DRV8601ZQVEVM ERM/LRA Driver Evaluation Module

The DRV8601 ERM/LRA driver evaluation module is a complete, low-power and ultra-fast turn-on driver for Eccentric Rotating Mass (ERM) and Linear Resonant Actuator (LRA) types of haptic actuators. All components and the evaluation module are Pb-free. The evaluation module (EVM) consists of a DRV8601ZQV device and all necessary components to evaluate it.

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1 Introduction

This section provides an overview of the Texas Instruments (TI) DRV8601 ERM/LRA driver evaluation module (DRV8601ZQVEVM). It includes a description of the module and a list of EVM specifications.

1.1 DRV8601ZQVEVM Specifications

Operation at room temperature assumed.

Supply voltage range, V_{DD}	2.5 V to 5.5 V
Power supply current rating required	2.5 A
Input voltage, V_I	0 V-V_{DD}
Minimum load impedance, Z_L	6.4 Ω
Maximum continuous output current	400 mA

2 Operation

This section describes how to operate the DRV8601ZQVEVM.

2.1 Quick Start for Stand-Alone Operation

Use the following steps when operating the DRV8601ZQVEVM stand-alone or when connecting it to existing circuits or equipment.

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2.1.1 Initial Configuration

The DRV8601ZQVEVM can be operated in two configurations. For a detailed description of each configuration, see the DRV8601ZQV data sheet.

1. Pseudo-Differential Feedback with Internal Reference - used when V_{DD} is equal to the maximum IN voltage
2. Differential Feedback with External Reference - used when V_{DD} is not equal to the maximun IN voltage

Table 1 describes how to modify the DRV8601ZQVEVM for the two configurations. Note that the voltages listed (IN, REFIN, and V_{DD}) must be used for proper operation. If alternate voltages are required, see the data sheet to select different passive components.

Table 1. Configuration Settings

No.	Configuration	JP1	R4	C4	R5	C5	R1	R2	R6	IN V_{MAX}	REFIN	V_{DD}
1	Pseudo-Differential Feedback with Internal Reference	2-3	100k	0.01 µF(1)	DNP	DNP	49.9 k	-	-	3.3V	N/A	3.3V
2	Differential Feedback with External Reference (GAIN = 3.7 V/V)	1-2	100 k	0.01 µF (1)	100 k	0.01 µF (1)	27.4 k	53.6 k	53.6 k	1.8 V	1.8V	3.3V

(1) Choose C4 to set the corner frequency according to the equation $f_{3dB} = 1 / (2 \times \pi \times R4 \times C4)$. For configuration two, choose R5 = R4 and C5 = C4.

2.1.2 Power and Ground

For all three configurations:

1. Set the voltage of an external power supply between 2.5 V and 5.5 V and turn it OFF.
2. Attach the ground connection of the power supply to the GND header pin of the EVM, and then connect the positive supply to the VDD header pin. Verify that the connections are made to the correct header pins.

2.1.3 Inputs and Outputs

2.1.3.1 Vibration Input

1. Make sure that the signal source is set to the minimum level.
2. Connect the signal source to the IN header pin on the EVM.
3. Connect the actuator (ERM or LRA) between OUT+ and OUT–.

2.1.3.2 Enable Settings

The DRV8601ZQV has an active high enable pin EN. A high value on this pin places the device in the operating mode, and a low value on this pin places it in the shutdown mode. Press and hold pushbutton S1 to place the DRV8601ZQVEVM in the shutdown mode. Release pushbutton S1 to restart normal operation.

2.1.3.3 Gain Settings

DC gain of the device is given by 2×R4/R1 for the pseudo-differential configurations, and R4/R1 for the differential configuration. R5, when used, must be well matched with R4 for proper performance. The DRV8601ZQVEVM is pre-configured for a pseudo-differential gain of 4 V/V and a differential gain of 2V/V.

2.2 Power Up

1. Verify the correct connections as described in Sections 2.1.
2. Verify the voltage setting of the power supply is between 2.5 V and 5.5 V, and turn on the power supply. Proper operation of the EVM begins.
3. Adjust the audio signal source as needed.

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(a) For LRAs, drive a PWM signal at the resonant frequency of the LRA. ensure that the low-pass corner frequency is beyond the resonant frequency of the LRA.

(b) For ERMs, drive a PWM signal below 30 kHz.

3 Reference

This section includes the EVM PCB layout reference, schematic, and parts list.

3.1 DRV8601ZQVEVM PCB Layers

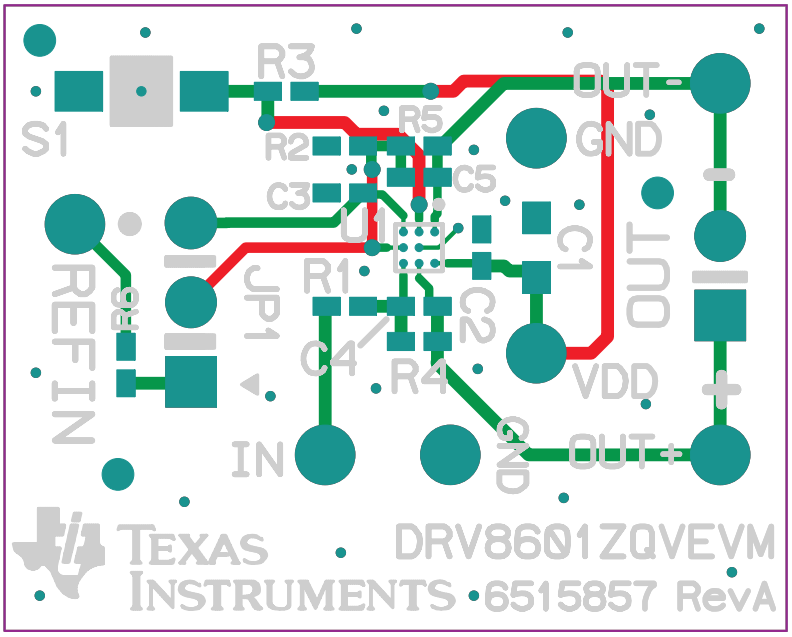

Figure 1. Top Layer

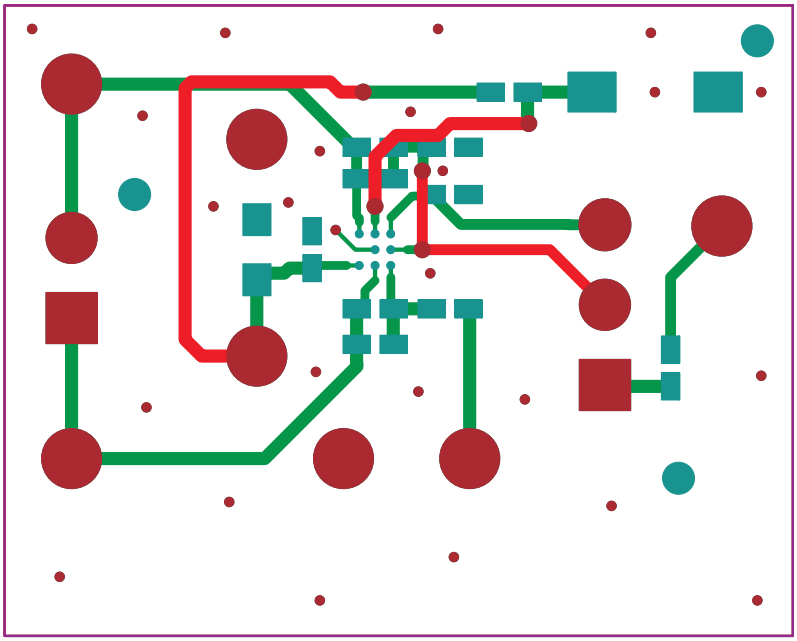

Figure 2. Bottom Layer

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3.2 DRV8601ZQVEVM Schematic Diagram

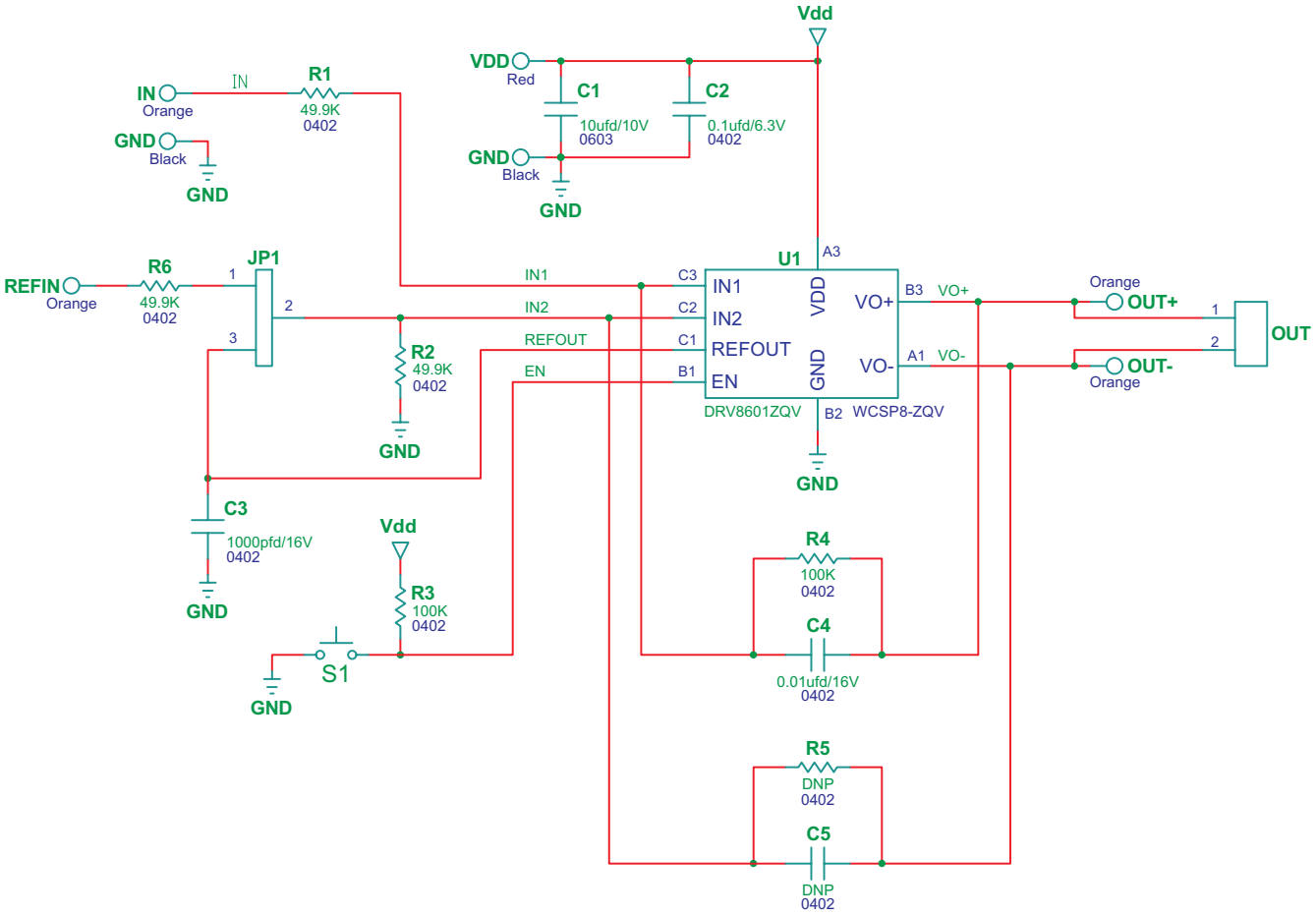

Figure 3. DRV8601ZQVEVM Schematic Diagram

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3.3 DRV8601ZQVEVM Evaluation Module Parts List

Table 2. DRV8601ZQVEVM Parts List

Item	MANU Part No.	QTY	REF DES	Vendor Part No.	Description	Vendor	MANU
				TI-SEMICONDUCTORS			
1	DRV8601ZQV	1	U1	DRV8601ZQV	400mA DRIVER FOR DC MOTORS AND LINEAR VIBRATORS WCSP8-ZQV ROHS	Texas Instruments	Texas Instruments
				CAPACITORS			
Item	**MANU Part No.**	**QTY**	**REF DES**	**Vendor Part No.**	**Description**	**Vendor**	**MANU**
2	CC0402KRX7R7BB102	1	C3	311-1352-1	CAP SMD0402 CERM 1000pfd 16V 10% X7R ROHS	DIGI-KEY	Yageo
3	0402YC103KAT2A	1	C4	478-1114-1	CAP SMD0402 CERM 0.01ufd 16V 10% X7R ROHS	DIGI-KEY	AVX
4	C1005X5R0J104K	1	C2	445-1266-1	CAP SMD0402 CERM 0.1UFD 6.3V 10% X5R ROHS	DIGI-KEY	TDK Corp
5	ECJ-1VB1A106M	1	C1	PCC2479CT	CAP SMD0603 CERM 10UFD 10V 20% X5R ROHS	DIGI-KEY	Panasonic
				RESISTORS			
Item	**MANU Part No.**	**QTY**	**REF DES**	**Vendor Part No.**	**Description**	**Vendor**	**MANU**
6	ERJ-2RKF4992X	3	R1, R2, R6	P49.9KLCT	RESISTOR SMD0402 THK FLM 49.9K 1/16W 1% ROHS	DIGI-KEY	Panasonic
7	ERJ-2RKF1003X	2	R3, R4	P100KLCT	RESISTOR SMD0402 THK FLM 100K 1/16W 1% ROHS	DIGI-KEY	Panasonic
				HEADERS AND JACKS			
Item	**MANU Part No.**	**QTY**	**REF DES**	**Vendor Part No.**	**Description**	**Vendor**	**MANU**
8	PBC02SAAN	1	OUT	S1011E-02	HEADER THRU MALE 2 PIN 100LS GOLD ROHS	DIGI-KEY	SULLINS
9	PBC03SAAN	1	JP1	S1011E-03	HEADER THRU MALE 3 PIN 100LS GOLD ROHS	DIGI-KEY	SULLINS
				TESTPOINTS AND SWITCHES			
Item	**MANU Part No.**	**QTY**	**REF DES**	**Vendor Part No.**	**Description**	**Vendor**	**MANU**
10	5000	1	VDD	5000K	PC TESTPOINT, RED, ROHS	DIGI-KEY	Keystone Electronics
11	5001	2	GNDx2	5001K	PC TESTPOINT, BLACK, ROHS	DIGI-KEY	Keystone Electronics
12	5003	4	IN, OUT+, OUT–, REFIN	5003K	PC TESTPOINT, ORANGE, ROHS	DIGI-KEY	Keystone Electronics
13	TL1015AF160QG	1	S1	EG4344CT	SWITCH, MOM, 160G SMT 4X3MM ROHS	DIGI-KEY	E-SWITCH
				SHUNTS			
Item	**MANU Part No.**	**QTY**	**REF DES**	**Vendor Part No.**	**Description**	**Vendor**	**MANU**
14	SPC02SYAN	1	JP1	S9001	SHUNT, BLACK AU FLASH 0.100LS	DIGI-KEY	SULLINS
	Component Count:	21					
				COMPONENTS NOT ASSEMBLED			
C5, R5							

4 Related Documentation From Texas Instruments

- DRV8601 data sheet (SLOS629): Driver for DC Motors (ERMs) and Linear Vibrators (LRAs) with Ultra-Fast Turn-On.

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EVM Warnings and Restrictions

It is important to operate this EVM within the input voltage range of 2.5 V to 5 V and the output voltage range of 0 V to 5.5 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 60°C. The EVM is designed to operate properly with certain components above 60°C 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.

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