TMC5031-EVAL Evaluation Board

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The TMC5031-EVAL allows evaluation of the TMC5031-LA in combination with the TRINAMIC evaluation board system, or as stand-alone-board. It uses the standard schematic and offers several options in order to test different modes of operation.

Features

1.1A coil current

controller

SPI Interface

Guard2™

StallGuard2[™]

CoolSter

1...256 microsteps



Applications

- Battery operated equipment
- Printers, POS
- Miniature 3D Printers
- Toys
- Office and home automation
- CCTV, Security
- HVAC
- Mobile medical devices

Motor 1

Motor 2

• Lab automation

• Two 2-phase stepper motors up to

• Integrated **SixPoint**[™] ramp motion

• Supply Voltage 7...18V DC

• 2x Ref.-Switch Inputs per axis

· Stall detection using sensorless Stall-

SpreadCycle[™] smart mixed decay



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2x Ref Switches





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1 Getting Started

You need

- TMC5031-EVAL
- Landungsbruecke or Startrampe with latest firmware (We recommend the Landungsbruecke as it offers faster USB communication.)
- Eselsbruecke bridge board
- 2x Stepper motor (e.g. QMot line)
- USB interface
- Power Supply
- Latest TMCL-IDE V3.0 and PC
- Cables for interface, motors and power

Precautions

- Do not mix up connections or short-circuit pins.
- Avoid bundling I/O wires with motor wires.
- Do not exceed the maximum rated supply voltage!
- Do not connect or disconnect the motor while powered!
- START WITH POWER SUPPLY OFF!



Figure 1: Getting started



1.1 First Start-Up

- 1. Make sure that the latest version of the TMCL-IDE 3.0 is installed. The TMCL-IDE can be downloaded from www.trinamic.com/support/software/tmcl-ide/.
- Open the TMCL-IDE and connect the Landungsbruecke via USB to the computer. For Windows 8 and higher is no driver needed, on Windows 7 machines the TMCL-IDE is installing the driver automatically.
- 3. Verify that the Landungsbruecke is using the latest firmware version. The firmware version is shown in the connected device tree.

🚴 TMCL-IDE 3.0	
<u>File Tools Options Views H</u> elp	
Connected devices ×	
Device	
V 🛶 USB	
🗸 🏹 COM6: USB port	
🗸 🌰 ID1: Landungsbruecke [V 3.01]	
🖢 Direct mode	

Figure 2: Firmware Version

- 4. The TMCL-IDE 3.0 needs room to show all important information and to provide a good overview. Therefore, arrange the main window related to your needs. We recommend using full screen. For evaluation boards it is essential to have access to the registers. Therefore open up the Register Browser (left side). For a better view click top right on the normal icon to get a maximized register browser window.
- 5. The TMCL-IDE includes a dialogue for diagnostic tasks. Further, the dialogue provides an overview of the connected motion controller and driver chips. A window pops up immediately after connecting the evaluation kit the first time. The window shows the actual status of the connections. The second tab of the dialogue offers the possibility to choose basic settings or to reset the module to factory defaults.

andungsbruecke :	VC1-Id 1	**	Landungsbruecke : VC1-Id 1	-
oard Assignment	Settings		Board Assignment Settings	
Automated board (detection		Reset	
Push scan for auto keep the evaluatio	omated detection of connected boards. on board firmware up to date.	Please	You can reset the board settings to defaults here. Form Trinamic chips it's a matter of firmware to restore defa	m most Aults.
Fanneing	Scan	_	Please note that the default settings are not neccessarily the chip reset settings. The defaul	lt ,
scarining.			O Motion controller board only	
Manual board assig	gnment		O Power driver board only Reset boards to	defaults
Select connected i automated detect	boards manually. This is only recomment tion fails somehow. Please keep the eva	nded if luation	Both	
board firmware up may lead to une	to date. Choosing a wrong combine spected behaviour.	nation	Driver Enable	
Motion controller	Driver		Please disable drivers before plug/unplug a mo driver board. Otherwhise the driver may be da	otor to a maged!
none	+ none	•	Enable drivers	
agnostics			Diagnostics	
verything seems to	be fine. Have Fun!		Everything seems to be fine. Have Fun!	
nformation			Information	
Notor Supply:	0.0V		Motor Supply: 0.0V	
Board at ch1(Motio	n Controller): none		Board at ch1(Motion Controller): none	
	Driver): none		Board at ch2(Power Driver): none	
Board at ch2(Power				

Figure 3: Landungsbruecke Dialogue

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2 Hardware Information

All design files for our evaluation boards are available for free. We offer the original ECAD files (Eagle, Altium, or PADS), Gerber data, the BOM, and PDF copies. Please check schematics for Jumper settings and input/output connector description.

The files can be downloaded from the evaluation boards' website directly at our homepage: TRINAMIC TMC5031-EVAL homepage.

Note If files are missing on the website or something is wrong please send us a note.



3 Evaluation Features in the TMCL-IDE

This chapter gives some hints and tips on using the functionality of the TMCL-IDE, e.g., how to use the velocity mode or some feature-based tools.

Note In order to achieve good settings please refer to descriptions and flowcharts in the TMC5031-LA data sheet. The register browser of the TMCL-IDE provides help-ful information about any currently selected parameter. Beyond that, the data sheet explains concepts and ideas which are essential for understanding how the registers are linked together and which setting will fit for which kind of application. For getting more familiar with the evaluation kit in the beginning of your examinations, drive the motor using velocity mode and/or positioning mode first. Beyond this, the direct mode function can be used. This way, TMCL commands can be sent to the evaluation board system.

3.1 Velocity Mode

To move the motor in velocity mode, open the velocity mode tool by clicking the appropriate entry in the tool tree. In the velocity mode tool you can enter the desired velocity and acceleration and then move the motor using the arrow buttons. The motor can be stopped at any time by clicking the stop button. Open the velocity graph tool to get a graphical view of the actual velocity.

Note

In order to get a more accurate graphical velocity view, close the register browser window when using the velocity graph.



Figure 4: Driving the motor in velocity mode (TMCL-IDE provides similar view for TMC5031-EVAL)

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3.2 **Position Mode**

To move the motor in position mode, open the position mode tool by clicking the appropriate entry in the tool tree. In the position mode tool you can enter a target position and then start positioning by clicking the Absolute or Relative Move button. The speed and acceleration used for positioning can also be adjusted here.

Open the position graph tool to get a graphical view of the actual position.

Note In order to get a more accurate graphical position view, close the register browser window when using the position graph.



Figure 5: Driving the motor in position mode (TMCL-IDE provides similar view for TMC5031-EVAL)



3.3 StallGuard2[™] Tuning

To tune StallGuard2[™] properly you need to set the current for the motor first, e.g. 1A RMS. After that you specify the velocity to run the motor with. This could be 75 rpm as in this example. You can use the TMCL IDE to calculate the velocity with the "Parameter calculator" tool shown in the list on the left when connecting the board.

Parameter calculator @TMC26x : COM24-Id 1					
TMCL axis parameters		Motor parameters			
Velocity [pps]:	64000 🜲				
Acceleration [pps]:	65535 🗘	Full steps / rev.:	200 🜲		
Microsteps: 8 (2	56x) 🔸				
Physical units					
Fullstep Frequency [pps]:	250.00000 ≑	Acceleration fullsteps [pps ²]:	255.99609 🗘		
Revolutions per sec.:	1.25000 🗘	Acceleration [RPS ²]:	1.27998 🗘		
Revolutions per minute:	75.00000 🔹	Acceleration [RPM/S]:	76.79883 🔹		
Time to reach velocity [s]:	0.97658				
Fullsteps to reach velocity:	122.07218				
Microsteps to reach velocity:	31250.47684				

Figure 6: TMCL IDE v3.0.20.0 Parameter calculator

In the TMCL IDE you can use the CoolStep[™] & StallGuard2[™] graph where the StallGuard2[™] value is shown in blue. There are two parameters that need tuning for proper StallGuard2[™] use. StallGuard2[™] Threshold (SGT), will need to be tuned by raising or lowering the SGT value. The goal of SGT it so have it hit 0 before a stall occurs. If the SGT is too high, a step loss will occur and you need to lower it. In the picture you see two regions. In the first region the SGT value was too high. It was set to 10 and with loading the motor you can see the value does not reach 0. In the second region the SGT value was set to 4 which results in hitting the 0 axis just short before the motor stalls.

actual motor current vs. time: 17 stallGuard value vs. time: 160 velocity: 65 535		
Region 1	Region 2 22 704	
Filter enable	Run current: 17 [031] 🖨	
stall guard threshold:	Standby current: 5 [031]	
stall velocity threshold: 0 [pps] 🗘		
Restart motor:		

Figure 7: CoolStep™ & StallGuard2™ window

With optimal StallGuard2[™] settings you can optionally activate CoolStep[™].

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3.4 CoolStep[™] Tuning

With the TMCL IDE and the EVAL-KIT you have a powerful tool to find your CoolStep[™] to run your motor most energy efficient and cool. To tune it, please open the CoolStep[™] & StallGuard2[™] or StallGuard4[™] window you'll find on the left of the IDE when you have connected the EVAL board. On the CoolStep[™] tab you will see below picture by default.

coolStep & stallGuard			
actual motor curren stallGuard value vs. velocity: 65 535	t vs. time: 17 time: 160		32 10 30 96 28 85 26 83 24 76 22 70
			16 57 16 51 14 44 12 38 10 32 8 25
stallGuard2 cools			
stallGuard2 cools	5tep TMCL 0 - 1/2 +	יי איזער איי איי איי איי איי איי איי איי איי אי	0 (pps) ÷
stallGuard2 cools Current minimum: Current down step:	5tep TMCL 0 - 1/2 + 0 - slow +	Threshold speed:	0 (pps) 🗘

Figure 8: CoolStep[™] & StallGuard2[™] (or StallGuard4[™]) window

CoolStep™ will get activated as soon as you change the "Hysteresis start" value higher than 0 and enter a "Threshold speed" value higher than 0.



coolStep & stallGuard					
actual motor current vs. time: 11 32 1014 stallGuard value vs. time: 192 38 96 velocity: 65 26 632 24 768 27					
22 704 18 576 16 512 14 448 10 320 10 320 14 128 10 320 5 192 2 64 10 320 5 192 14 128 2 64 10 320 5 192 10 320 10 30 10 320 10 30 10 30 10 10 30 10 30 10 10 30 10 3					
سس ^س س stallGuard2 cools	will کر	พ ^ม ีไวนา _น เกกเงงารงงสต			
۲۰۰۰ stallGuard2 cools Current minimum:	itep TMCL	ທ ^{ເມ} ີດາແ _ບ າມ ກະ ການໜາ Threshold speed:	200 [pps] 🜩		
نتسي stallGuard2 cools Current minimum: Current down step:	TMCL 0-1/2 0-slow	المحمد من معالم معالم Deactivation threshold speed:	200 (pps) ÷		

Figure 9: CoolStep[™] & StallGuard2[™] (or StallGuard4[™]) window

The above values activate CoolStep[™] but the values can be fine tuned to make CoolStep[™] work reliable and in a way as you need it in your application. For that it is important to understand what each setting is doing.

- **Current minimum**: The current minimum setting will be the lowest current when CoolStep[™] is activated. With 1A RMS the current will either be reduced to a quarter or to the half of this current when no or less force is applied to the motor shaft.
- **Current down step**: Current down steps defines the speed of the current to drop down after load gets released from the motor shaft.
- **Current up step**: This setting defines the step height when hitting the lower StallGuard2[™] or Stall-Guard4[™] threshold (Hysteresis start).
- **Hysteresis width**: This setting defines the area of the StallGuard2[™] or StallGuard4[™] threshold (Hysteresis end).
- **Hysteresis start**: This setting defines the switching point, related to the StallGuard2[™] or StallGuard4[™] value, to boost up the current by one step.



4 Revision History

4.1 Document Revision

Version	Date	Author	Description
1.0	2020-OCT-02	LH	Initial release.

Table 1: Document Revision



X-ON Electronics

Largest Supplier of Electrical and Electronic Components

Click to view similar products for Power Management IC Development Tools category:

Click to view products by Analog Devices manufacturer:

Other Similar products are found below :

EVB-EP5348UI MIC23451-AAAYFL EV MIC5281YMME EV 124352-HMC860LP3E DA9063-EVAL ADP122-3.3-EVALZ ADP130-0.8-EVALZ ADP130-1.8-EVALZ ADP1740-1.5-EVALZ ADP1870-0.3-EVALZ ADP1874-0.3-EVALZ ADP199CB-EVALZ ADP2102-1.25-EVALZ ADP2102-1.875EVALZ ADP2102-1.8-EVALZ ADP2102-2-EVALZ ADP2102-3-EVALZ ADP2102-4-EVALZ AS3606-DB BQ25010EVM BQ3055EVM ISLUSBI2CKIT1Z LP38512TS-1.8EV EVAL-ADM1186-1MBZ EVAL-ADM1186-2MBZ ADP122UJZ-REDYKIT ADP166Z-REDYKIT ADP170-1.8-EVALZ ADP171-EVALZ ADP1853-EVALZ ADP1873-0.3-EVALZ ADP198CP-EVALZ ADP2102-1.0-EVALZ ADP2102-1-EVALZ ADP2107-1.8-EVALZ ADP5020CP-EVALZ CC-ACC-DBMX-51 ATPL230A-EK MIC23250-S4YMT EV MIC26603YJL EV MIC33050-SYHL EV TPS60100EVM-131 TPS65010EVM-230 TPS71933-28EVM-213 TPS72728YFFEVM-407 TPS79318YEQEVM UCC28810EVM-002 XILINXPWR-083 LMR22007YMINI-EVM LP38501ATJ-EV