

User's Guide SLVU528–March 2012

DRV201 Evaluation Module



Figure 1. DRV201EVM

The DRV201EVM is an evaluation board to assist in evaluating the DRV201 IC as a voice coil motor (VCM) driver for camera auto focus.

The device is an advanced voice coil motor driver for camera auto focus. It has an integrated D/A converter for setting the VCM current. VCM current is controlled with a fixed frequency PWM controller or a linear mode driver. Current generation can be selected via I²C register. Device has integrated sense resistor for current regulation and the current can be controlled through I²C.

When changing the current in the VCM the lens ringing is compensated with an advanced ringing compensation function. Ringing compensation reduces the needed time for auto focus significantly. The device has also VCM short and open protection functions.

The following related documents are available for download through the Texas Instruments web site at http://www.ti.com.

- 1. DRV201 Voice Coil Motor Driver for Camera Auto Focus (SLVSB25)
- 2. USB Interface Adapter Evaluation Module (SLLU093)



Contents

1	Introd	duction	3				
	1.1	Description	3				
	1.2	Applications	3				
	1.3	Features	3				
2	Syste	em Overview	4				
3	Hard	Hardware Overview					
	3.1	Connectors	6				
	3.2	Jumpers	6				
	3.3	Test Points	6				
	3.4	EVM Operation	6				
4	Softw	ware	7				
	4.1	Software Installation Instructions	7				
5	EVM	I Schematic	9				
6	PCB	layout	10				
7	Bill of	of Materials	12				



1 Introduction

1.1 Description

The DRV201EVM is an evaluation board to assist in evaluating the DRV201 IC as a voice coil motor (VCM) driver for camera autofocus.

The device is an advanced voice coil motor driver for camera Auto focus. It has integrated D/A converter for setting the VCM current. VCM current is controlled with a fixed frequency PWM controller or a linear mode driver. Current generation can be selected via I²C register. Device has integrated sense resistor for current regulation and the current can be controlled through I²C.

When changing the current in the VCM the lens ringing is compensated with an advanced ringing compensation function. Ringing compensation reduces the needed time for auto focus significantly. The device has also VCM short and open protection functions.

1.2 Applications

- Camera auto focus
- Camera Iris control

1.3 Features

- Configurable for linear or PWM mode VCM current generation
- High efficiency PWM current control for VCM
- Advanced ringing compensation
- Integrated 10-bit D/A converter for VCM current control
- Protection
 - Open and short-circuit detection on VCM pins
 - Undervoltage lockout (UVLO)
 - Thermal shutdown
 - Open and short circuit protection on VCM output
 - Internal current limit for VCM driver
- I²C interface
- Operating temperature range: -40°C to 85°C
- 6-ball WCSP package with 0.4-mm pitch
- Max die size: 0.8 mm x 1.48 mm
- Package height: 0.15 mm

З

2 System Overview



Figure 2. System Block Diagram

The system consists of these components:

- Host (PC): a Windows[™] personal computer (PC) used to configure and monitor the DRV201EVM. The GUI operates on the host. For the GUI to execute properly, the host needs to have the correct LabView[™] RunTime version. If the host doesn't have the correct RunTime version it will be prompted during GUI installation. More information in GUI installation section.
- USB-to-I²C adapter: DRV201EVM uses the I²C interface for communication with the host. The TI-supplied USB-to-I²C adapter shown in Figure 3. USB-to-GPIO adapter does the appropriate conversion so the host can use the USB interface for communication. USB-to-I²C adapter has a 3.3-V supply rail which is used to supply the EVM so no external power supply is needed.
- **DRV201EVM:** EVM board that houses the DRV201 and peripheral components.





3 Hardware Overview

The DRV201EVM allows evaluation of the DRV201 IC as a voice coil motor (VCM) driver for camera autofocus. DRV201EVM has separate connections for Isource and Isink pins that can be used to connect to any VCM actuator or VCM in a camera module. If VCM actuator is not available there are on board mounted inductor and resistor available to model VCM.

The DRV201EVM can be configured and monitored through a Windows GUI application running on a PC. The GUI communicates with the DRV201EVM through the USB Interface Adapter (included with EVM kit), which acts as an I^2C master for the board.

The DRV201EVM provides the following functionality:

- Programming of the DRV201 device.
- R_VCM and L_VCM are meant as a model of a typical VCM actuator electrical parameters.
- Driving either external VCM connected to I_{SOURCE} and I_{SINK} headers or using on board inductor and resistor (see jumper setting).
- Standard 400-kHz I²C communication via I²C connector to USB adapter for connection to a PC.
- Board can be supplied through the 3.3 V from the USB adapter or from an external power source (see jumper setting).



Figure 4. Connecting the ribbon cable to DRV201EVM pin one is marked on the EVM and with the red stripe in the ribbon cable.

5

Hardware Overview

3.1 Connectors

The DRV201EVM has connectors for power and I²C communications. J1 provides a possibility to power EVM from an external power supply (between 2.5 V and 4.8 V). USB adapter interface adapter has a 3.3-V power output that can be used to power the board so there is no need for external power source.

P1 header provides the I²C communication interface to the DRV201EVM. The USB Interface Adapter includes a ribbon cable that can be connected to P1. The adapter is connected to a Windows-based PC.

WARNING

When using external power DRV201EVM, it should be noted that the recommended supply range for DRV201 is from 2.5 V to 4.8 V.

3.2 Jumpers

The DRV201EVM operation can be configured using jumpers:

- · Board power from external supply or USB interface adapter
- Driving on board inductor and resistor or external VCM actuator

See Table 1 for descriptions and default settings for the jumpers on the DRV201EVM.

NUMBER	FUNCTION	DEFAULT SETTING
P2	Board power supply selection. Connect to pins 1-2 when using 3.3 V from the USB interface adapter and pins 2-3 if external power supply is used.	Pins 1-2 (power from USB interface adapter)
JP1 andJP2	R_VCM and L_VCM are connected between DRV201 pins I_{SOURCE} and I_{SINK} . If jumpers are not connected, VCM actuator can be connected between I_{SOURCE} and I_{SINK} .	JP1 and JP2 jumpers connected

Table 1. DRV201EVM Jumpers

3.3 Test Points

The DRV201EVM provides test points that can be used for evaluation. Important voltages can be monitored with a meter through the use of the test points.

3.4 EVM Operation

The DRV201EVM operates from either a USB interface adapter (through P1) or an external power supply (through J1). Jumper P2 can be used to select the power source as described in Section 3.2. Use the following steps to set up the DRV201EVM.

- 1. Connect the USB interface adapter to the DRV201EVM P1 connector using the ribbon cable provided.
- 2. Plug the appropriate end of the USB cable into the adapter and the other end into your PC.

NOTE: If using an external power supply, connect jumper's pins 2-3 and use J1 to connect the power supply.



4 Software

The DRV201EVM comes with a Windows application that can be used to configure and monitor the EVM. The GUI can be used to configure all available options of the EVM such as programming, current settings, ringing compensation, VCM resonance frequency, open VCM, and short VCM.

The following section explains the procedure for installing the graphical user interface (GUI) onto a Windows based PC. A USB interface adapter is required to connect the EVM to a PC and should have been provided with the EVM.

Additional interfaces can be ordered through <u>http://focus.ti.com/docs/toolsw/folders/print/usb-to-gpio.html</u>.

4.1 Software Installation Instructions

To install the EVM software follow the steps outlined:

- Copy the DRV201EVM.zip to your computer and extract all files.
- Double-click on the setup.exe file in the \Installer\Volume\ directory.
- Follow the prompts to finish the installation.
- At the end of the installation, a reboot of your computer may be required.

😂 Volume						
File Edit View Favori	ites Tools Help					12
🔇 Back 🝷 🔘 💡	🏂 🔎 Search	Folders	B B × 9	•	f 🕈	
Address 🛅 C:\Installer\Vol	lume					💌 🋃 Go
Folders	×	Name 🔺		Size	Туре	Date Modified
🖃 🚞 Installer	^	bin			File Folder	29.2.2012 14:57
🖃 🧰 Volume		license			File Folder	29.2.2012 14:57
🏵 🧰 bin		C supportfiles	2		File Folder	29.2.2012 14:57
Co licens	se	🛅 nidist.id		1 KB	ID File	13.12.2011 12:43
C supp	ortfiles	Setup.exe		1 382 KB	Application	6.9.2011 16:24
	>	📑 setup.ini		9 KB	Configuration Settings	13.12.2011 12:43
6 objects (Disk free space: 63	3,5 GB)				1,35 MB	4y Computer

Figure 5. setup.exe File Located in the Volume Directory

I²C read/write commands may be made using the provided software. A dark grey block means the bit is 'high'. A white block means the bit is 'low'. A write may be performed simply by clicking on an individual bit or an entire register may be written by using the write command on the left side of the GUI.

TEXAS INSTRUMENTS

www.ti.com

Software

DRV201 GUI	Task Window Halo			
	ÈEXAS NSTRUMENT	S		
Config Register READ ALL CLEAR ALL	Enable Bits	VCM FREQUENCY	STATUS bits	
READ REG REG h' 0 VALUE h' 0	PWM Frequency 0.5 MH2 PWM/LIN PWM PWM PWM	VCM Current	VCHS VCHO UVLO OVC	
WRITE REG REG h' 0 VALUE h' 0	2x(1)f_vcm)			



it ti It	EXAS NSTRUME	NTS			D	۲ ۷2	01		
	Main Basic		🎯 Upd	ate Registers	· 🧿 I2C	Error	TOP		
ig Register									
EAD ALL									
LEAR ALL	CONTROL_02h)3	()			i		EN_RING	RESET
	VCM_1_MSB_03		·					1_VCM[9]	I_VCM[8]
EAD REG	VCM_I_LSB_04h	I_VCM[7]	I_VCM[6]	I_VCM[5]	I_VCM[4]	I_VCM[3]	I_VCM[2]	I_VCM[1]	I_VCM[0]
EG h' 0	STATUS_05h			1	TSD	VCMS	VCMO	UVLO	OVC
JE h' 0	MODE_06h		1	1	PWM_F[2]	PWM_F[1]	PWM_F[0]	PWM/LIN	RING_MODE
	VCM_FREQ_07h	VCM_F[7]	VCM_F[6]	VCM_F[5]	VCM_F[4]	VCM_F[3]	VCM_F[2]	VCM_F[1]	VCM_F[0]
RITE REG									
EG h' 0									

Figure 7. DRV201EVM GUI Basic



5 EVM Schematic



6 PCB layout

PCB layout



Figure 8. DRV201EVM Board Layer 1. (TOP)





Figure 9. Board Layer 4. (BOTTOM)



Bill of Materials

7 Bill of Materials

Table 2. Bill of Materials

Count	RefDes	Value	Description	Size	Part Number	MFR
1	Cin	1 µF	Capacitor, Ceramic, 10V, X5R	0402	ECJ0EB1A105M	Panasonic
1	R_VCM	15 Ω	Resistance to model VCM	2010	MCR50JZHJ150	Rohm
1	L_LCVM	100 µH	Inductance to model VCM		NR4018T101M	Taiyo Yuden
1	J1		Terminal Block	2 x 3.5 mm	ED555/2DS	On Shore
1	P1		Header, 2x5			
1	P2		Header, 1x3			
2	JP1, JP2		Header, 1x2			
4	U1		IC, Autofocus driver		DRV201	ТІ

Evaluation Board/Kit Important Notice

Texas Instruments (TI) provides the enclosed product(s) under the following conditions:

This evaluation board/kit is intended for use for **ENGINEERING DEVELOPMENT**, **DEMONSTRATION**, **OR EVALUATION PURPOSES ONLY** and is not considered by TI to be a finished end-product fit for general consumer use. Persons handling the product(s) must have electronics training and observe good engineering practice standards. As such, the goods being provided are not intended to be complete in terms of required design-, marketing-, and/or manufacturing-related protective considerations, including product safety and environmental measures typically found in end products that incorporate such semiconductor components or circuit boards. This evaluation board/kit does not fall within the scope of the European Union directives regarding electromagnetic compatibility, restricted substances (RoHS), recycling (WEEE), FCC, CE or UL, and therefore may not meet the technical requirements of these directives or other related directives.

Should this evaluation board/kit not meet the specifications indicated in the User's Guide, the board/kit may be returned within 30 days from the date of delivery for a full refund. THE FOREGOING WARRANTY IS THE EXCLUSIVE WARRANTY MADE BY SELLER TO BUYER AND IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESSED, IMPLIED, OR STATUTORY, INCLUDING ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR ANY PARTICULAR PURPOSE.

The user assumes all responsibility and liability for proper and safe handling of the goods. Further, the user indemnifies TI from all claims arising from the handling or use of the goods. Due to the open construction of the product, it is the user's responsibility to take any and all appropriate precautions with regard to electrostatic discharge.

EXCEPT TO THE EXTENT OF THE INDEMNITY SET FORTH ABOVE, NEITHER PARTY SHALL BE LIABLE TO THE OTHER FOR ANY INDIRECT, SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES.

TI currently deals with a variety of customers for products, and therefore our arrangement with the user is not exclusive.

TI assumes no liability for applications assistance, customer product design, software performance, or infringement of patents or services described herein.

Please read the User's Guide and, specifically, the Warnings and Restrictions notice in the User's Guide prior to handling the product. This notice contains important safety information about temperatures and voltages. For additional information on TI's environmental and/or safety programs, please contact the TI application engineer or visit www.ti.com/esh.

No license is granted under any patent right or other intellectual property right of TI covering or relating to any machine, process, or combination in which such TI products or services might be or are used.

FCC Warning

This evaluation board/kit is intended for use for **ENGINEERING DEVELOPMENT**, **DEMONSTRATION**, **OR EVALUATION PURPOSES ONLY** and is not considered by TI to be a finished end-product fit for general consumer use. It generates, uses, and can radiate radio frequency energy and has not been tested for compliance with the limits of computing devices pursuant to part 15 of FCC rules, which are designed to provide reasonable protection against radio frequency interference. Operation of this equipment in other environments may cause interference with radio communications, in which case the user at his own expense will be required to take whatever measures may be required to correct this interference.

EVM Warnings and Restrictions

It is important to operate this EVM within the input voltage range of 2.5 V to 4.8 V and the output voltage range of 2.5 V to 4.8 V.

Exceeding the specified input range may cause unexpected operation and/or irreversible damage to the EVM. If there are questions concerning the input range, please contact a TI field representative prior to connecting the input power.

Applying loads outside of the specified output range may result in unintended operation and/or possible permanent damage to the EVM. Please consult the EVM User's Guide prior to connecting any load to the EVM output. If there is uncertainty as to the load specification, please contact a TI field representative.

During normal operation, some circuit components may have case temperatures greater than 85°C ambient. The EVM is designed to operate properly with certain components above 85°C ambient as long as the input and output ranges are maintained. These components include but are not limited to linear regulators, switching transistors, pass transistors, and current sense resistors. These types of devices can be identified using the EVM schematic located in the EVM User's Guide. When placing measurement probes near these devices during operation, please be aware that these devices may be very warm to the touch.

Mailing Address: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265 Copyright © 2012, Texas Instruments Incorporated

IMPORTANT NOTICE

Texas Instruments Incorporated and its subsidiaries (TI) reserve the right to make corrections, modifications, enhancements, improvements, and other changes to its products and services at any time and to discontinue any product or service without notice. Customers should obtain the latest relevant information before placing orders and should verify that such information is current and complete. All products are sold subject to TI's terms and conditions of sale supplied at the time of order acknowledgment.

TI warrants performance of its hardware products to the specifications applicable at the time of sale in accordance with TI's standard warranty. Testing and other quality control techniques are used to the extent TI deems necessary to support this warranty. Except where mandated by government requirements, testing of all parameters of each product is not necessarily performed.

TI assumes no liability for applications assistance or customer product design. Customers are responsible for their products and applications using TI components. To minimize the risks associated with customer products and applications, customers should provide adequate design and operating safeguards.

TI does not warrant or represent that any license, either express or implied, is granted under any TI patent right, copyright, mask work right, or other TI intellectual property right relating to any combination, machine, or process in which TI products or services are used. Information published by TI regarding third-party products or services does not constitute a license from TI to use such products or services or a warranty or endorsement thereof. Use of such information may require a license from a third party under the patents or other intellectual property of the third party, or a license from TI under the patents or other intellectual property of TI.

Reproduction of TI information in TI data books or data sheets is permissible only if reproduction is without alteration and is accompanied by all associated warranties, conditions, limitations, and notices. Reproduction of this information with alteration is an unfair and deceptive business practice. TI is not responsible or liable for such altered documentation. Information of third parties may be subject to additional restrictions.

Resale of TI products or services with statements different from or beyond the parameters stated by TI for that product or service voids all express and any implied warranties for the associated TI product or service and is an unfair and deceptive business practice. TI is not responsible or liable for any such statements.

TI products are not authorized for use in safety-critical applications (such as life support) where a failure of the TI product would reasonably be expected to cause severe personal injury or death, unless officers of the parties have executed an agreement specifically governing such use. Buyers represent that they have all necessary expertise in the safety and regulatory ramifications of their applications, and acknowledge and agree that they are solely responsible for all legal, regulatory and safety-related requirements concerning their products and any use of TI products in such safety-critical applications, notwithstanding any applications-related information or support that may be provided by TI. Further, Buyers must fully indemnify TI and its representatives against any damages arising out of the use of TI products in such safety-critical applications.

TI products are neither designed nor intended for use in military/aerospace applications or environments unless the TI products are specifically designated by TI as military-grade or "enhanced plastic." Only products designated by TI as military-grade meet military specifications. Buyers acknowledge and agree that any such use of TI products which TI has not designated as military-grade is solely at the Buyer's risk, and that they are solely responsible for compliance with all legal and regulatory requirements in connection with such use.

TI products are neither designed nor intended for use in automotive applications or environments unless the specific TI products are designated by TI as compliant with ISO/TS 16949 requirements. Buyers acknowledge and agree that, if they use any non-designated products in automotive applications, TI will not be responsible for any failure to meet such requirements.

Following are URLs where you can obtain information on other Texas Instruments products and application solutions:

Products		Applications	
Audio	www.ti.com/audio	Automotive and Transportation	www.ti.com/automotive
Amplifiers	amplifier.ti.com	Communications and Telecom	www.ti.com/communications
Data Converters	dataconverter.ti.com	Computers and Peripherals	www.ti.com/computers
DLP® Products	www.dlp.com	Consumer Electronics	www.ti.com/consumer-apps
DSP	dsp.ti.com	Energy and Lighting	www.ti.com/energy
Clocks and Timers	www.ti.com/clocks	Industrial	www.ti.com/industrial
Interface	interface.ti.com	Medical	www.ti.com/medical
Logic	logic.ti.com	Security	www.ti.com/security
Power Mgmt	power.ti.com	Space, Avionics and Defense	www.ti.com/space-avionics-defense
Microcontrollers	microcontroller.ti.com	Video and Imaging	www.ti.com/video
RFID	www.ti-rfid.com		
OMAP Mobile Processors	www.ti.com/omap		
Wireless Connectivity	www.ti.com/wirelessconnectivity		

TI E2E Community Home Page

e2e.ti.com

Mailing Address: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265 Copyright © 2012, Texas Instruments Incorporated