EVM User's Guide: LDC5072Q1EVM

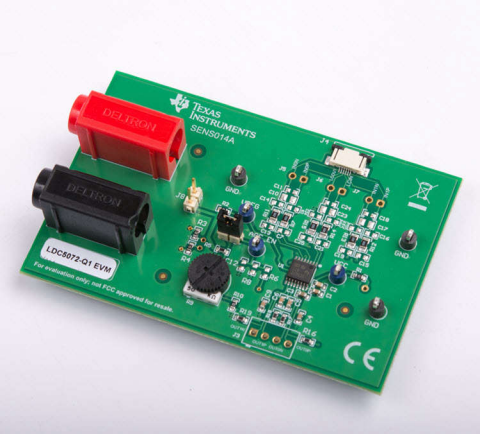
LDC5072-Q1 Evaluation Module

Description

The Texas Instruments LDC5072-Q1 evaluation module (EVM) kit helps designers evaluate the operation and performance of the LDC5072-Q1 Inductive Position Sensor.

Features

- Integrated AFE for contact-less inductive angle sensing without a resolver
- Quick integration into existing systems
- Downloadable supporting inductive sensor design tool: LDC5072-Q1-SENSOR-DESIGN-TOOL



LDC5072Q1EVM

1 Evaluation Module Overview

1.1 Introduction

The LDC5072-Q1 evaluation module (EVM) helps designers evaluate the operation and performance of the LDC5072-Q1 inductive position sensor. The LDC5071-Q1 device is also supported by this EVM as shown in the Device Compatibility table. The EVM contains all passive components necessary for the LDC5072-Q1 and can be quickly evaluated in a system. A sensor printed circuit board (PCB) for the LDC5072-Q1 can be created by the LDC5072-Q1 sensor designer tool.

1.2 Kit Contents

The EVM contains one LDC5072-Q1 soldered onto the EVM PCB. A 50kΩ trim potentiometer is also included to help the designer change the Automatic Gain Control settings and evaluate the LDC5072-Q1 in a wide variety of use cases. The kit also contains two unpopulated PC boards, one for the inductive sensor and one for the target that rotates close to the sensor PC board. These boards are included in this kit to provide you with a convenient start to using the EVM.

If the included sensor and target PC boards do not meet your requirements, you can design your own using the LDC507X-SENSOR-DESIGN-TOOL, which is available as a free download from TI.com. For more information about the tool, see the LDC5072-Q1 Sensor Design Tool Getting Started Guide. The included sensor and target PC boards are designed using the LDC507X-SENSOR-DESIGN-TOOL in the default settings.

1.3 Device Information

The LDC5072-Q1 IC is an analog front-end for contact-less, inductive position sensors targeted for absolute rotary position . The LDC5072-Q1 excites a coil that is typically printed on a printed circuit board (PCB). The excitation is coupled back into two sets of receiver coils on the same PCB using a conductive target that is placed in close proximity of the PCB. The conductive target can also be a pattern printed on another PCB. The coil PCB stays stationary and the target moves with the motor, actuator, or valve. The excitation coil generates a secondary voltage on the receiver coils depending on the position of the target relative to the receiver coils. A signal representation of the position is obtained by reading in the voltages from the receiver coils, processing the voltages, and giving analog outputs representing the Sine and Cosine components of the position of the target.

The following table shows the devices that are compatible with the LDC5072-Q1 EVM.

Table 1-1. Device Compatibility

PART NUMBER	PACKAGE	PACKAGE SIZE
LDC5072-Q1	PW (TSSOP, 16)	5.00mm × 6.40mm
LDC5071-Q1		

2 Hardware

2.1 EVM Connections

2.1.1 Theory of Operation

The LDC05072-Q1 is a front-end for inductive position sensors for measuring absolute rotary position in automotive and industrial applications. Inductive position sensors work on the principle of eddy current generation and magnetic coupling. The LDC5072-Q1 connects to three inductive sensing coils that are typically on the printed-circuit board. One of the coils is connected to the exciter circuit of the LDC5072-Q1 and acts as a transmitter, and the other two secondary coils are used as receivers. The primary or transmitter coil induces a voltage in the secondary coils, which is a function of the conductive target above the sensor coils. The LDC5072-Q1 demodulates the signal received by the secondary coils and outputs a sine and a cosine waveform that represents the position of the conductive target above the sensor coils.

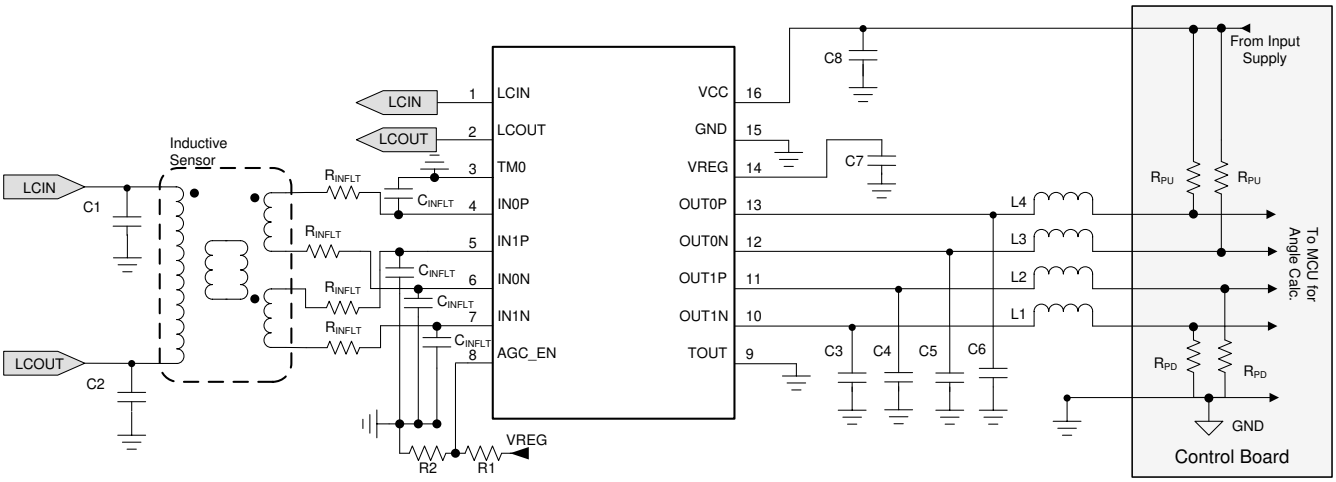


Figure 2-1. Typical Application Diagram

2.1.2 EVM Connections

This section describes the connectors on the LDC5072Q1EVM and how to properly connect, set up, and use the LDC5072-Q1.

Table 2-1. Connector Description

Connector	Type	Functionality
J1	Banana Jack Terminal	VCC Supply
J2	Banana Jack Terminal	Ground
J3	4 pin 100mil terminal block	Provides connections to ADC for OUT1N, OUT1P, OUT0N, and OUT0P.
J4	6 position FPC female connector	Provides connections to sensor for LCIN, LCOUT, IN0P, IN1P, IN0N, and IN1N.
J5	2 pin 100mil header	Provides connections to IN0P and IN0N.
J6	2 pin 100mil header	Provides connections to LCIN and LCOUT.
J7	2 pin 100mil header	Provides connections to IN1P and IN1N.
J8	2 pin 100mil header	Jumper to connect VCC to VREG. This must only be installed when using 3.3V VCC operation.
J9	2 pin 100mil header	Jumper to connect AGC_EN pin to potentiometer circuit.
R9 - AGC Adjust	50k Trim Pot	Provides adjustable resistance to create a voltage divider between 0V and VREG on the AGC pin.

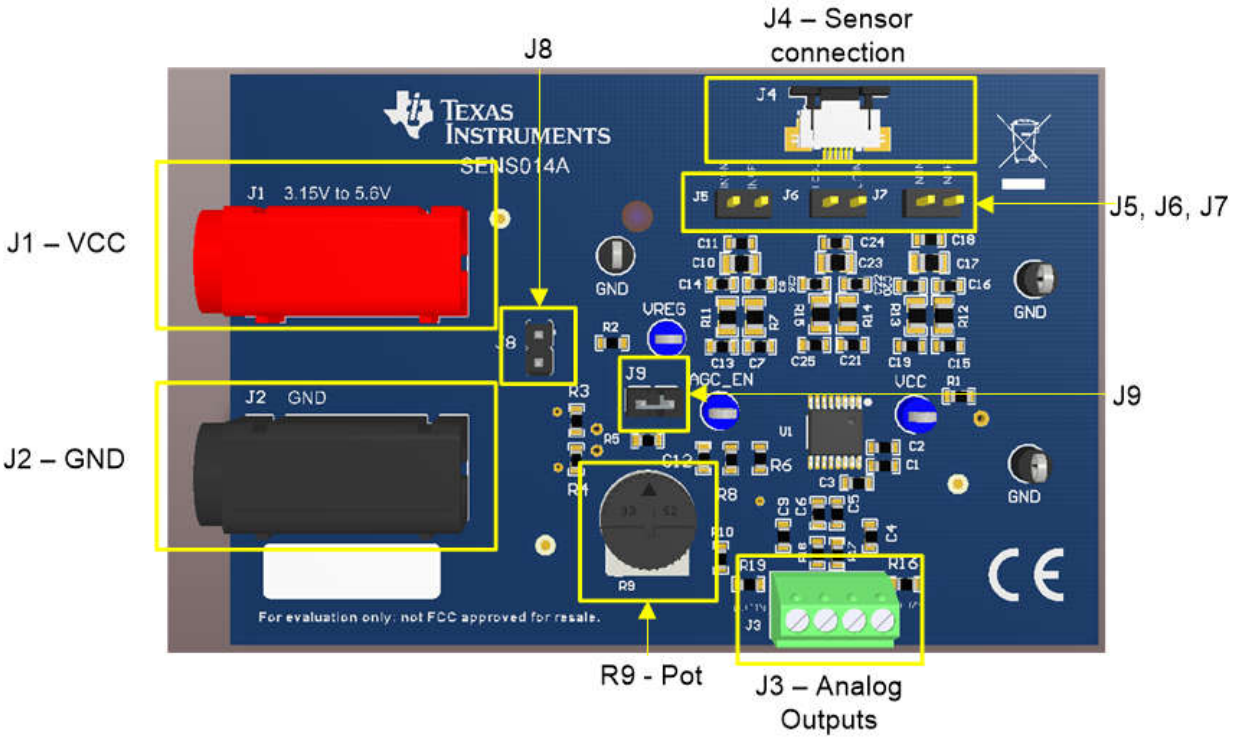


Figure 2-2. Connector and Feature Locations

2.1.3 EVM Interface

The LDC5072Q1EVM can be powered with 5V across J1 (VCC) and J2 (GND) placed on the left side of the EVM. Leave jumper J8 uninstalled when using 5V operation. To select 3.3V operation, supply 3.3V to J1 (VCC) and install jumper J8.

The voltage on the AGC pin of the LDC5072-Q1 at start-up determines the automatic gain control settings. The voltage can be easily controlled through the 50kΩ trim potentiometer (R96).

2.2 Quick Start Guide

2.2.1 Supply Power to the LDC5072EVM

Power can be supplied either through a banana jack connector (J1 – VCC and J2 – GND).

5V operation:

1. Remove jumper J8.
2. Connect J1 to a 5V power supply and J2 to GND.

3.3V operation:

1. Install jumper J8.
2. Connect J1 to a 3.3V power supply and J2 to GND.

2.2.2 Adjust the AGC

The EVM has a potentiometer (R9) that can be used to control the voltage level on the AGC pin. Note that the voltage at the AGC_EN pin is sampled during start-up. After adjusting the pin to the desired voltage, restart the power to start using the selected AGC_EN setting.

Figure 2-3. Potentiometer Available on EVM

To select a precise voltage at the AGC_EN pin, do the following steps:

1. Uninstall jumper J9
2. Choose one of the following steps:
   a. Use the AGC_EN test point to supply a precise voltage
   b. Install R6 and R8. This forms a resistive divider from the VREG supply.

2.2.3 Connect the Inductive Sensor

Terminal J4 or headers J5, J6, and J7 can be used to connect the EVM board to an inductive position sensor.

Note

Without a sensor, the LDC5072 defaults into a fault state, no outputs are observed on LCIN, and the LCOUT and OUTx pins are High-Z.

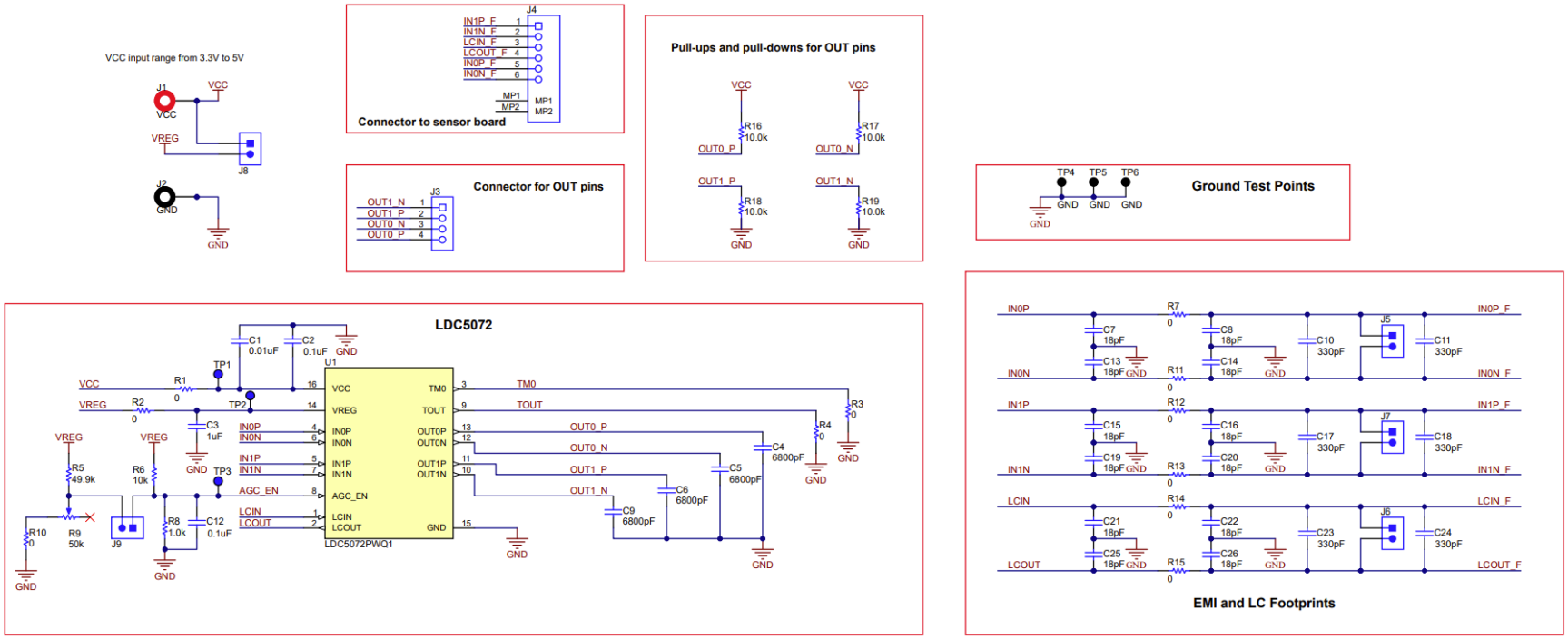
2.2.4 Measure the Analog Outputs

The analog outputs can be measured manually by monitoring the OUTx signals available at J3. Note that without a sensor connected, the device goes into a FAULT condition and these pins are in a High-Z state.

These analog outputs can be connected to a differential ADC to simulate a real system.

3 Hardware Design Files

3.1 Schematics



3.2 PCB Layouts

Table 3-1. Layer Usage

Layer	Functionality
Top	Signals and components
Mid-layer 1	Ground plane
Mid-layer 2	VCC power plane
Bottom	Signals

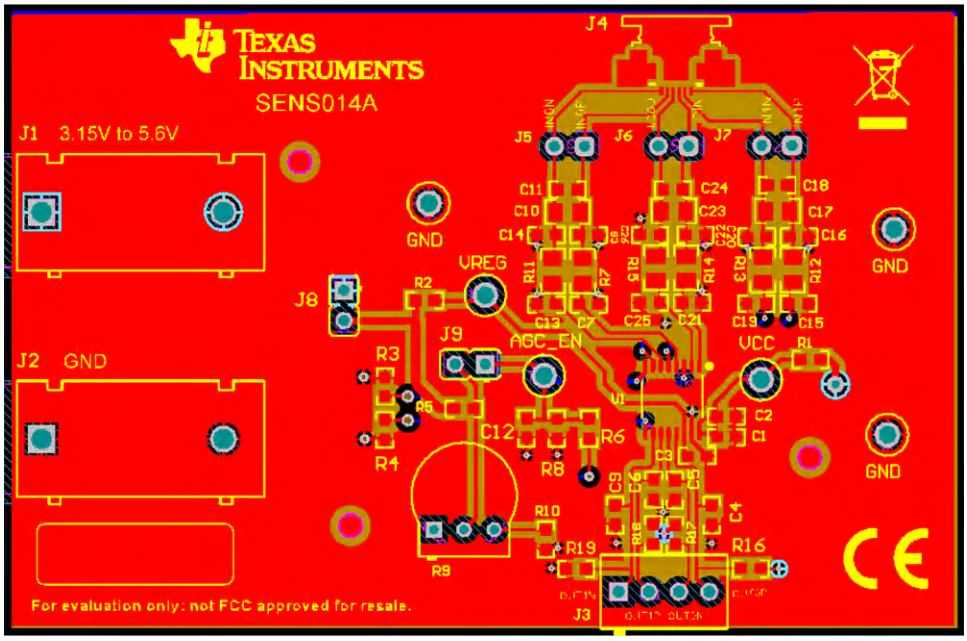


Figure 3-1. Top Layer

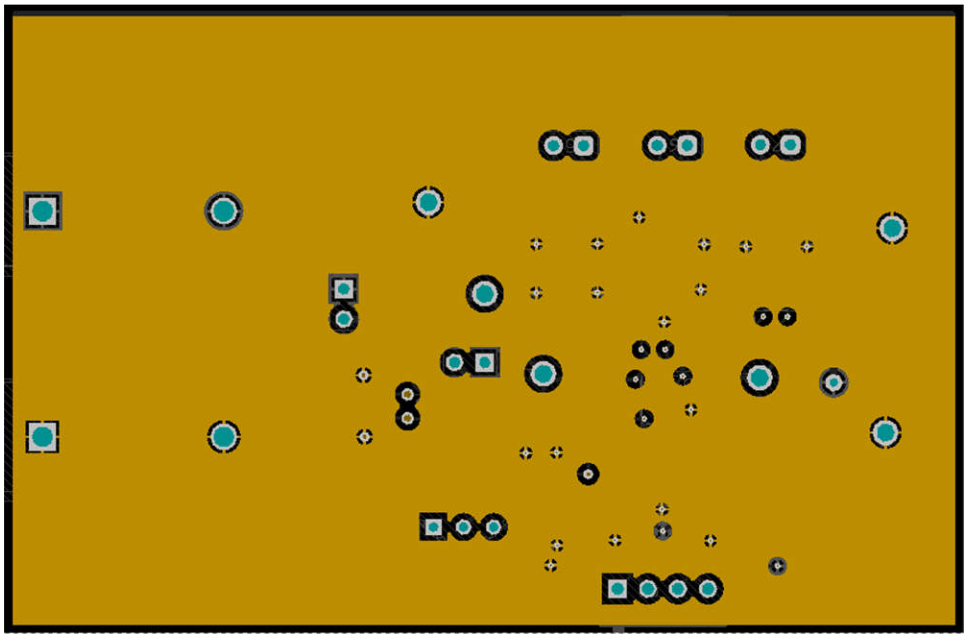


Figure 3-2. Mid-Layer 1

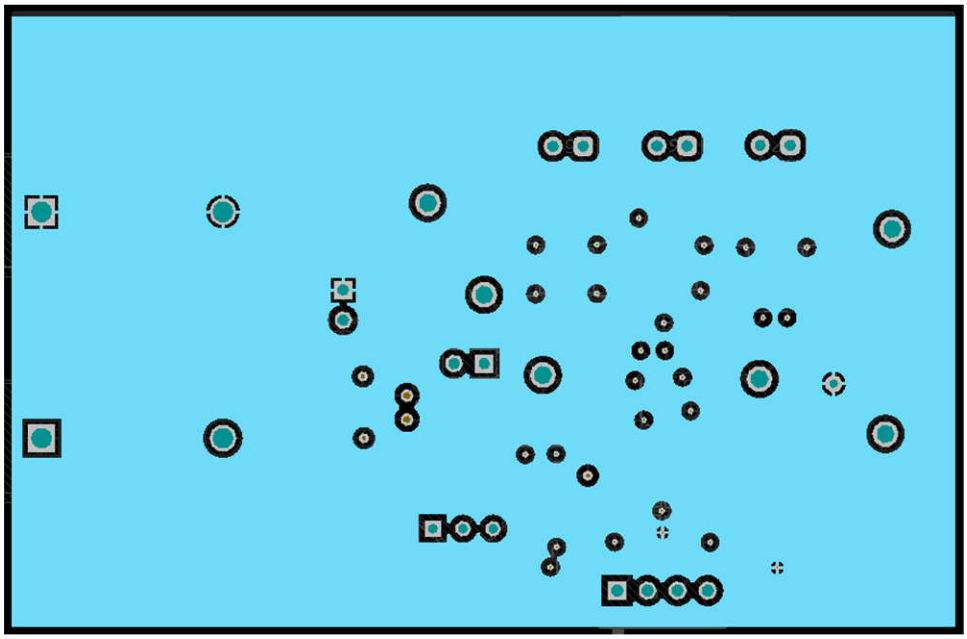


Figure 3-3. Mid-Layer 2

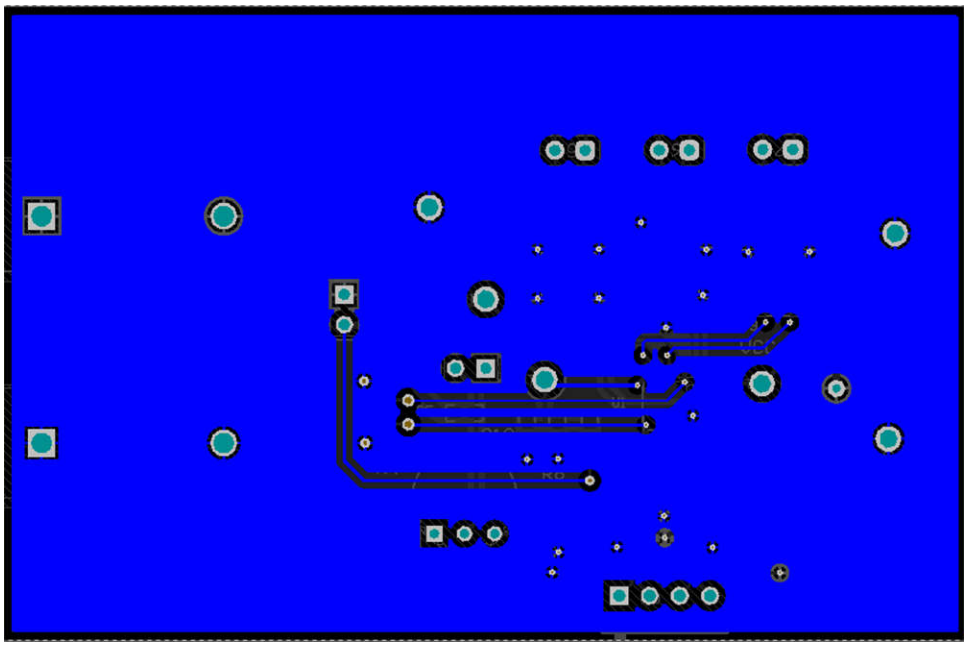


Figure 3-4. Bottom Layer

3.3 Bill of Materials (BOM)

Table 3-2. LDC5072Q1EVM BOM

Designator	Quantity	Value	Description	Package	PartNumber	Manufacturer
C1	1	0.01uF	CAP, CERM, 0.01 uF, 25 V, +/- 10%, X7R, 0603	0603	GRM188R71E103KA01D	MuRata
C2	1	0.1uF	CAP, CERM, 0.1 uF, 25 V, +/- 10%, X7R, 0603	0603	C1608X7R1E104K080AA	TDK
C3	1	1uF	CAP, CERM, 1 uF, 35 V, +/- 10%, X7R, AEC-Q200 Grade 1, 0603	0603	CGA3E1X7R1V105K080AC	TDK
C4, C5, C6, C9	4	6800 pF	CAP, CERM, 6800 pF, 25 V, +/- 10%, X7R, 0603	0603	GRM188R71E682KA01D	MuRata
H9, H10, H11, H12	4		Bumpon, Hemisphere, 0.44 X 0.20, Clear	Transparent Bumpon	SJ-5303 (CLEAR)	3M
J1	1		Standard Banana Jack, insulated, 10 A, red	571-0500	571-0500	DEM Manufacturing
J2	1		Standard Banana Jack, insulated, 10 A, black	571-0100	571-0100	DEM Manufacturing
J4	1		FFC/FPC Connector, 6 POS, 0.5mm, R/A, Tin, SMT	FFC/FPC Connector, 6 POS, 0.5mm, R/A, SMT	52745-0633	Molex
J8, J9	2		Header, 2.54mm, 2x1, Tin, TH	Header, 2.54mm, 2x1, TH	22284023	Molex
LBL1	1		Thermal Transfer Printable Labels, 0.650" W x 0.200" H - 10,000 per roll	PCB Label 0.650 x 0.200 inch	THT-14-423-10	Brady
R1, R2, R3, R4, R10	5	0	RES, 0, 5%, 0.1 W, AEC-Q200 Grade 0, 0603	0603	CRCW06030000Z0EA	Vishay-Dale
R5	1	49.9k	RES, 49.9 k, 1%, 0.1 W, AEC-Q200 Grade 0, 0603	0603	ERJ-3EKF4992V	Panasonic
R7, R11, R12, R13, R14, R15	6	0	RES, 0, 5%, 0.125 W, AEC-Q200 Grade 0, 0805	0805	CRCW08050000Z0EA	Vishay-Dale
R9	1	50k	Trimming Potentiometer, 50K, 0.5W, TH	9.53x8.89mm	3352T-1-503LF	Bourns
R16, R17, R18, R19	4	10.0k	RES, 10.0 k, 1%, 0.1 W, AEC-Q200 Grade 0, 0603	0603	CRCW060310K0FKEA	Vishay-Dale
SH-J1	1		Shunt, 2.54mm, Gold, Black	Shunt, 2.54mm, Black	60900213421	Wurth Elektronik

Table 3-2. LDC5072Q1EVM BOM (continued)

Designator	Quantity	Value	Description	Package	PartNumber	Manufacturer
TP1, TP2, TP3	3		Test Point, Compact, Blue, TH	Blue Compact Testpoint	5122	Keystone
TP4, TP5, TP6	3		Test Point, Compact, Black, TH	Black Compact Testpoint	5006	Keystone
U1	1		Inductive Position Sensor with Sin/Cos Interface, PW0016A (TSSOP-16)	PW0016A	LDC5072PWQ1	Texas Instruments
C7, C8, C13, C14, C15, C16, C19, C20, C21, C22, C25, C26	0	18 pF	CAP, CERM, 18 pF, 100 V, +/- 5%, C0G/NP0, 0603	0603	GRM1885C2A180JA01D	MuRata
C10, C17, C23	0	330 pF	CAP, CERM, 330 pF, 50 V, +/- 5%, C0G/NP0, 0805	0805	08055A331JAT2A	AVX
C11, C18, C24	0	330 pF	CAP, CERM, 330 pF, 50 V, +/- 1%, C0G/NP0, 0603	0603	C1608C0G1H331F080AA	TDK
C12	0	0.1uF	CAP, CERM, 0.1 uF, 25 V, +/- 10%, X7R, 0603	0603	C1608X7R1E104K080AA	TDK
FID1, FID2, FID3	0		Fiducial mark. There is nothing to buy or mount.	N/A	N/A	N/A
J3	0		Terminal Block, 4x1, 2.54 mm, Green, TH	Terminal Block, 4x1, 2.54 mm, TH	1725672	Phoenix Contact
J5, J6, J7	0		Header, 100mil, 2x1, Gold, TH	2x1 Header	TSW-102-07-G-S	Samtec
R6	0	10k	RES, 10 k, 5%, 0.1 W, 0603	0603	RC0603JR-0710KL	Yageo
R8	0	1.0k	RES, 1.0 k, 5%, 0.1 W, AEC-Q200 Grade 0, 0603	0603	CRCW06031K00JNEA	Vishay-Dale

4 Additional Information

4.1 Trademarks

All trademarks are the property of their respective owners.

5 Revision History

NOTE: Page numbers for previous revisions may differ from page numbers in the current version.

Changes from Revision * (November 2018) to Revision A (June 2026)	Page
• Moved the content in the *Abstract* to the *Description* and *Kit Contents* sections	1
• Added *Features* list	1
• Added the *Evaluation Module Overview* section	2
• Added *Introduction* section	2
• Added the *Kit Contents* section	2
• Added *Device Information* from LDC5072-Q1 Datasheet	2
• Added the *Hardware* section	3
• Updated incomplete schematic with complete schematic	7

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   1.2 EVMs are not intended for consumer or household use. EVMs may not be sold, sublicensed, leased, rented, loaned, assigned, or otherwise distributed for commercial purposes by Users, in whole or in part, or used in any finished product or production system.

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   2.2 TI warrants that the TI EVM will conform to TI's published specifications for ninety (90) days after the date TI delivers such EVM to User. Notwithstanding the foregoing, TI shall not be liable for a nonconforming EVM if (a) the nonconformity was caused by neglect, misuse or mistreatment by an entity other than TI, including improper installation or testing, or for any EVMs that have been altered or modified in any way by an entity other than TI, (b) the nonconformity resulted from User's design, specifications or instructions for such EVMs or improper system design, or (c) User has not paid on time. Testing and other quality control techniques are used to the extent TI deems necessary. TI does not test all parameters of each EVM. User's claims against TI under this Section 2 are void if User fails to notify TI of any apparent defects in the EVMs within ten (10) business days after delivery, or of any hidden defects with ten (10) business days after the defect has been detected.

   2.3 TI's sole liability shall be at its option to repair or replace EVMs that fail to conform to the warranty set forth above, or credit User's account for such EVM. TI's liability under this warranty shall be limited to EVMs that are returned during the warranty period to the address designated by TI and that are determined by TI not to conform to such warranty. If TI elects to repair or replace such EVM, TI shall have a reasonable time to repair such EVM or provide replacements. Repaired EVMs shall be warranted for the remainder of the original warranty period. Replaced EVMs shall be warranted for a new full ninety (90) day warranty period.

WARNING

Evaluation Kits are intended solely for use by technically qualified, professional electronics experts who are familiar with the dangers and application risks associated with handling electrical mechanical components, systems, and subsystems.

User shall operate the Evaluation Kit within TI’s recommended guidelines and any applicable legal or environmental requirements as well as reasonable and customary safeguards. Failure to set up and/or operate the Evaluation Kit within TI’s recommended guidelines may result in personal injury or death or property damage. Proper set up entails following TI’s instructions for electrical ratings of interface circuits such as input, output and electrical loads.

NOTE:

EXPOSURE TO ELECTROSTATIC DISCHARGE (ESD) MAY CAUSE DEGREDATION OR FAILURE OF THE EVALUATION KIT; TI RECOMMENDS STORAGE OF THE EVALUATION KIT IN A PROTECTIVE ESD BAG.

3 *Regulatory Notices:*

3.1 *United States*

3.1.1 *Notice applicable to EVMs not FCC-Approved:*

FCC NOTICE: This kit is designed to allow product developers to evaluate electronic components, circuitry, or software associated with the kit to determine whether to incorporate such items in a finished product and software developers to write software applications for use with the end product. This kit is not a finished product and when assembled may not be resold or otherwise marketed unless all required FCC equipment authorizations are first obtained. Operation is subject to the condition that this product not cause harmful interference to licensed radio stations and that this product accept harmful interference. Unless the assembled kit is designed to operate under part 15, part 18 or part 95 of this chapter, the operator of the kit must operate under the authority of an FCC license holder or must secure an experimental authorization under part 5 of this chapter.

3.1.2 *For EVMs annotated as FCC – FEDERAL COMMUNICATIONS COMMISSION Part 15 Compliant:*

CAUTION

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

FCC Interference Statement for Class A EVM devices

NOTE: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

FCC Interference Statement for Class B EVM devices

NOTE: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- *Reorient or relocate the receiving antenna.*
- *Increase the separation between the equipment and receiver.*
- *Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.*
- *Consult the dealer or an experienced radio/TV technician for help.*

3.2 *Canada*

3.2.1 *For EVMs issued with an Industry Canada Certificate of Conformance to RSS-210 or RSS-247*

Concerning EVMs Including Radio Transmitters:

This device complies with Industry Canada license-exempt RSSs. Operation is subject to the following two conditions:

(1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

Concernant les EVMs avec appareils radio:

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes: (1) l'appareil ne doit pas produire de brouillage, et (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

Concerning EVMs Including Detachable Antennas:

Under Industry Canada regulations, this radio transmitter may only operate using an antenna of a type and maximum (or lesser) gain approved for the transmitter by Industry Canada. To reduce potential radio interference to other users, the antenna type and its gain should be so chosen that the equivalent isotropically radiated power (e.i.r.p.) is not more than that necessary for successful communication. This radio transmitter has been approved by Industry Canada to operate with the antenna types listed in the user guide with the maximum permissible gain and required antenna impedance for each antenna type indicated. Antenna types not included in this list, having a gain greater than the maximum gain indicated for that type, are strictly prohibited for use with this device.

Concernant les EVMs avec antennes détachables

Conformément à la réglementation d'Industrie Canada, le présent émetteur radio peut fonctionner avec une antenne d'un type et d'un gain maximal (ou inférieur) approuvé pour l'émetteur par Industrie Canada. Dans le but de réduire les risques de brouillage radioélectrique à l'intention des autres utilisateurs, il faut choisir le type d'antenne et son gain de sorte que la puissance isotrope rayonnée équivalente (p.i.r.e.) ne dépasse pas l'intensité nécessaire à l'établissement d'une communication satisfaisante. Le présent émetteur radio a été approuvé par Industrie Canada pour fonctionner avec les types d'antenne énumérés dans le manuel d'usage et ayant un gain admissible maximal et l'impédance requise pour chaque type d'antenne. Les types d'antenne non inclus dans cette liste, ou dont le gain est supérieur au gain maximal indiqué, sont strictement interdits pour l'exploitation de l'émetteur

3.3 *Japan*

3.3.1 *Notice for EVMs delivered in Japan:* Please see http://www.tij.co.jp/lsds/ti_ja/general/eStore/notice_01.page 日本国内に輸入される評価用キット、ボードについては、次のところをご覧ください。

https://www.ti.com/ja-jp/legal/notice-for-evaluation-kits-delivered-in-japan.html

3.3.2 *Notice for Users of EVMs Considered "Radio Frequency Products" in Japan:* EVMs entering Japan may not be certified by TI as conforming to Technical Regulations of Radio Law of Japan.

If User uses EVMs in Japan, not certified to Technical Regulations of Radio Law of Japan, User is required to follow the instructions set forth by Radio Law of Japan, which includes, but is not limited to, the instructions below with respect to EVMs (which for the avoidance of doubt are stated strictly for convenience and should be verified by User):

1. Use EVMs in a shielded room or any other test facility as defined in the notification #173 issued by Ministry of Internal Affairs and Communications on March 28, 2006, based on Sub-section 1.1 of Article 6 of the Ministry's Rule for Enforcement of Radio Law of Japan,
2. Use EVMs only after User obtains the license of Test Radio Station as provided in Radio Law of Japan with respect to EVMs, or
3. Use of EVMs only after User obtains the Technical Regulations Conformity Certification as provided in Radio Law of Japan with respect to EVMs. Also, do not transfer EVMs, unless User gives the same notice above to the transferee. Please note that if User does not follow the instructions above, User will be subject to penalties of Radio Law of Japan.

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3.3.3 *Notice for EVMs for Power Line Communication:* Please see http://www.tij.co.jp/lsds/ti_ja/general/eStore/notice_02.page

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3.4 *European Union*

3.4.1 *For EVMs subject to EU Directive 2014/30/EU (Electromagnetic Compatibility Directive)*:

This is a class A product intended for use in environments other than domestic environments that are connected to a low-voltage power-supply network that supplies buildings used for domestic purposes. In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures.

4 *EVM Use Restrictions and Warnings:*

4.1 EVMS ARE NOT FOR USE IN FUNCTIONAL SAFETY AND/OR SAFETY CRITICAL EVALUATIONS, INCLUDING BUT NOT LIMITED TO EVALUATIONS OF LIFE SUPPORT APPLICATIONS.

4.2 User must read and apply the user guide and other available documentation provided by TI regarding the EVM prior to handling or using the EVM, including without limitation any warning or restriction notices. The notices contain important safety information related to, for example, temperatures and voltages.

4.3 *Safety-Related Warnings and Restrictions:*

4.3.1 User shall operate the EVM within TI's recommended specifications and environmental considerations stated in the user guide, other available documentation provided by TI, and any other applicable requirements and employ reasonable and customary safeguards. Exceeding the specified performance ratings and specifications (including but not limited to input and output voltage, current, power, and environmental ranges) for the EVM may cause personal injury or death, or property damage. If there are questions concerning performance ratings and specifications, User should contact a TI field representative prior to connecting interface electronics including input power and intended loads. Any loads applied outside of the specified output range may also result in unintended and/or inaccurate operation and/or possible permanent damage to the EVM and/or interface electronics. Please consult the EVM user 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, even with the inputs and outputs kept within the specified allowable ranges, some circuit components may have elevated case temperatures. These components include but are not limited to linear regulators, switching transistors, pass transistors, current sense resistors, and heat sinks, which can be identified using the information in the associated documentation. When working with the EVM, please be aware that the EVM may become very warm.

4.3.2 EVMs are intended solely for use by technically qualified, professional electronics experts who are familiar with the dangers and application risks associated with handling electrical mechanical components, systems, and subsystems. User assumes all responsibility and liability for proper and safe handling and use of the EVM by User or its employees, affiliates, contractors or designees. User assumes all responsibility and liability to ensure that any interfaces (electronic and/or mechanical) between the EVM and any human body are designed with suitable isolation and means to safely limit accessible leakage currents to minimize the risk of electrical shock hazard. User assumes all responsibility and liability for any improper or unsafe handling or use of the EVM by User or its employees, affiliates, contractors or designees.

4.4 User assumes all responsibility and liability to determine whether the EVM is subject to any applicable international, federal, state, or local laws and regulations related to User's handling and use of the EVM and, if applicable, User assumes all responsibility and liability for compliance in all respects with such laws and regulations. User assumes all responsibility and liability for proper disposal and recycling of the EVM consistent with all applicable international, federal, state, and local requirements.

5. *Accuracy of Information:* To the extent TI provides information on the availability and function of EVMs, TI attempts to be as accurate as possible. However, TI does not warrant the accuracy of EVM descriptions, EVM availability or other information on its websites as accurate, complete, reliable, current, or error-free.

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