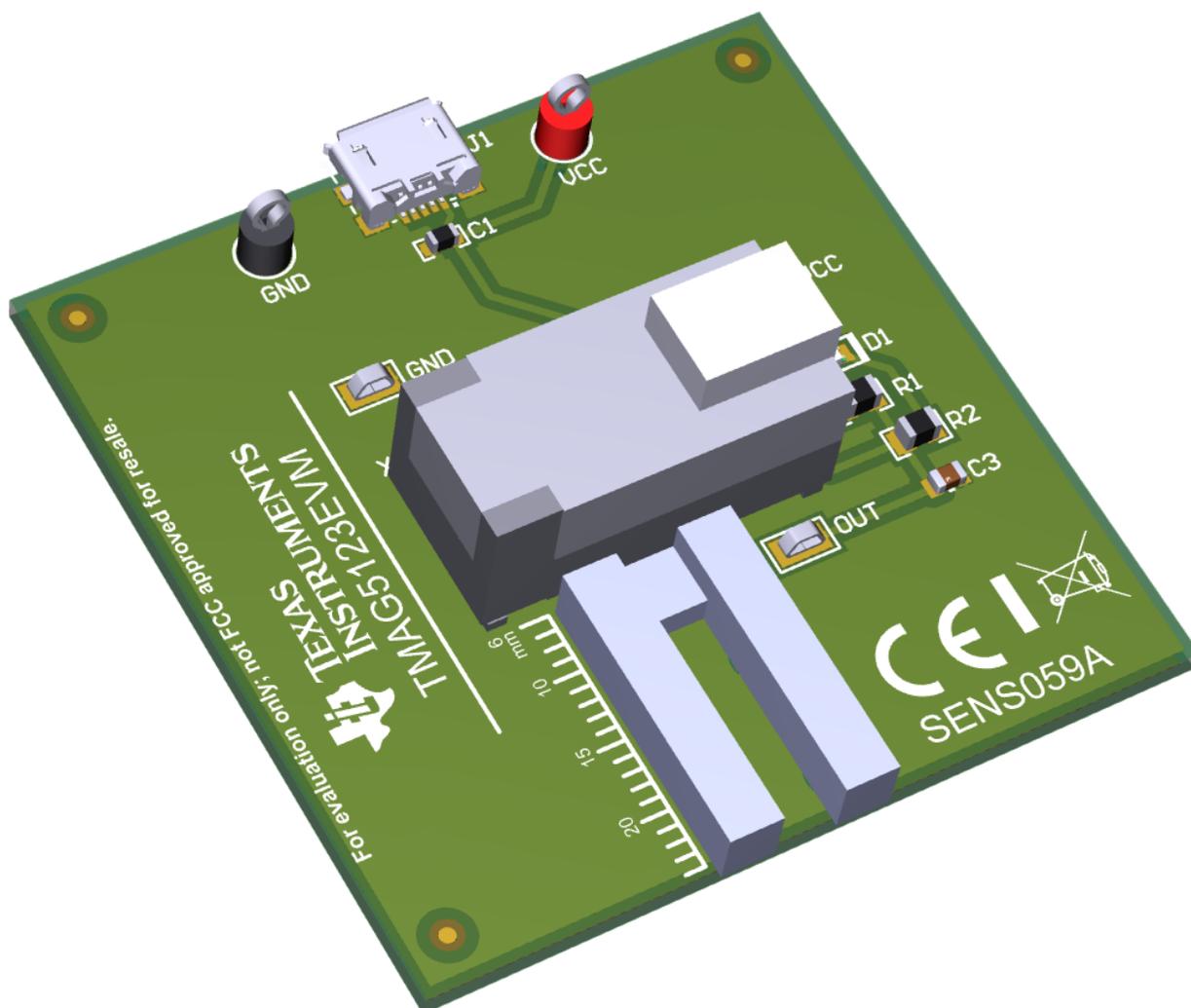


TMAG5123EVM

This user's guide describes the characteristics, operation, and use of the TMAG5123 high-precision, in-plane switch evaluation module (EVM). This EVM is designed to evaluate the performance of the TMAG5123. This document includes a schematic, printed-circuit board (PCB) layouts, and a complete bill of materials (BOM).

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1 Overview

The TMAG5123 is a family of high-precision, wide input voltage, in-plane Hall effect sensors designed for system challenges where higher magnetic precision is needed for more flexibility in design. The TMAG5123 evaluation module is populated with a Sensata 499-P36-20 test socket, which allows for convenient testing of all variants of the TMAG5123 family. Each device variant exhibits a different magnetic sensitivity, allowing utility for distance measurement in application. When the applied magnetic flux density exceeds the magnetic operating point (B_{OP}) threshold, the device output drives into low voltage state. When the magnetic flux density returns to a value below the magnetic release point (B_{RP}), the device output returns itself to a high voltage state. The TMAG5123EVM comes prepopulated with a TMAG5123B1 variant for out of the box evaluation. Additional variants can be sampled from www.ti.com. [Table 1](#) lists the different device variants available.

Table 1. Device Variants

DEVICE	BOP SENSITIVITY (MIN)	BOP SENSITIVITY (MAX)
TMAG5123A1	1 mT	3 mT
TMAG5123B1	2.5 mT	4.5 mT
TMAG5123C1	6 mT	8 mT
TMAG5123D1	9 mT	11 mT

The device operates from a VCC range of 2.5 V to 38 V, and is available in a standard SOT-23 package.

1.1 TMAG5123EVM Kit Contents

[Table 2](#) lists the contents of the TMAG5123EVM kit. Contact the nearest [Texas Instruments Product Information Center](#) if any component is missing. TI highly recommends checking the TMAG5123 family product folder on the TI website at www.ti.com for further information regarding this product.

Table 2. TMAG5123EVM Kit Contents

ITEM	QUANTITY
TMAG5123EVM test board	1
Handheld magnet (D3X8)	1
USB-Micro Cable	1

1.2 Related Documentation From Texas Instruments

The following document provides information regarding TI's integrated circuits used in the assembly of the TMAG5123EVM. This user's guide is available from the TI website under literature number [SLYU056](#). Any letter appended to the literature number corresponds to the document revision that is current at the time of the writing of this document. Newer revisions are available from www.ti.com or the Texas Instruments' Literature Response Center at (800) 477-8924 or the Product Information Center at (972) 644-5580. When ordering, identify the document by both title and literature number.

Table 3. Related Documentation

DOCUMENT	LITERATURE NUMBER
TMAG5123 product data sheet	SLYS030

2 TMAG5123EVM Hardware

The TMAG5123EVM is a simple-to-use platform for evaluating the main features and performance of the TMAG5123 across a wide voltage range. The EVM provides quick visual feedback to the user in the form of LED indication when the device under test's B_{OP} or B_{RP} thresholds are crossed.

2.1 Features

The layout of the TMAG5123EVM printed-circuit board (PCB) is designed to provide the following features:

- Burn-in test socket and precision 3D printed cradle for precise distance evaluation of in-plane sensors
- Provides LED feedback to the user to quickly determine output state from the TMAG5123
- Conveniently powered from a common micro-USB connector for quick prototyping

3 Quick Start Setup and Use

The following instructions are to set up and use the TMAG5123EVM:

1. Power up the EVM using either of the following methods:
 - a. USB power:
 - i. Insert the micro USB cable into the EVM onboard USB receptacle J1.
 - ii. Plug the USB cable into any USB power source (for example: laptop, desktop, power bank, and so forth).
 - b. Variable power supply
 - i. Set the power supply voltage to desired setting between 2.5 V and 38 V. Do not turn on the power yet.
 - ii. Connect the power supply V– terminal to the black GND test point on the EVM.
 - iii. Connect the power supply V+ terminal to the red VCC test point on the EVM.
 - iv. Turn on the power supply.

3.1 Measurements

The TMAG5123EVM enables the user to evaluate the functionality of the TMAG5123 Hall-effect sensor using either a common USB-micro connector or external power supply, which must first be setup as described in [Section 3](#).

The following test procedures are to be used for both USB and external power options.

- Step 1. Trigger the TMAG5123 device output: Slide either the north or south pole of the included D3X8 magnet along the measurement channel of the TMAG5123 Hall-effect sensor.
- Step 2. Observe the output: If using the onboard hardware, observe the indicator light D1 illuminate when the magnet gets close to the Hall-effect sensor. Alternatively, measurement can also be made through a voltage drop using an external voltage measuring device, such as an oscilloscope or digital multimeter (DMM).

4 TMAG5123EVM Circuit

This section summarizes the TMAG5123EVM components.

4.1 *Micro-USB Receptacle*

J1 is standard micro-USB receptacle. This receptacle provides 5-V power to the board if being used.

4.2 *Test Socket*

XU1 is a 499-P36-20 Sensata test socket, which is made for devices in a SOT-23 package, such as the TMAG5123. This socket allows for quick and easy transition between variants of the TMAG5123.

4.3 *LED Control*

R1 functions as a pullup resistor for the open-drain output of the TMAG5123.

R2 is a current-limiting resistor to control the output intensity of the signal diode D1.

While not normally populated, C3 is an optional SMT pad for capacitor placement, forming a first-order low pass filter with the pullup resistor.

5 TMAG5123EVM Schematic and PCB Layout

NOTE: Board layouts are not to scale. These figures are intended to show the board layout. The figures are not intended to be used for manufacturing TMAG5123EVM PCBs.

5.1 Schematic

Figure 1 shows the schematic for the TMAG5123EVM PCB.

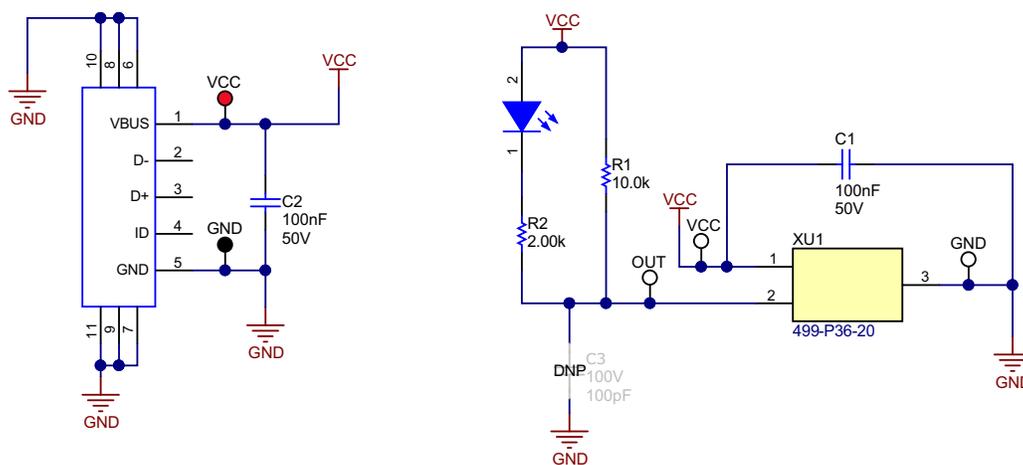


Figure 1. TMAG5123EVM Schematic

5.2 PCB Layout

Figure 2 through Figure 5 illustrate the PCB layout for the TMAG5123EVM.

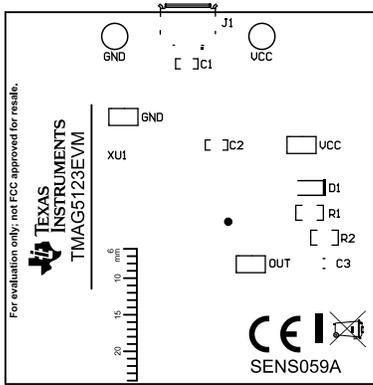


Figure 2. TMAG5123EVM Top Overlay

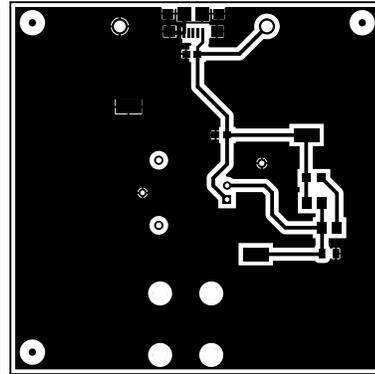


Figure 3. TMAG5123EVM Top Copper

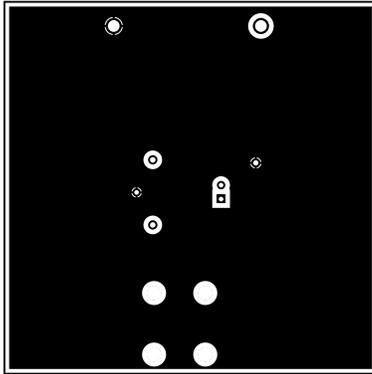


Figure 4. TMAG5123EVM Bottom Copper

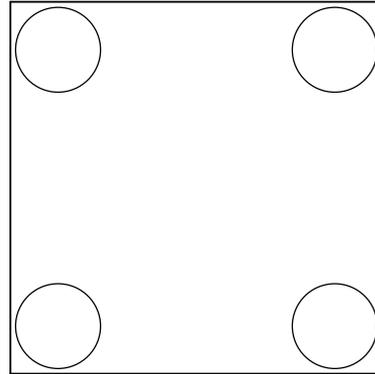


Figure 5. TMAG5123EVM Bottom Overlay

6 Bill of Materials

Table 4 provides the parts list for the TMAG5123EVM.

Table 4. TMAG5123EVM Bill of Materials

DESIGNATOR	QTY	VALUE	DESCRIPTION	PACKAGE REFERENCE	PART NUMBER	MANUFACTURER	ALTERNATE PART NUMBER	ALTERNATE MANUFACTURER
C1, C2	2	0.1uF	CAP, CERM, 0.1 uF, 50 V, +/- 10%, X7R, 0603	0603	C1608X7R1H104K080AA	TDK		
D1	1	Blue	LED, Blue, SMD	LED_0805	150080BS75000	Würth Elektronik		
H9,H10,H11,H12	4		Bumpon, Hemisphere, 0.44 X 0.20, Clear	Transparent Bumpon	SJ-5303 (CLEAR)	3M		
J1	1		Connector, Receptacle, Micro-USB Type B, R/A, Bottom Mount SMT	MICRO USB CONN, R/A	1981568-1	TE Connectivity		
MAG1	1		Magnet, N42, 3/16" Diameter, 1.5" Thickness		D3X8	KJMagnetics		
R1	1	10.0k	RES, 10.0 k, 1%, 0.125 W, AEC-Q200 Grade 0, 0805	0805	CRCW080510K0FKEA	Vishay-Dale		
R2	1	2.00k	RES, 2.00 k, 1%, 0.125 W, AEC-Q200 Grade 0, 0805	0805	CRCW08052K00FKEA	Vishay-Dale		
TP1	1		Test Point, Compact, Red, TH	Red Compact Testpoint	5005	Keystone		
TP2	1		Test Point, Compact, Black, TH	Black Compact Testpoint	5006	Keystone		
TP3, TP4, TP5	3		Test Point, Miniature, SMT	Testpoint_Keystone_Miniature	5015	Keystone		
U1	1		Precision In-Plane Digital-Switch Hall-effect Sensor, DBZ0003A	DBZ0003A	TMAG5123B1	Texas Instruments		
XU1	1		Socket, SOT23-3	Socket, 910x520x450 mil	499-P36-20	Sensata/Wells-CTI		
C3	0		100pF ±10% 100V Ceramic Capacitor X7R 0805 (2012 Metric)	0805	885012207110	Würth Electronics		

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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

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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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3.4.1 *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.

-
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 - 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.
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9. *Return Policy.* Except as otherwise provided, TI does not offer any refunds, returns, or exchanges. Furthermore, no return of EVM(s) will be accepted if the package has been opened and no return of the EVM(s) will be accepted if they are damaged or otherwise not in a resalable condition. If User feels it has been incorrectly charged for the EVM(s) it ordered or that delivery violates the applicable order, User should contact TI. All refunds will be made in full within thirty (30) working days from the return of the components(s), excluding any postage or packaging costs.

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