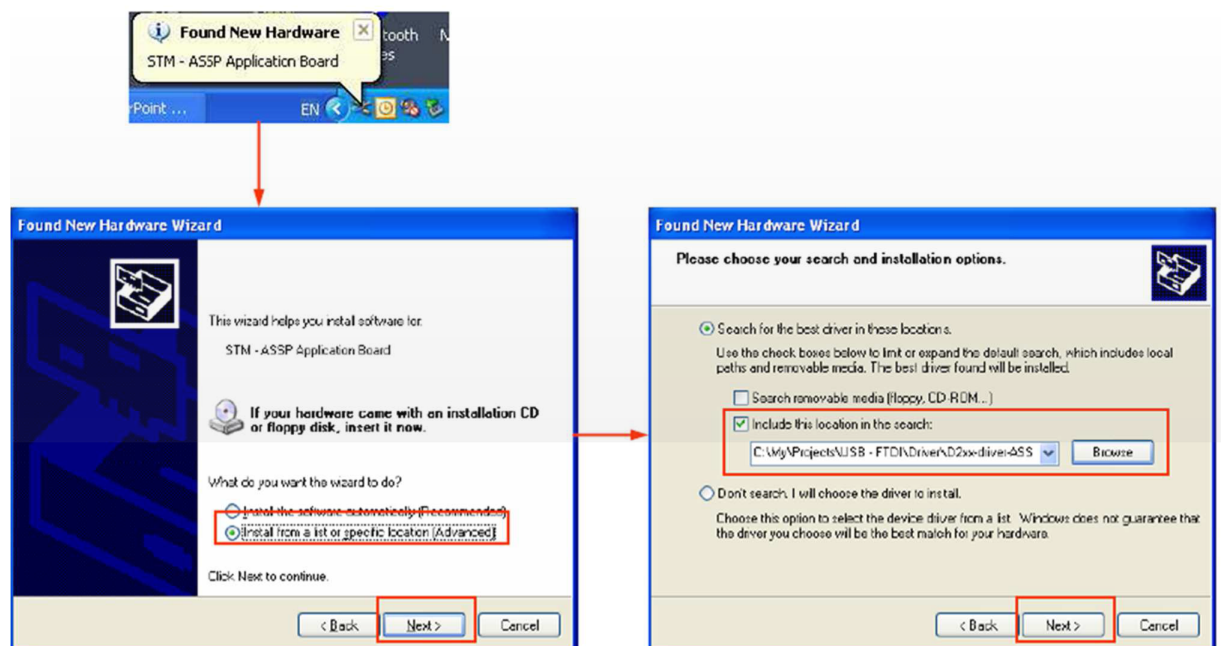


## 2 Application boards connection

When an EVAL-L99H02QF or EVAL-L99H02XP application board is connected for the first time to a PC the "Found New Hardware" message appears (see the Figure 3) and consequently, the wizard to install the driver for the new hardware is opened.

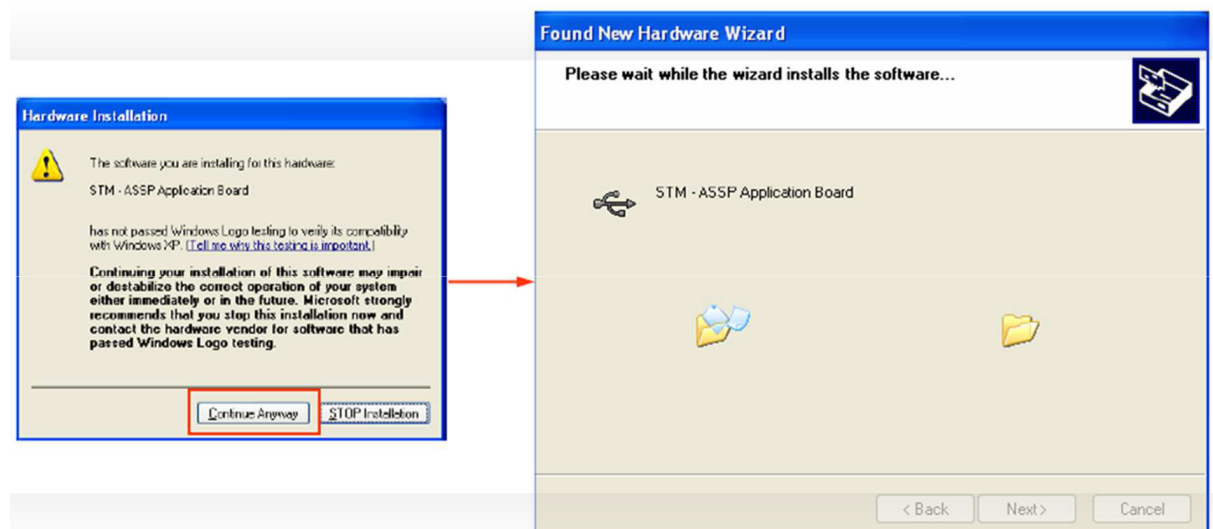
The software for the STM - ASSP Application Board must be installed from a specific location as described in the below picture.

Figure 3. Application board connection



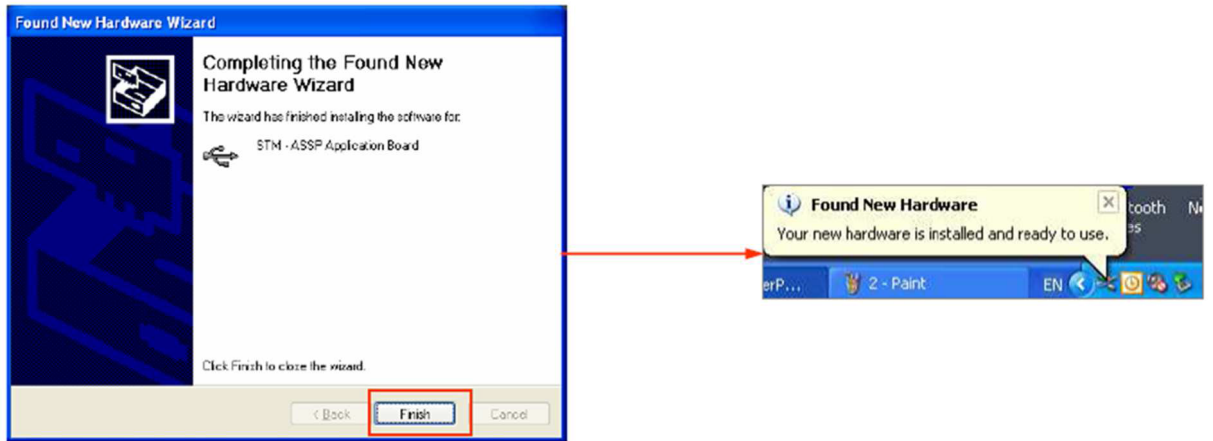
After the correct firmware is located, the hardware installation popup appears (see the Figure 4) because the firmware has not passed the Windows Logo just to verify the compatibility with the Windows operative system. In this case the "Continue Anyway" button must be pressed to proceed with the installation.

Figure 4. New hardware installation



When the installation is finished the new hardware will be recognized from the PC (see the [Figure 5](#)).

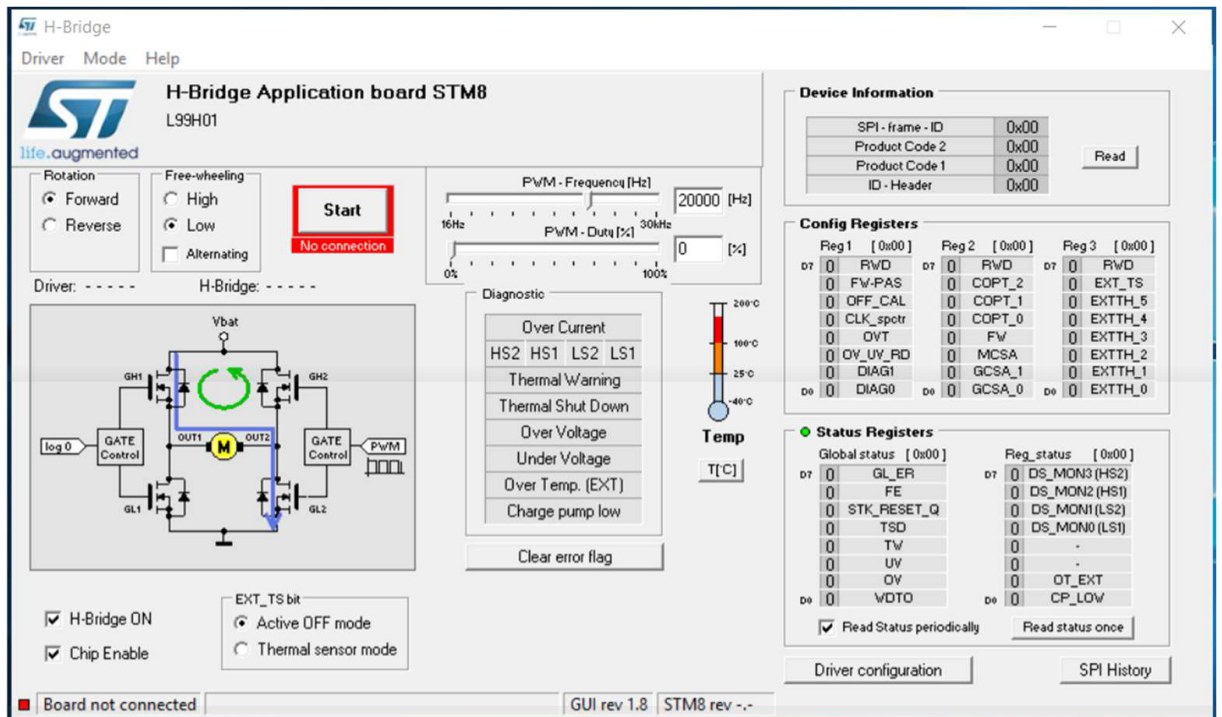
**Figure 5. Installation finished**



### 3 Graphical User Interface (GUI)

The Graphical User Interface (GUI) designed to drive the L99H02QF or L99H02XP devices must not be installed. An executable file is released from ST to open the GUI (see the Figure 6).

Figure 6. Graphical user interface (GUI)



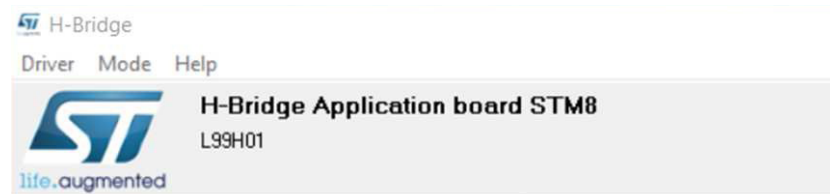
All the commands needed to program and drive the application board are available in a single screen, but they are divided in sections.

#### 3.1 Menu section

The menu is composed of three drop-down menus:

- *Driver*: manual choose of driver; a single choice is allowed in this menu.
- *Mode*: Online/Offline working mode.
- *Help*: information about supported device.

Figure 7. Menu section

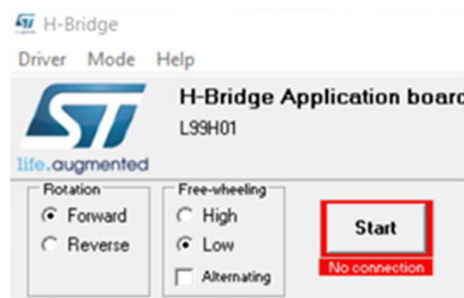


### 3.2 Motor control section

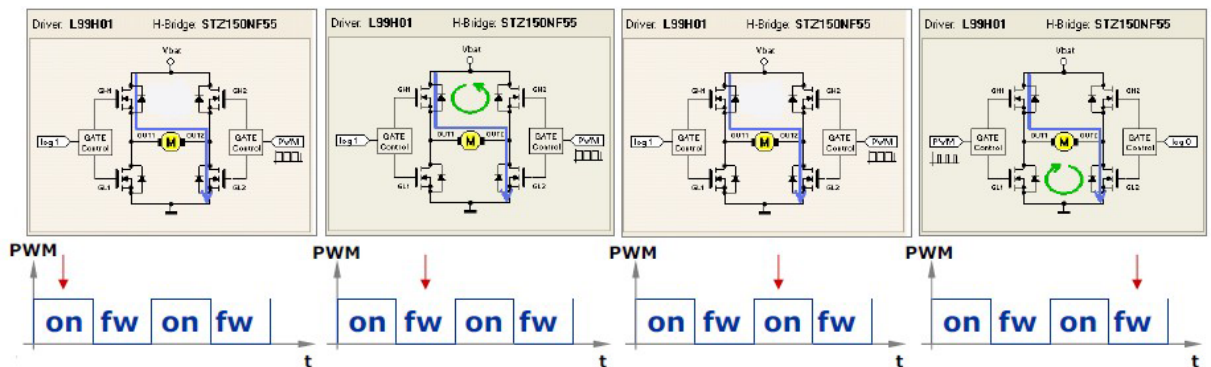
In the motor control section (see the [Figure 8](#)), the following choices can be made:

- *Motor rotation*: the direction of rotation of the motor, forward or reverse, can be established.
- *Free-wheeling*: it is programmable by SPI. Selecting the "Alternative" check box the correspondent bit in the configuration register will be switched continuously from 0 (low side free-wheeling) to 1 (high side free-wheeling) in order to reduce power MOS ageing and evenly distribute the power dissipation among 4 power MOSFET (see the [Figure 9](#)).
- *Start button*.

**Figure 8. Motor control section**



**Figure 9. Alternative free-wheeling**



### 3.3 Configuration/status registers and driver configuration section

After start-up of GUI, all the configuration registers (Reg1, Reg2 and Reg3, see the [Figure 9](#)) of L99H02 will be set. If the "Config.txt" file is available than the values of Reg1, Reg2 and Reg3 are loaded from Config.txt file, otherwise predefined values are used.

Disabling the device by "Chip Enable" (see the [Figure 10](#)) cause reset of all configuration registers. It means that Reg1, Reg2 and Reg3 will be set to zero.

Figure 10. Configuration and status registers

The screenshot shows the H-Bridge GUI for an STM8 application board. The 'Config Registers' section is highlighted with a red box and contains the following data:

Reg1 [0x00]	Reg2 [0x00]	Reg3 [0x00]
D7: 0 RVD	D7: 0 RVD	D7: 0 RVD
D6: 0 FW_PAS	D6: 0 COPT_2	D6: 0 EXT_TS
D5: 0 OFF_CAL	D5: 0 COPT_1	D5: 0 EXTTH_5
D4: 0 CLK_sptr	D4: 0 COPT_0	D4: 0 EXTTH_4
D3: 0 OVT	D3: 0 FV	D3: 0 EXTTH_3
D2: 0 OV_UV_RD	D2: 0 MCSA	D2: 0 EXTTH_2
D1: 0 DIAG1	D1: 0 GCSA_1	D1: 0 EXTTH_1
D0: 0 DIAG0	D0: 0 GCSA_0	D0: 0 EXTTH_0

Below the Config Registers, the Status Registers section is also visible:

Global status [0x00]	Reg_status [0x00]
D7: 0 GL_ER	D7: 0 DS_MON3 (HS2)
D6: 0 FE	D6: 0 DS_MON2 (HS1)
D5: 0 STK_RESET_Q	D5: 0 DS_MON1 (LS2)
D4: 0 TSD	D4: 0 DS_MON0 (LS1)
D3: 0 TV	D3: 0
D2: 0 UV	D2: 0
D1: 0 OV	D1: 0 OT_EXT
D0: 0 VDTO	D0: 0 CP_LOV

If the "Config.txt" file is not present the Reg1, Reg2 and Reg3 registers are set with the following values (see the [Figure 11](#)):

#### Reg1 → 0x0F

- Offset Calibration mode for CSA: disabled
- Over Voltage threshold of the Vs Monitoring: 29 V
- Over/Under Recovery Disabled: ON
- Drain-Source Monitoring threshold voltage: 2 V

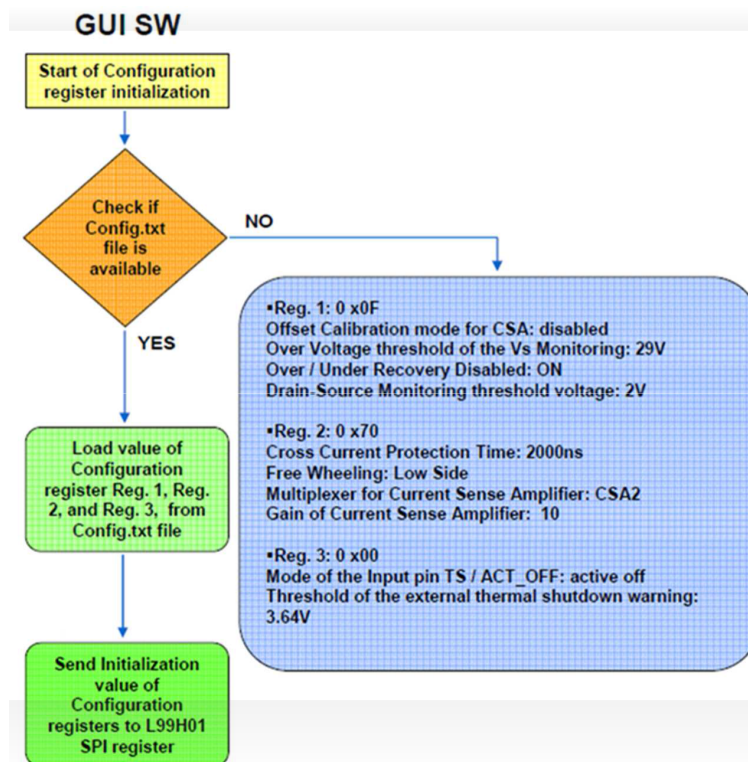
#### Reg2 → 0x70

- Cross Current Protection Time: 2000 ns
- Free Wheeling: LowSide
- Multiplexer for Current Sense Amplifier: CSA2
- Gain of Current Sense Amplifier: 10

#### Reg3 → 0x00

- Mode of the Input pin TS/ACT\_OFF: active off
- Threshold of the external thermal shutdown warning: 3.64 V

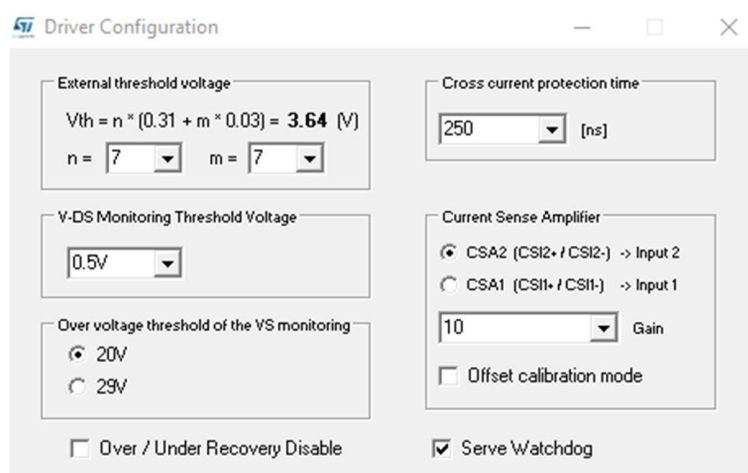
Figure 11. Start-up algorithm



Pushing the button "Driver configuration" a new window appears (see the Figure 12). The following parameters of the driver can be set in this window:

- *External threshold voltage*: in this block the external thermal sensor threshold voltage  $V_{th}$  is set.
- *V-DS Monitoring Threshold Voltage*: in this block the MOSFET drain - source monitoring threshold voltage (short circuit detection) is set.
- *Over voltage threshold of the VS monitoring*: in this block the VS monitoring threshold voltage is set
- *Cross current protection time*: this value can be set from 250 ns to 2000 ns.
- *Current sense Amplifier*: in this block the measurement input selection is chosen. Also, the current gain of the chosen amplifier is set.
- *Over/Under recovery Disable*.
- *Serve Watchdog*.

Figure 12. Driver configuration



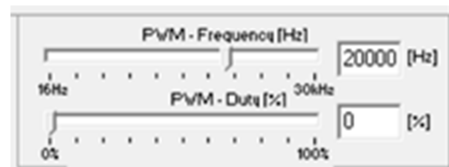


### 3.4 PWM control section

A PWM control section has been implemented in the GUI to set:

- *Frequency*: from 16 Hz to 30 kHz
- *Duty Cycle*: from 0% to 100%

Figure 13. PWM control

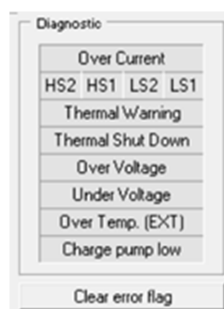


### 3.5 Diagnostic section

A section has been dedicated to the diagnostic of the L99H02 devices. The following parameters are controlled:

- *Over current detection*: in case a short circuit on power switches occurs, the over current field and the relative indicator turn red to indicate in which device the failure has been found.
- *Over/Under voltage*: if the driver's supply voltage  $V_s$  either rises above or drops below the voltage threshold the relative indicator turns red. The over voltage threshold level can be selected in the driver configuration window.
- *Charge pump low*: if the charge pump output voltage remains too low for longer than TCP filter time, the indicator turns red. The CP\_LOW bit must be cleared through a software reset pressing the "Clear Error Flag" button to reactive the gate drivers.
- *Thermal Warning/Shut Down*: if junction temperature of L99H02 raises above the first threshold ( $T_{JTW}$ ) a temperature warning indicator (Thermal Warning) is turned to red. If junction temperature increases above the second threshold ( $T_{JSD}$ ), the thermal shutdown indicator will turn to red.
- *Over Temp(EXT)*: in thermal sensor interface external diodes can be used to control the temperature of the H-Bridge. When the internal diodes forward voltage decreases below the reference voltage the indicator will be turned on.
- *Clear Error Bit*: the microcontroller needs to clear the status bits to reactive the driver which once an SPI. Press this button to reset the driver when failure occurs.

Figure 14. Diagnostic section



The TS/ACT\_OFF pin of the L99H02 is configurable by SPI with the EXT\_TS bit (see the Figure 15). This pin could be used as temperature sensor interface for the H-Bridge or external off for all the gate drivers.

The TS/ACT\_OFF pin is directly connected to the "H-Bridge ON" box (see the Figure 10):

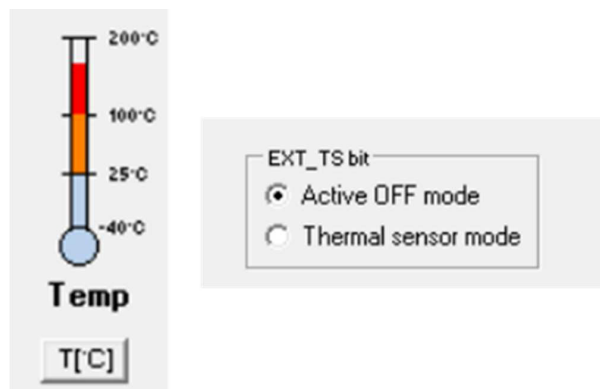
- If the "H-Bridge ON" check box is unchecked then the micro is pulling down the TS/ACT\_OFF pin. In this case:
  - If the bridge is switched off with "EXT\_TS" bit sets in "Active OFF mode", this will be indicated in the "Diagnostic" window. The bridge can be switched on again with "H-Bridge ON" check box
  - If the bridge is switched off with "EXT\_TS" bit sets in "Thermal sensor mode", this will be indicated in "Diagnostic" window. The bridge can be switched on again with "H-Bridge ON" check box and clearing the Error flag bit.

- If the check box is checked the micro output is in tristate

With the "H-Bridge ON" (see the [Figure 10](#)) checked, the EXT\_TS bit can be set as following:

- *EXT\_TSbit = 0*: pulling the TS/ACT\_OFFpin below the programmed threshold all the gate driver are switched off. The threshold is programmable by SPI with the register EXTTH\_5:0. In this mode no filter time is activated. In this case the OT\_EXT bit (see the [Figure 14](#)) is set. Increasing the voltage at TS/ACT\_OFF pin above the programmed threshold the device will remain to the status set by DIR and PWM pins. In this case the OT\_EXT bit (see the [Figure 14](#)) is reset.
- *EXT\_TSbit = 1*: with the thermal sensor interface external diodes can be used to control the temperature of external H-Bridge. A bias current of 205  $\mu$ A is sourced through the diodes and the resulting forward voltage is compared with an internal reference voltage. When the diode forward voltage decreases below the reference voltage the OT\_EXT bit (see the [Figure 14](#)) will be set. This reference voltage can be programmed with 6 bits. 3 bits (coarse) are intended for the number of diodes and the other 3 (fine) are intended for the threshold level. The OT\_EXT bit (see the [Figure 14](#)) will switch all gate drivers in sink condition (the external H-Bridge is switched off).

**Figure 15. EXT\_TS bit and temperature sense**



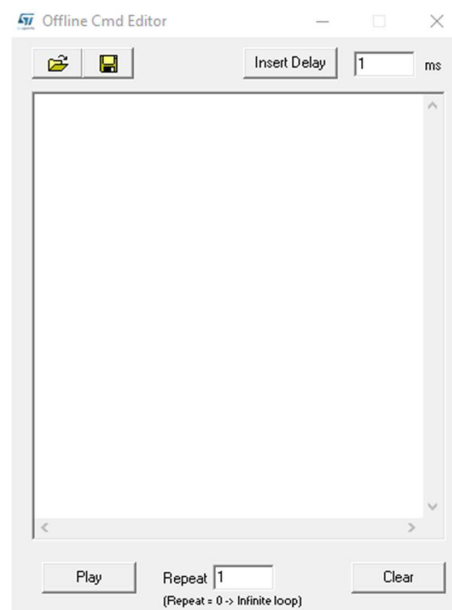
A temperature sense panel (see the [Figure 15](#)) is also present on the GUI. It shows the measurement of power board temperature, close to H-bridge location. The sensor (LM235DT) is located on the bottom side of the power board connected to the VNH7013 through thermal via holes.

### 3.6 Offline command editor window

The "Offline CMD Editor" (see the Figure 16) can be open from the "Mode" menu. In the "Offline CMD Editor" the following parts can be found:

- *Load & Save*: commands to load or save to text file.
- *Offline editor*: in offline mode the commands are copied automatically to this text box by clicking on buttons in main window.
- *Play*: send commands to microcontroller and play them
- *Delay*: insert delay between commands.
- *Repeat*: number of cycles to be repeated.
- *Clear*: clear editor.

Figure 16. Offline command editor window



## Revision history

**Table 1. Document revision history**

Date	Version	Changes
09-Sep-2021	1	Initial release.

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