

BOOST-LDC3114 Evaluation Module User's Guide



ABSTRACT

This user's guide describes the characteristics, operation, and use of the BOOST-LDC3114 Evaluation Module (EVM). Complete schematic diagrams, printed circuit board layouts, and bill of materials are included in this document.

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Trademarks

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1 Overview

The LDC3114EVM demonstrates the use of inductive sensing technology to sense and measure the presence or position of a conductive target object and to detect the press of an inductive touch button. The LDC3114EVM is controlled by an MSP432, which connects to a host computer.

The EVM is comprised of two boards, the LDC board and the MSP board. This is set up as a boosterpack and allows the LDC board to be used with a different microcontroller.

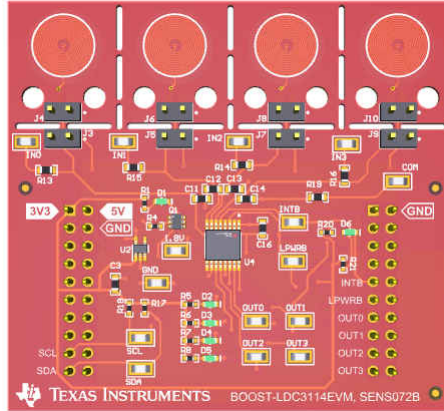


Figure 1-1. BOOST-LDC3114EVM

1.1 EVM Kit Contents

[Table 1-1](#) details the contents of the EVM kit. Contact the nearest Texas Instruments Product Information Center if any components are missing.

Table 1-1. EVM Kit Contents

Item	Quantity
BOOST-LDC3114EVM	1
PAMB Controller Board	1
Micro-USB Cable	1

1.2 Compatible Sensors

The LDC3114EVM includes four identical example sensors that are perforated so they can be removed and replaced with different sensors by soldering onto the provided header pin locations. The [LDCCOILEVM](#) and [LDCTOUCHCOMCOILEVM](#) both have compatible sensors that can be used with the LDC3114EVM. Other sensors can be connected to the input headers with an unshielded twisted pair of wires.

1.3 Main EVM Elements

[Figure 1-2](#) shows the layout of the LDC3114EVM and points out various features. The sensor coils are located on a perforated section of the board so they can be placed remotely from the sensor or replaced with other, [compatible sensors](#) by using the sensor connection headers.

The LDC3114EVM has multiple test points designated for the power, ground, I²C, and output pins. Additionally, the button detection LEDs on the output pins are located in the center of the board.

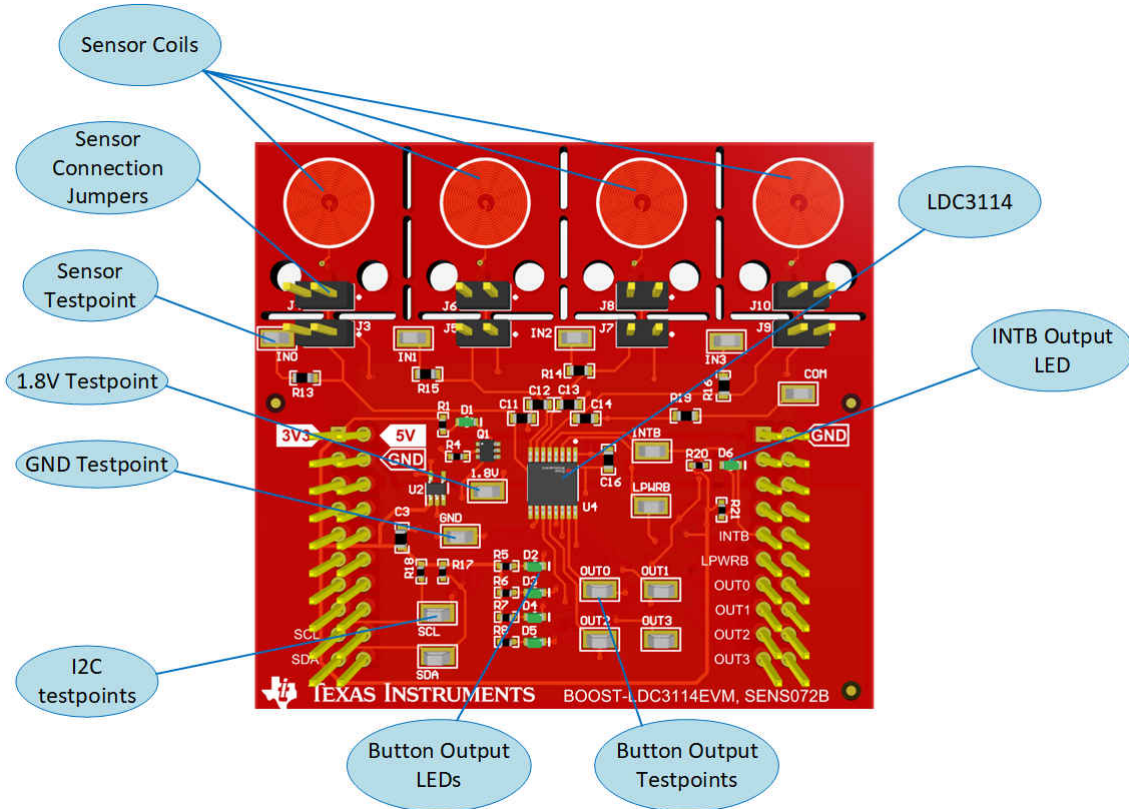


Figure 1-2. EVM Features

2 EVM GUI

The LDC3114EVM GUI provides direct device register access and data streaming.

2.1 System Requirements

The LDC3114EVM software is compatible with Windows, Mac, and Linux operating systems. The online software works with Chrome, Firefox, and Safari browsers.

2.2 Installation

The GUI software for the LDC3114EVM runs on TI's GUI Composer framework. The software is available as a live version that runs in a browser and as a download for offline use.

Download and install the PAMB Controller drivers from <https://www.ti.com/lit/zip/sbac253>. This is a one-time only setup.

Access the online version by navigating to https://dev.ti.com/gallery/search/LDC3114EVM_GUI. To access the offline GUI, mouse over the *Download* icon, select your operating system from the list, then follow the installation instructions.

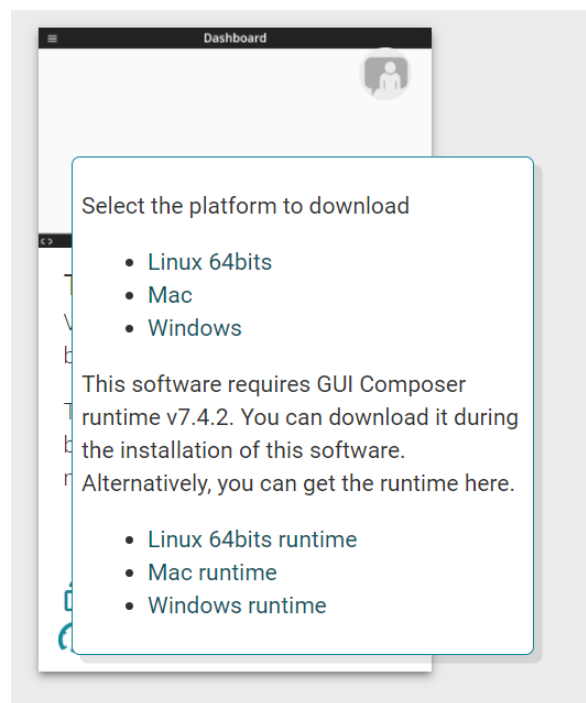


Figure 2-1. Download Pop-Up

2.3 Navigation

For first-time use, follow the prompts for TI Cloud Agent Installation:

TI Cloud Agent Installation

Hardware interaction requires additional one time set up. Please perform the actions listed below and try your operation again.(What's this?)

- Step 1: **INSTALL** browser extension
- Step 2: **DOWNLOAD** and install the TI Cloud Agent Application
- Help. I already did this

FINISH

Figure 2-2. Initial GUI Setup

After the successful completion of the previous steps, make sure the text **Hardware Connected** appears in the bottom-left corner of the screen.

If the hardware is not recognized, go to **Options**→**Serial Port...** and select the correct port, then click **Ok**.

The main page has the device name and links to other pages in the GUI.

2.3.1 Registers

The Registers page allows the user to read and write to the device registers. Additionally, the Auto Read function will default to Off, but can be set to the following speeds:

- Every 1 sec
- Every 5 sec
- Every 10 sec
- Every 20 sec
- Every 30 sec
- Every 60 sec
- As fast as possible

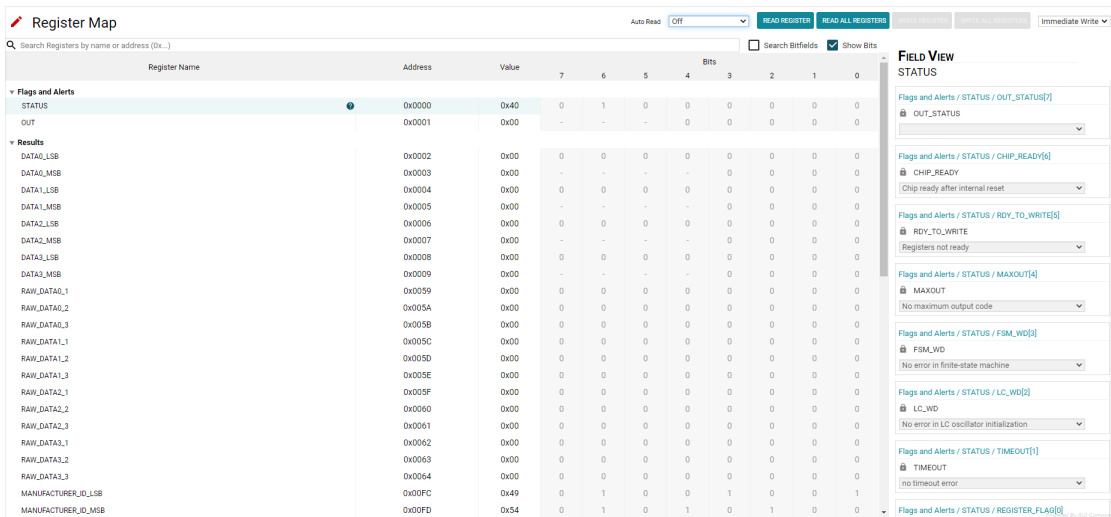


Figure 2-3. Registers Page

2.3.1.1 Basic Register Configuration

- The device must be in Config mode before you are able to set register configurations
 - Set the *CONFIG_MODE* bit of *RESET (Address 0x0A)* to 1 to put the device into Config mode
- Choose the sampling rate based on the power consumption requirement of the system by configuring the *NP_SCAN_RATE (Address 0x0D)* or *LP_SCAN_RATE (Address 0x0F)* registers
- Ensure that the correct sensor parameters are selected by configuring the *SENSORn_CONFIG* registers
 - These registers are used to set the sensor Rp range, frequency range, and cycle count
- To operate in Raw Data Mode, set the *BALG_EN* bit of *INTPOL (Address 0x011)* to 0 to disable the Button Algorithm
- Set the *CONFIG_MODE* bit of *RESET (Address 0x0A)* to 0 to put the device back into Normal mode

2.3.2 Data Plot

In the Data Plot tab the data will be read as fast as the register is set. The graph can be configured as either Button Data or Raw Data, depending on register settings.

Make sure to select the correct view for the selected data, either Button Data or Raw Data. The data plot can be saved as a .csv file or cleared by clicking either the *Save Plot* or *Clear Plot* icons.

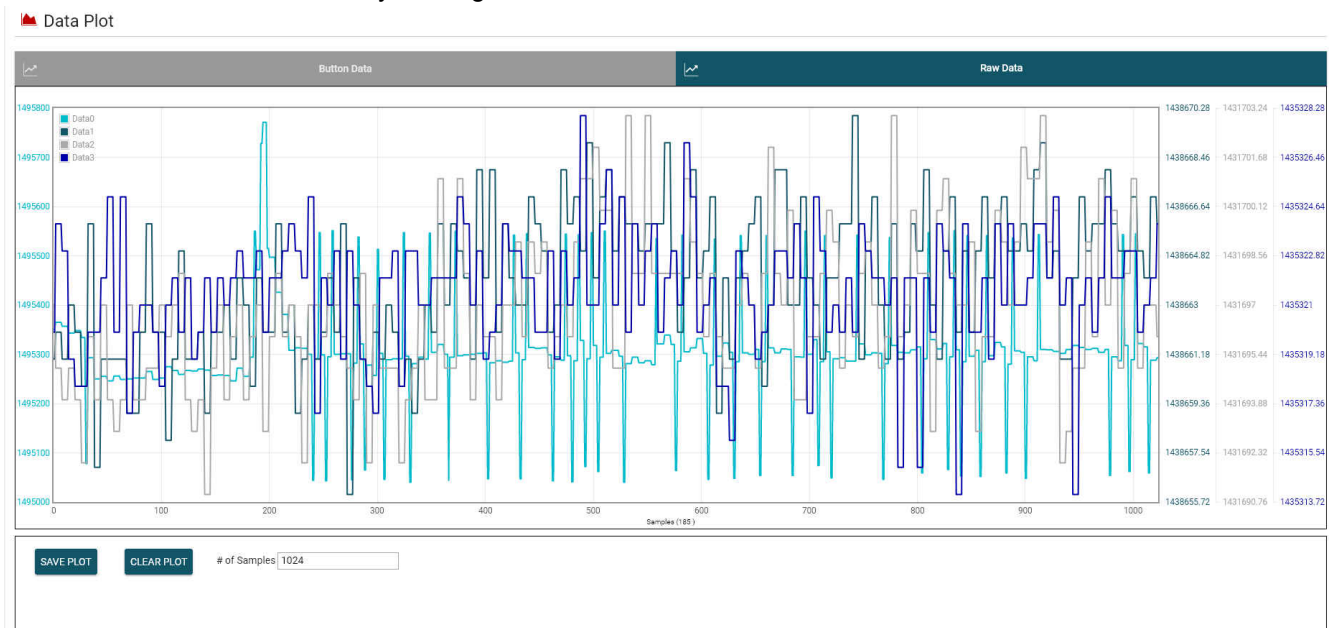


Figure 2-4. Data Plot

2.3.3 Settings

The Settings page has select register settings that can be controlled directly, as well as GPIO settings.

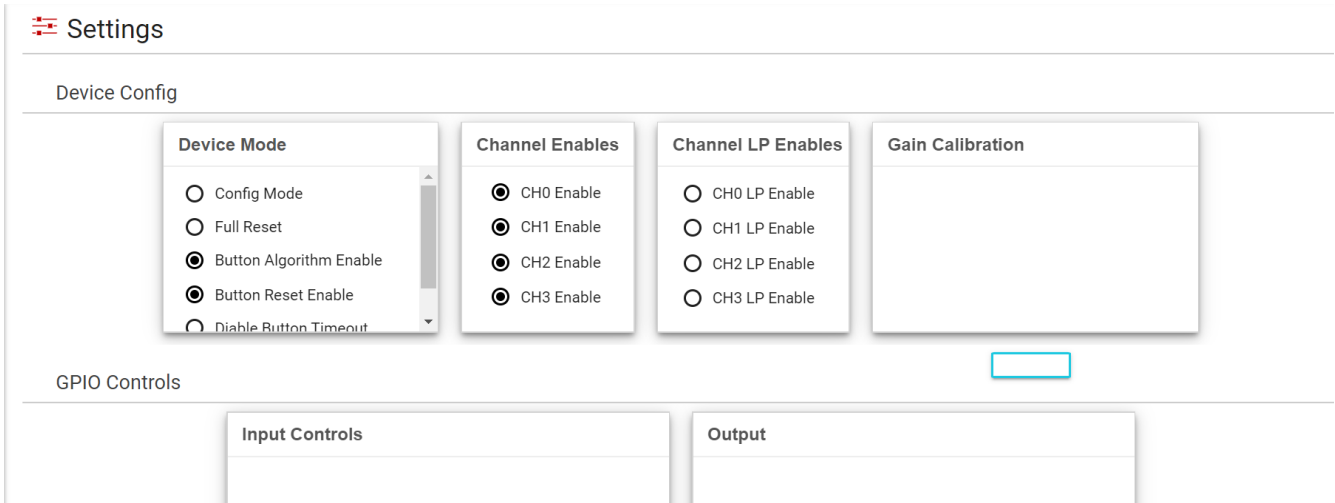


Figure 2-5. Settings

2.3.4 Collateral

The Collateral page is where the user can find links to various resources, including data sheets, application notes, firmware, and any applicable reports.

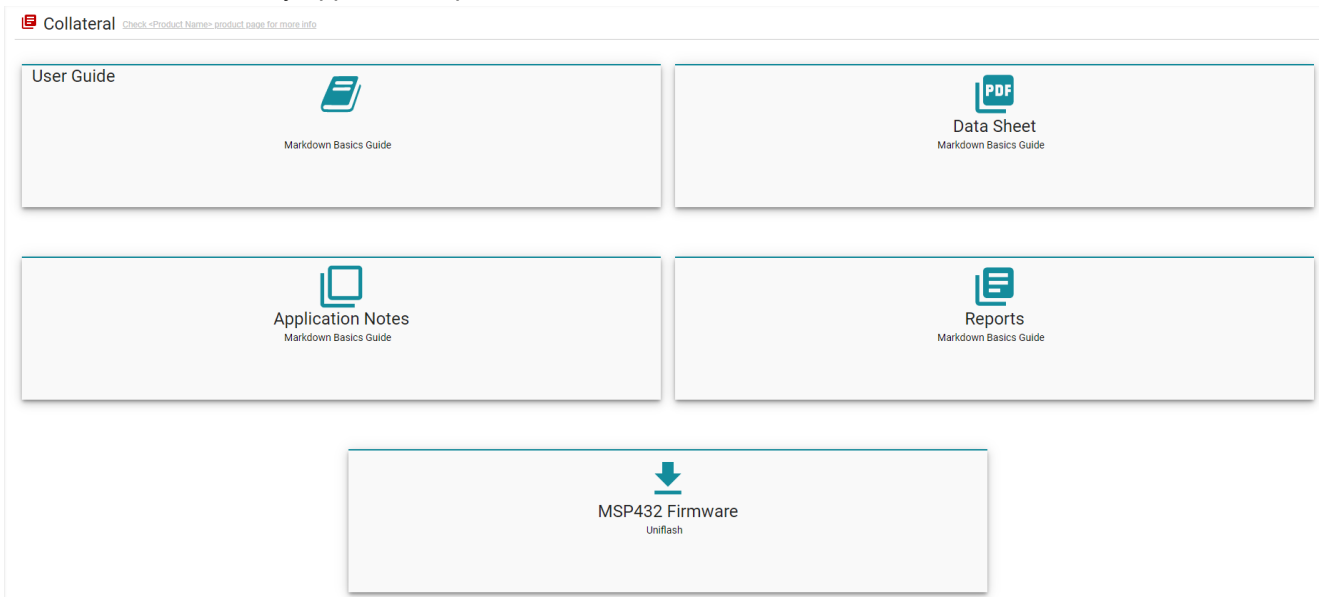


Figure 2-6. Collateral Page

2.4 Firmware Updates

If there are issues with the PAMB controller such that it is unable to connect to the GUI or the LEDs do not light, the firmware may need to be re-flashed through a batch file.

Before this can be done, the PAMB controller must be put back into Device Firmware Upgrade (DFU) mode. The steps to put the controller into DFU mode are as follows:

1. With the USB cable unplugged, remove the LDC3114 daughter card from the PAMB.
2. Locate the two test points near the PK1 and PK2 header pins.
3. Reconnect the USB cable to power the USB board.
4. With a pair of metal tweezers or wire, short and hold the connection between the PK1 and PK2 test points.
5. With the test points still shorted, press and release the RESET button (SW1) on the PAMB board.
6. If successful, none of the LEDs on the PAMB board will be on.
7. Launch the LDC3114EVM GUI.
8. Navigate to File > Program Device to launch the firmware update. Wait for the firmware to update and **do not disconnect the USB cable or press the RESET button during the update.**
9. When the update is complete, the EVM firmware should reboot and connect to the GUI. If the firmware does not reconnect momentarily, press the RESET button OR unplug and plug in the USB cable to reconnect.

3 Schematic

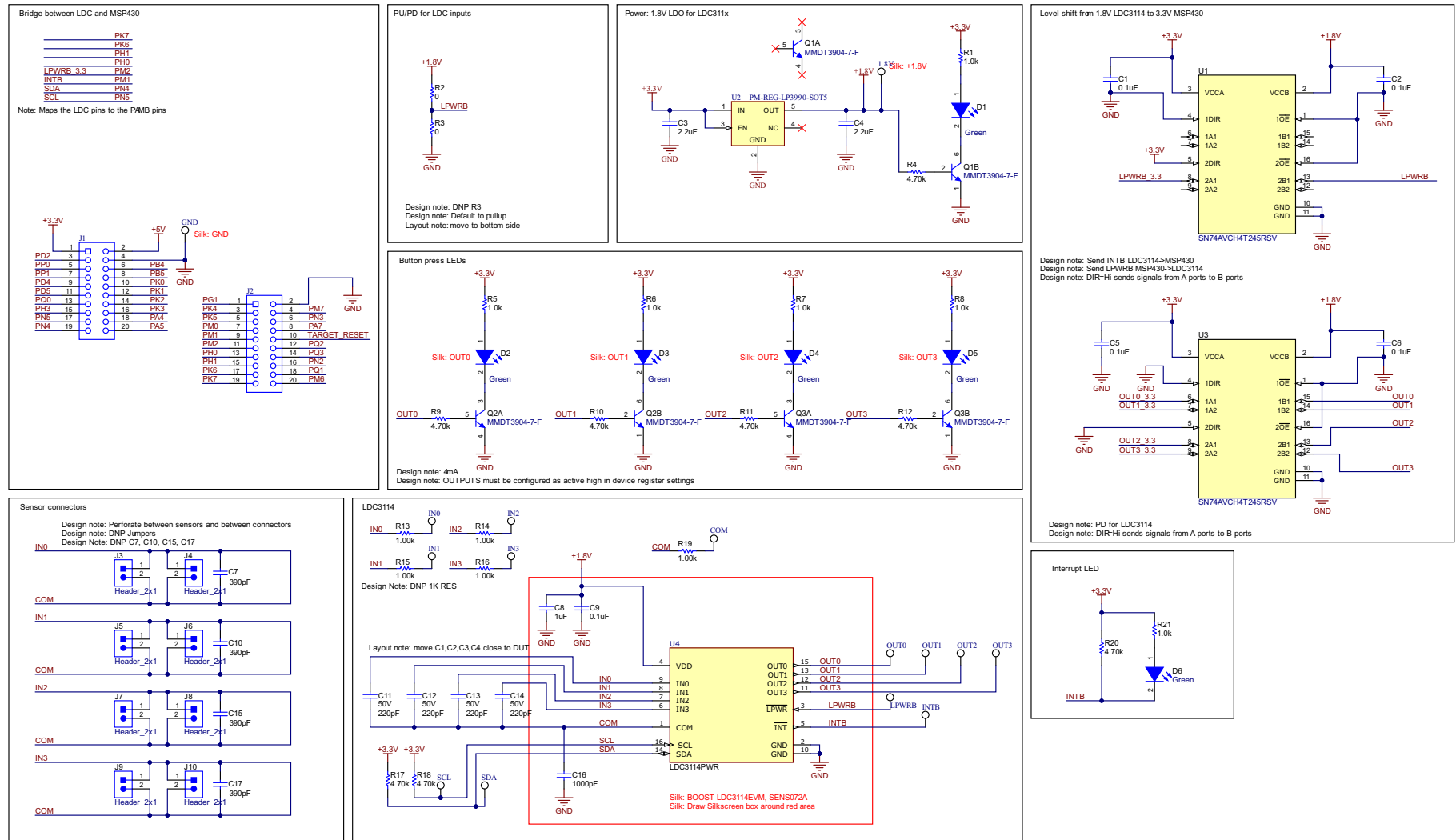


Figure 3-1. Schematic

4 Layout

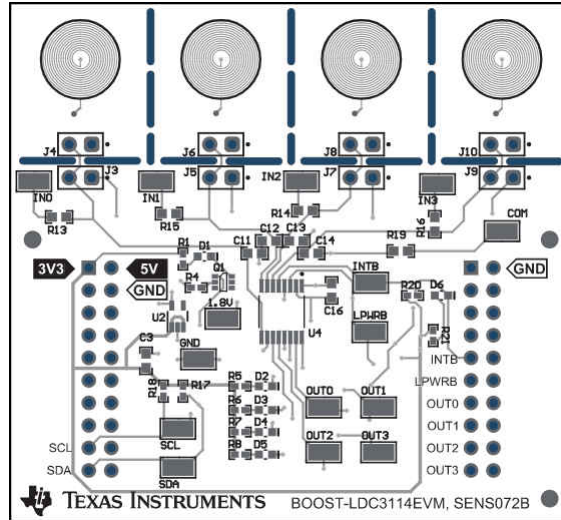


Figure 4-1. Top View Layout

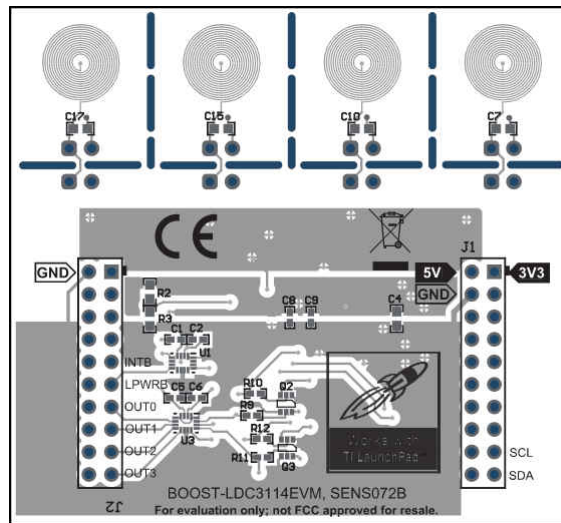


Figure 4-2. Bottom View Layout

5 Bill of Materials

Table 5-1. BOOST-LDC3114EVM BOM

Designator	QTY	Value	Description	Package Reference	Part Number	Manufacturer
!PCB1	1		Printed Circuit Board		SENS072	Any
1.8V, COM, GND, IN0, IN1, IN2, IN3, INTB, LPWRB, OUT0, OUT1, OUT2, OUT3, SCL, SDA	15		Test Point, Miniature, SMT	Testpoint_Keystone_Miniatu re	5015	Keystone
C1, C2, C5, C6, C9	5	0.1uF	CAP, CERM, 0.1 uF, 50 V, +/- 10%, X7R, 0402	0402	C1005X7R1H104K050BB	TDK
C3, C4	2	2.2uF	CAP, CERM, 2.2 uF, 10 V, +/- 10%, X5R, 0603	0603	C0603C225K8PACTU	Kemet
C7, C10, C15, C17	4	390pF	CAP, CERM, 390 pF, 50 V, +/- 1%, C0G/NP0, 0603	0603	CC0603FRNPO9BN391	Yageo America
C8	1	1uF	CAP, CERM, 1 uF, 6.3 V, +/- 20%, X7R, 0402	0402	GRM155R70J105MA12D	MuRata
C11, C12, C13, C14	4	220pF	CAP, CERM, 47 pF, 50 V, +/- 1%, C0G/NP0, 0603	0603	GRM1885C1H470FA01J	MuRata
C16	1	1000pF	CAP, CERM, 1000 pF, 50 V, +/- 1%, C0G/NP0, 0603	0603	GRM1885C1H102FA01J	MuRata
D1, D2, D3, D4, D5, D6	6	Green	LED, Green, SMD	1.7x0.65x0.8mm	LG L29K-G2J1-24-Z	OSRAM
H1	1		Kitting Item: PAMB Controller		DC081	Texas Instruments
H2	1		Kitting Item: 3025010-03; Cable, USB A MALE to Micro B MALE 3'; CDDS 6612041		6612041	Qualtek
J1, J2	2		Receptacle, 2.54mm, 10x2, Tin, TH	Receptacle, 2.54mm, 10x2, TH	SSQ-110-03-T-D	Samtec
Q1, Q2, Q3	3	40 V	Transistor, Dual NPN, 40 V, 0.2 A, SOT-363	SOT-363	MMDT3904-7-F	Diodes Inc.
R1, R5, R6, R7, R8, R21	6	1.0k	RES, 1.0 k, 5%, 0.1 W, AEC-Q200 Grade 0, 0402	0402	ERJ-2GEJ102X	Panasonic
R2, R3	2	0	RES, 0, 5%, 0.1 W, AEC-Q200 Grade 0, 0603	0603	ERJ-3GEY0R00V	Panasonic
R4, R9, R10, R11, R12, R17, R18, R20	8	4.70k	RES, 4.70 k, 1%, 0.1 W, 0402	0402	ERJ-2RKF4701X	Panasonic
R19	1	1.00k	RES, 1.00 k, 1%, 0.1 W, 0603	0603	ERJ-3EKF1001V	Panasonic
U1, U3	2		4-Bit Dual-Supply Bus Transceiver with Configurable Voltage Translation and 3-State Outputs, RSV0016A (UQFN-16)	RSV0016A	SN74AVCH4T245RSVR	Texas Instruments
U2	1		Micropower, 150mA Low-Dropout CMOS Voltage Regulator, 5-pin SC-70, Pb-Free	DCK0005A	LP5951MG-1.8/NOPB	Texas Instruments
U4	1		4-channel hybrid inductive touch and inductance to digital converter	TSSOP16	LDC3114PWR	Texas Instruments

Table 5-1. BOOST-LDC3114EVM BOM (continued)

Designator	QTY	Value	Description	Package Reference	Part Number	Manufacturer
FID1, FID2, FID3	0		Fiducial mark. There is nothing to buy or mount.	N/A	N/A	N/A
J3, J4, J5, J6, J7, J8, J9, J10	0		Header, 100mil, 2x1, Gold, TH	2x1 Header	TSW-102-07-G-S	Samtec
R13, R14, R15, R16	0	1.00k	RES, 1.00 k, 1%, 0.1 W, 0603	0603	ERJ-3EKF1001V	Panasonic

6 Revision History

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

Changes from Revision * (February 2021) to Revision A (September 2021)	Page
• Changed the <i>Overview</i> section.....	2
• Changed the <i>Main EVM Elements</i> section.....	2
• Changed the <i>Basic Register Configuration</i> section.....	6
• Changed the <i>Schematic</i> section.....	9
• Changed the <i>Layout</i> section.....	10
• Changed the <i>Bill of Materials</i> section.....	11

STANDARD TERMS FOR EVALUATION MODULES

1. *Delivery:* TI delivers TI evaluation boards, kits, or modules, including any accompanying demonstration software, components, and/or documentation which may be provided together or separately (collectively, an "EVM" or "EVMs") to the User ("User") in accordance with the terms set forth herein. User's acceptance of the EVM is expressly subject to the following terms.
 - 1.1 EVMs are intended solely for product or software developers for use in a research and development setting to facilitate feasibility evaluation, experimentation, or scientific analysis of TI semiconductor products. EVMs have no direct function and are not finished products. EVMs shall not be directly or indirectly assembled as a part or subassembly in any finished product. For clarification, any software or software tools provided with the EVM ("Software") shall not be subject to the terms and conditions set forth herein but rather shall be subject to the applicable terms that accompany such Software
 - 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.
2. *Limited Warranty and Related Remedies/Disclaimers:*
 - 2.1 These terms do not apply to Software. The warranty, if any, for Software is covered in the applicable Software License Agreement.
 - 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 DEGRADATION 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/lstds/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。
http://www.tij.co.jp/lstds/ti_ja/general/eStore/notice_01.page

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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2. 実験局の免許を取得後ご使用いただく。
3. 技術基準適合証明を取得後ご使用いただく。

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西新宿三井ビル

3.3.3 *Notice for EVMs for Power Line Communication:* Please see http://www.tij.co.jp/lstds/ti_ja/general/eStore/notice_02.page
電力線搬送波通信についての開発キットをお使いになる際の注意事項については、次のところをご覧ください。http://www.tij.co.jp/lstds/ti_ja/general/eStore/notice_02.page

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.
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