ON Semiconductor®

Test Procedure for the LV8121VGEVK Evaluation Board

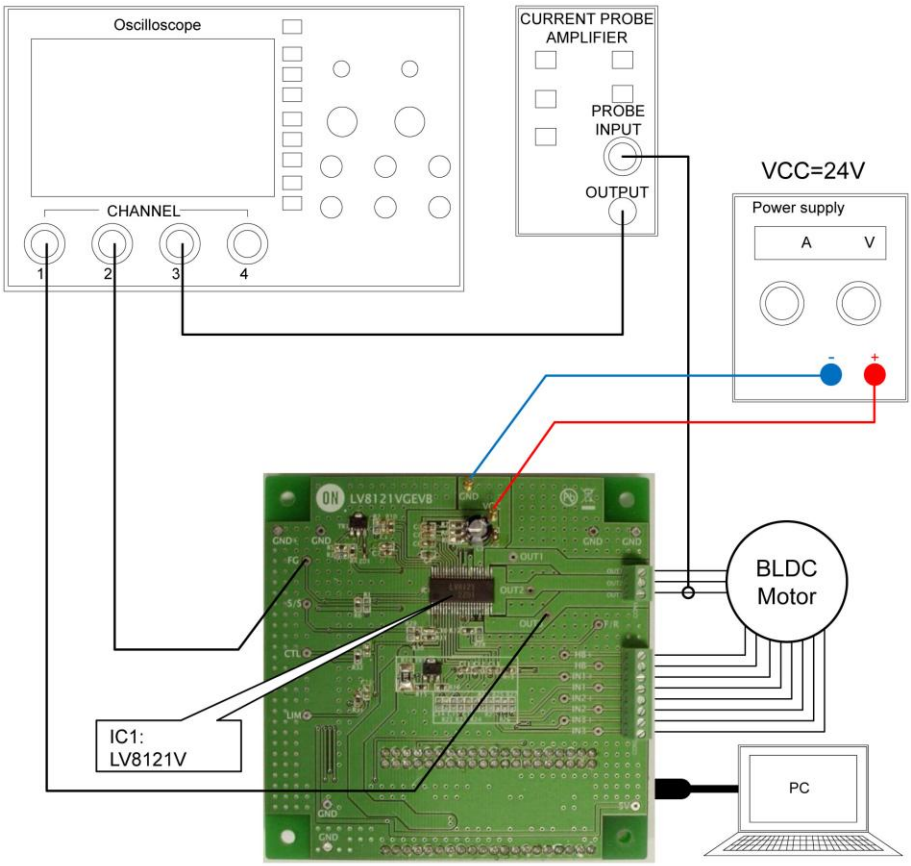


Figure 1. Setup for motor control

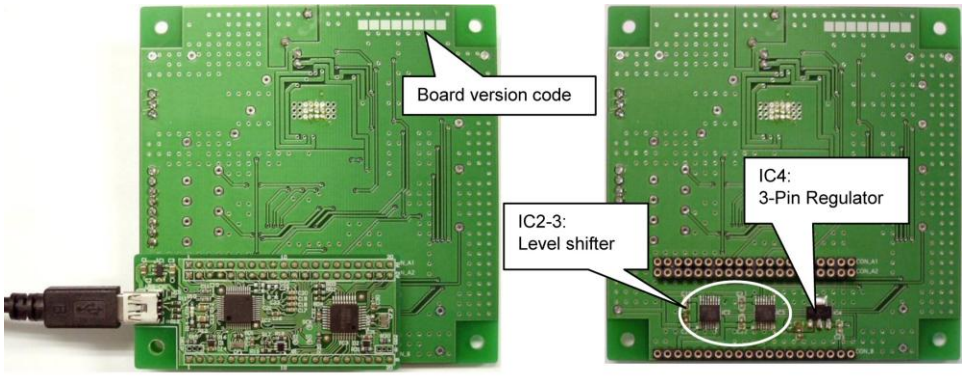


Figure 2. Bottom view of the Evaluation Board

Table1: Reference Equipment

Equipment	Specifications
DC Power supply	30V-2.0A
Oscilloscope	3 channel
BLDC Motor	3-phase brushless motor with built-in Hall elements, 24V-1A
Current probe	
LV8121VGEVB Evaluation Board	
MOTOR DRIVER DAUGHTER BOARD	
USB Type A to Type mini-B cable	
PC with M-DrAGON* GUI installed	32bit: Windows XP(SP3) / 7 / 8 64bit: Windows 7

* It means "Motor- Driver And GUI produced by ON semiconductor".

Description of the Evaluation Board

Supply voltage (VCC): 8 to 30V*

* The upper side N-channel power FET is turned off when VCC rises above about 32.0V because the maximum voltage of VG is limited to about 36.7V by using Zener diode, NPN transistor and some resistors. (See P.14/23 of the application note) Therefore, it is necessary to be used below 30V.

PWM frequency: fPWM = 1 / (28900 x C) = 1 / (28900 x 1800pF) = 19kHz
(See P.13/23 of the application note)

Current limiter: I = VRF / Rf = 0.25V / 0.17Ω = 1.47A
(See P.14/23 of the application note)

Constraint protection: TCSD1 = 8.21 x C [μF] = 8.21 x 0.047 = 0.39sec
TCSD2 = TCSD1 x 15 = 0.39 x 15 = 5.8sec
(See P.15/23 of the application note)

Hall input signal:
It is necessary to adjust R13, R16 to the values matched with a characteristic of Hall element because the input DC voltage must be set within the common mode input voltage range. (See P.19/23 of the application note)

Hall IC application:
When we provide the Evaluation Board, it is mounted peripheral parts for Hall elements. If you drive the Brushless DC motor with Hall ICs, please remove Tr.2, R13-16, C11-13 and mount R20-27, C14-16. (See P.19/23 of the application note)

DSP application:
When you control LV8121V by DSP, remove the Daughter Board and R32. Then, apply each signal to CTL, LIM, S/S, F/R terminal pads.

Test Procedure

- Connect the test setup as shown Figure 1.
- It is important to follow the order shown for starting the system:
  1. Plug a USB cable into the Daughter Board.
  2. Start up the GUI for LV8121.
  3. Apply input voltage to the terminal pad "VCC".
  4. Apply drive signals with GUI (See the following pages).

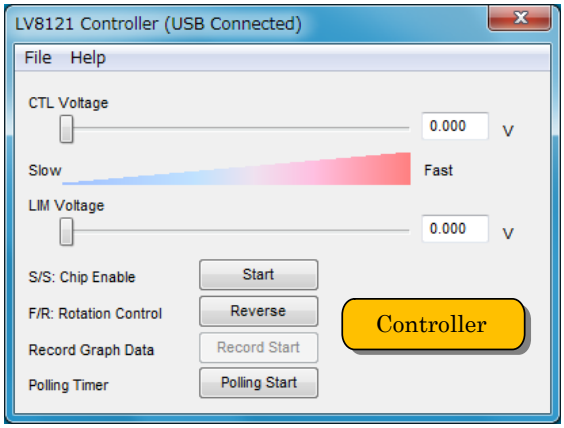
* Always remove VCC before unplugging the Daughter Board.

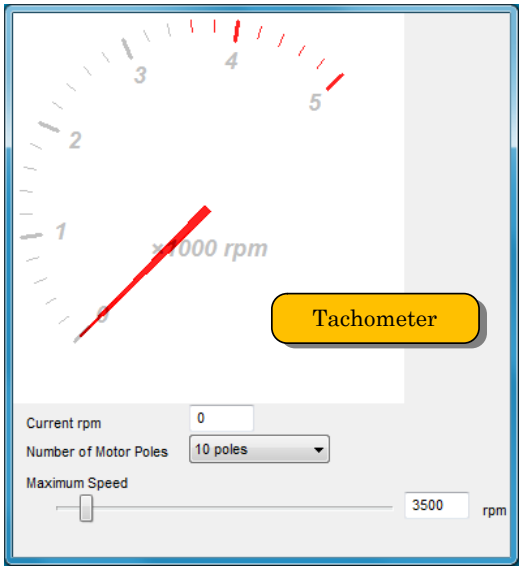
GUI Operation

Figure 3. The first window of M-DrAGON

When you double click the icon, the above window appears.

1. Select "BLDC" in Motor Type.
2. Select "LV8121" in Driver type.
3. Push the "OK" button.
4. The following windows should appear:





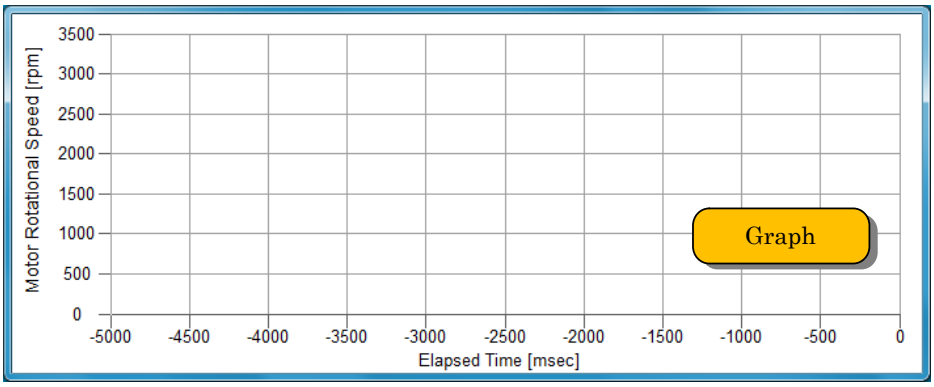


Figure 4. GUI windows for LV8121V

- Controller window

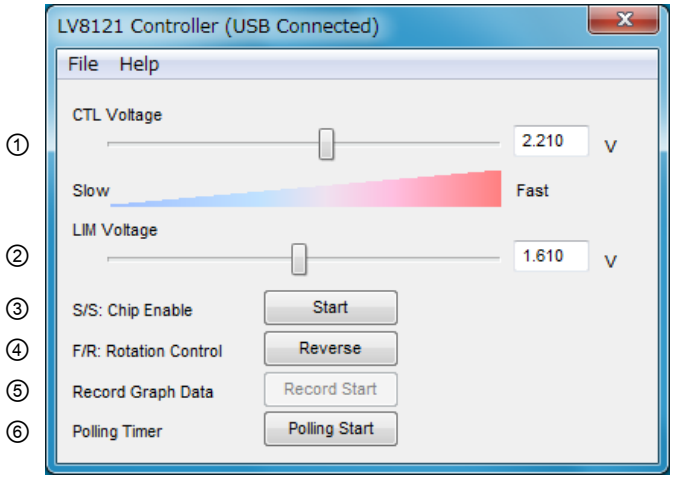


Figure 5. Controller window

① CTL Voltage : Please drag & slide the bar. It can control the CTL voltage.
The monitoring result of the CTL voltage is displayed in the box.
The output duty is changed by the CTL voltage. The motor speed is controlled by changing the output duty according to the CTL voltage.
(See P.13/23 of the application note)

② LIM Voltage : Please drag & slide the bar. It is possible at stop mode. It can control the LIM voltage.
The monitoring result of the LIM voltage is displayed in the box.
A minimum output duty is set by the LIM voltage.
(See P.13/23 of the application note)

③ S/S : This is start / stop switching button.
When this button is pushed, the S/S voltage is switched.

- If "Start" is displayed, the S/S voltage is the high level (stop mode).
- If "Stop" is displayed, the S/S voltage is the low level (start mode).

(See P.14/23 of the application note)

④ F/R : This is forward / reverse switching button.
When this button is pushed, the F/R voltage is switched. It is possible at low speed while the motor is rotating. The threshold is 1000rpm or 35pps.

- If "Reverse" is displayed, the F/R voltage is the low level.
- If "Forward" is displayed, the F/R voltage is the high level.

(See P.14/23 of the application note)

⑤ Record Graph Data : This is a function to save the data of speed into a file sequentially. Time and date, counts, pps, rpm are saved in MS-Excel CSV file.

The following operation is necessary beforehand.

1. Select “File” from the menu of “Controller window”.
2. Select “Export Speed graph data” from a selection.
3. “Save graph data window” appears. Input a file name. Then, select "save".

- If "Record Start" is displayed, the data of speed are not recorded.
- If "Record End" is displayed, the data of speed are recorded.

⑥ Polling Timer : This is a function to monitor the CTL voltage, the LIM voltage, the FG pulse frequency.

- If "Polling Start" is displayed, the monitoring results are not updated.
- If "Polling Stop" is displayed, the monitoring results are updated sequentially.

- Tachometer window

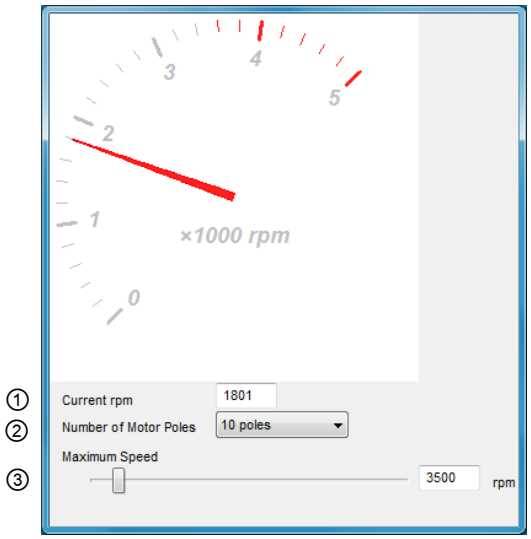


Figure 6. Tachometer window

① Current rpm : This displays the data of speed.
The calculation formula is given below.

$$rpm = \left(f_{FG} \times \frac{2}{N} \right) \times 60$$

* f_{FG} = FG pulse frequency
* N = ② Number of Motor poles

② Number of Motor Poles : Select the number of poles of the connected motor.
If you don't know the number of motor poles, select "N/A".
When "N/A" is selected, “Current rpm” is changed to “Current pps”.
“pps” is the same as FG pulse frequency (Hz).

③ Maximum Speed : Please drag & slide the bar, or input a numerical value directly in a box.
It can adjust the range of tachometer and the axis of graph window.

- Graph window

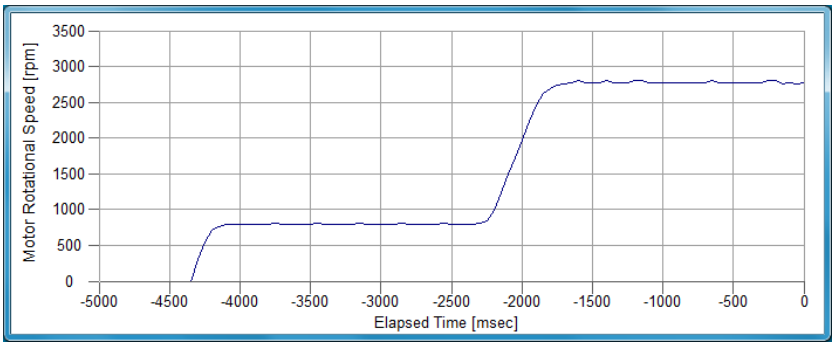


Figure 7. Graph window

This graph displays the data of speed along the elapsed time.
The data of speed is the same as tachometer window.

Table 2: Example 1

INPUT	OUTPUT
VCC= 24V (Power Supply) CTL= 2.26V, Output duty= 50% F/R= forward	Motor rotational speed = 1520rpm

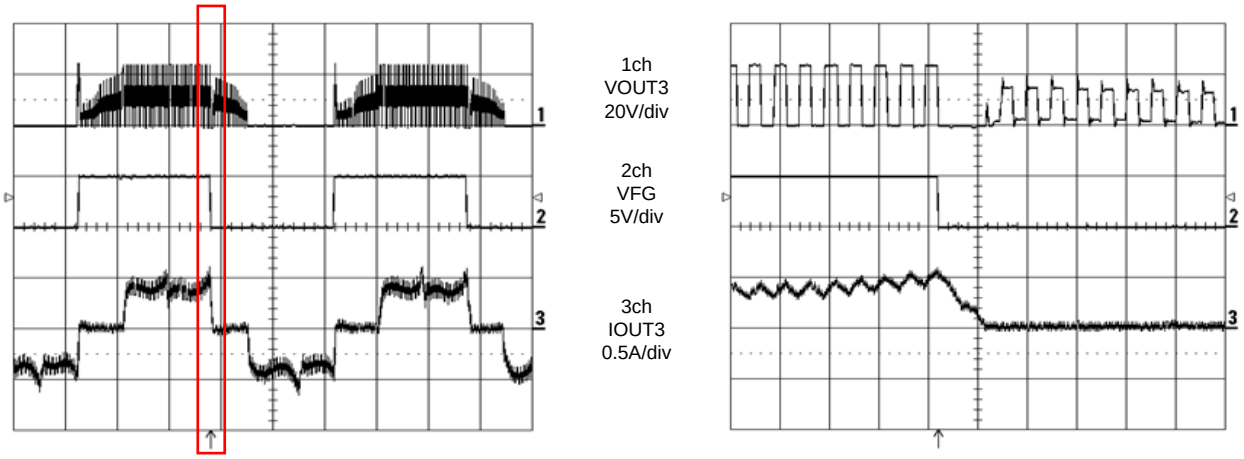


Figure 8. The image of waveforms for example 1

Table 3: Example 2

INPUT	OUTPUT
VCC=24V (Power Supply) CTL= 3.29V, Output duty= 100% F/R= forward	Motor rotational speed = 3270rpm

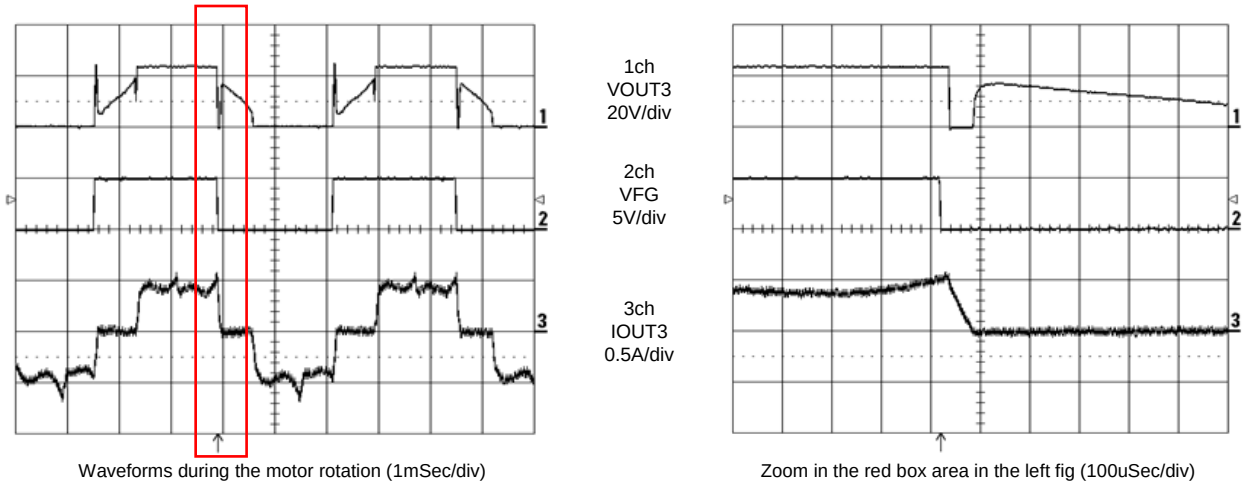


Figure 9. The image of waveforms for example 2

Cautions

• This system is intended for an initial evaluation of LV8121V. We will not guarantee measured values as full evaluation. The validation must be performed on your system independently.

• Never carry the motor with the lead wire or shaft. Affix the motor on a pedestal prior to operation.

• Attach the motor leads prior to applying power.

Safety

• Do not touch the rotating part when the motor is powered. Doing so may result in injury.

• Do not touch conductive parts such as connectors when the motor is powered. Doing so may result in electric shocks.

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Телефон: 8 (812) 309-75-97 (многоканальный)
Факс: 8 (812) 320-03-32
Электронная почта: ocean@oceanchips.ru
Web: http://oceanchips.ru/
Адрес: 198099, г. Санкт-Петербург, ул. Калинина, д. 2, корп. 4, лит. А