

TLIN2029-Q1 Evaluation Module

This user guide describes the TLIN2029-Q1 evaluation module (EVM). This EVM helps designers evaluate device performance, support fast development, and analyze automotive local interconnect network (LIN) systems using TLIN2029-Q1 LIN physical layer transceiver devices.

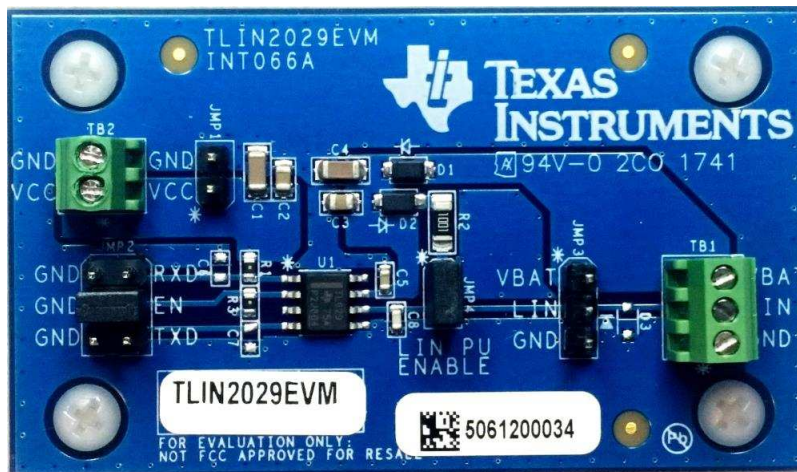


Figure 1. TLIN2029-Q1 EVM Board

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1 Introduction

1.1 Features

The EVM supports the following features:

- *Master Mode* and *Slave Mode* configurations
- Terminal block and header pins are available on all power and LIN bus connections
- An optional VCC rail and pullup resistors for EN input and RXD (open-drain) output

1.2 Description

The TLIN2029-Q1 EVM provides users with the ability to evaluate TI's TLINx029-Q1 family of single-channel, LIN transceivers. The EVM allows both master and slave mode applications to be evaluated through the use of a single jumper that connects or disconnects the external 1-k Ω pullup resistor and series diode required in master mode from the LIN bus.

The EVM has a low-voltage VCC rail that provides the voltage to the pullup resistors on the received data (RXD) open-drain output, and enable (EN) control input pins. The TLIN2029-Q1 supports a V_{IH} from 2 V to 5.5 V, allowing operation with a variety of microcontrollers with common IO voltage levels such as 2.5 V, 3.3 V, and 5 V. Non-populated capacitor pads are available on the TXD and RXD pins to accommodate a variety of different tests requiring various capacitive load conditions.

The TLIN2029-Q1 supports both 12 V and 24 V automotive applications and is operated with a supply voltage from 4 V to 45 V, plus an extended bus fault protection of ± 58 V. Use the EVM to evaluate the TLIN1029-Q1 device for 12-V automotive applications by replacing the TLIN2029-Q1 with a TLIN1029-Q1 transceiver.

Furthermore, the TLINx029-Q1 transceivers include internally-protected bus terminals with greater than ± 8 -kV HBM and IEC ESD protection levels. If additional ESD protection is desired, a non-populated diode pad is available on the LIN bus to accommodate any SOD323 diode. Both headers and wire-terminals are provided on the power and LIN bus connections to allow the EVM to be evaluated in a larger system while still allowing for test equipment to be connected to the signals under test.

2 EVM Setup and Requirements

Use the following equipment to evaluate the performance of the TLIN2029-Q1 device:

- Power supply capable of supplying the desired supply voltage. Typical LIN applications use 12 V or 24 V, but the TLIN2029-Q1 will operate with any supply voltage from 4 V to 45 V. Connect this voltage across the VBAT and GND pins of either the TB1 or JMP3 connectors.
- Power supply capable of supplying the desired IO pin voltage from 2 V to 5.5 V. Connect this voltage across the VCC and GND pins of either the TB2 or JMP1 connectors.
- If the LIN bus interface is to be observed on an oscilloscope, use probes capable of tolerating voltages as large as VBAT.
- The logic interface pins (TXD, RXD, and EN) may interface to a microcontroller, pattern generator, or logic analyzer with logic levels matching the VCC voltage.

2.1 Master Mode

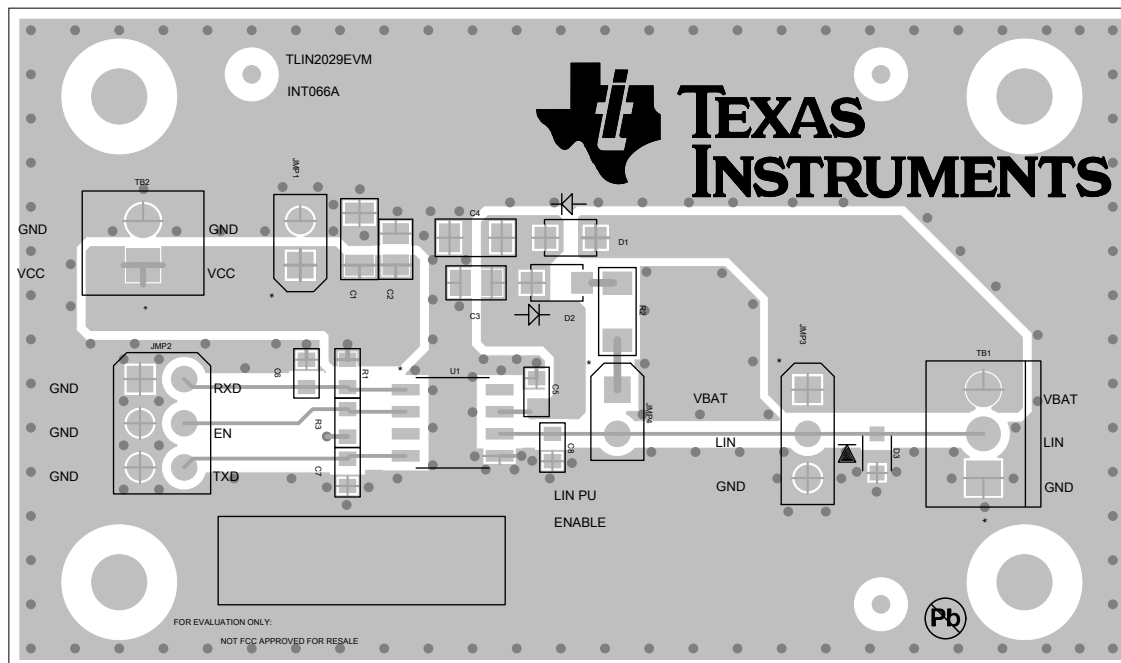
To configure the board for master mode, place a shunt on JMP4 to connect the external 1-k Ω resistor and series diode to the LIN bus per the LIN specification.

2.2 Slave Mode

To configure the board for slave mode, remove the shunt on JMP4 to disconnect the external 1-k Ω resistor and series diode from the LIN bus per the LIN specification.

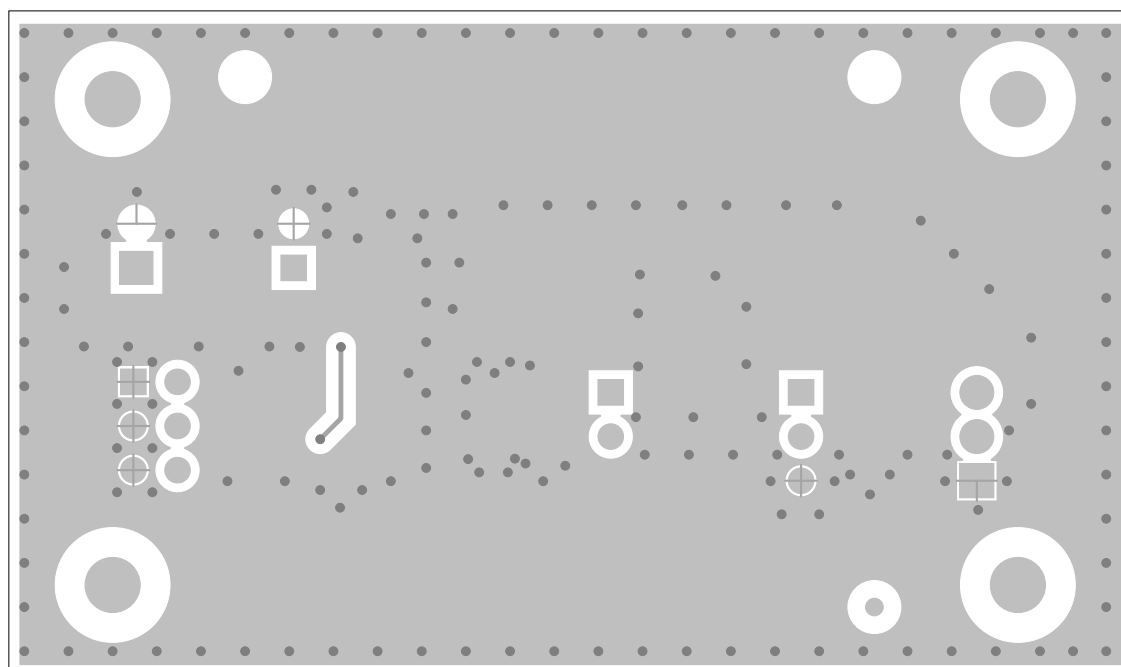
3 Board Layout

The board layout uses two layers (top and bottom) with most of the routing placed on the top layer (see [Figure 2](#) and [Figure 3](#)). The TLIN2029-Q1 device has a flow through pinout with the logic interface pins on one side of the device and the LIN bus pins on the other side resulting in simple and straight forward routing of signal and power nets.



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Figure 2. Top Layer

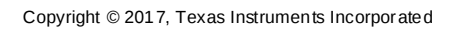


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Figure 3. Bottom Layer

Figure 4 illustrates the EVM schematic.

5. VCC is only used to provide a voltage for the RXD and EN Pull Up resistors.



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4.2 Bill of Materials

Table 1 lists the EVM BOM.

Table 1. Bill of Materials

Designator	QTY	Value	Description	Package Reference	Part Number	Manufacturer
C1,C4	2	10uF,50V	CAP, CERM, 10 μ F, 50 V, $\pm$ 10%, X5R, 1206	1206	CL31A106KBHNNNE	Samsung Electro-Mechanics America, Inc.
C2,C3	2	1uF,50V	CAP, CERM, 1 μ F, 50 V, $\pm$ 10%, X7R, 0805	0805	CL21B105KBFNNNE	Samsung Electro-Mechanics America, Inc.
C5	1	0.1uF,50V	CAP, CERM, 0.1 μ F, 50 V, $\pm$ 20%, X7R, 0603	0603	C0603C104M5RACTU	Kemet
C6,C7	0	15pF	CAP, CERM, 15 pF, 50 V, $\pm$ 5%, C0G/NP0, 0603	0603	CL10C150JB8NNNC	Samsung Electro-Mechanics America, Inc.
C8	1	220 pF	CAP, CERM, 220 pF, 50 V, $\pm$ 1%, C0G/NP0, 0603	0603	C0603C221F5GACTU	Kemet
D1,D2	2	1N4148W	Diode, General Purpose, 100 V, 150 mA, SOD123	SOD123	1N4148W-TP	Micro Commercial Co
D3	0	TVS Diode	Diode, Zener, 15 V / 24 V, 3 A, SOD323	SOD323	PESD1LIN,115	Nexperia USA Inc.
FID1,FID2,FID3, FID4,FID5,FID6	6	Fiducial	Fiducial mark. There is nothing to buy or mount.	Fiducial	N/A	N/A
H1,H2,H3,H4	4	NY PMS 440 0025 PH	Machine Screw, Round, #4-40 x 1/4, Nylon, Philips panhead	Screw	NY PMS 440 0025 PH	B&F Fastener Supply
H5,H6,H7,H8	4	1902C	Standoff, Hex, 0.5"L #4-40 Nylon	Standoff	1902C	Keystone
JMP1,JMP4	2	2 Pin Header	Header, 100mil, 2x1, Gold, TH	2x1 Header	TSW-102-07-G-S	Samtec
JMP2	1	Header 3x2	Header, 100mil, 3x2, Gold, TH	3x2 Header	TSW-103-07-G-D	Samtec
JMP3	1	3 Pin Header	Header, 100mil, 3x1, Gold, TH	3x1 Header	TSW-103-07-G-S	Samtec
LB1	1	PCB_Label	Thermal Transfer Printable labels, 0.650" W x 0.200" H - 10,000 per roll	PCB Label 0.650"H x 0.200"W	THT-14-423-10	Brady
M1,M2,M3,M4	4	MountingHole_125_NPTH	Mechanical mounting hole. There is nothing to buy or mount.	NPTH_125mil	N/A	N/A
PCB1	1	PCB	Printed Circuit Board	PCB	INT066	ANY
R1,R3	2	10K,1/4W,1%	RES, 10.0 k, 1%, 0.25 W, 0603	0603	ESR03EZPF1002	Rohm Semiconductor
R2	1	1K,1/4W,1%	RES, 1.00 k, 1%, 0.25 W, 1206	1206	RC1206FR-071KL	Yageo
TB1	1	3-POS_TERMINAL	3 Position Wire to Board Terminal Block Horizontal with Board 0.100" (2.54mm) Through Hole	2.54mm	282834-3	TE Connectivity AMP Connectors
TB2	1	2PIN_TERMINAL	2 Position Wire to Board Terminal Block Horizontal with Board 0.100" (2.54mm) Through Hole	2.54mm	282834-2	TE Connectivity AMP Connectors
U1	1	TLIN2029-Q1	Automotive Local Interconnect Network Transceiver, 8-SOIC	8-SOIC	TLIN2029D	Texas Instruments

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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.

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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:

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(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.

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http://www.tij.co.jp/llds/ti_ja/general/eStore/notice_01.page

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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
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