THE DATASHEET OF

SN65HVD01-EVM

SN65HVD01-EVM Evaluation Module

This user's guide describes the SN65HVD01-EVM Evaluation Module (EVM). The EVM hardware gives designers the ability to evaluate the performance of the SN65HVD01 device to support the fast development and analysis of data transmission systems using SN65HVD01 transceivers. The SN65HVD01 is available in a tiny, 3-mm × 3-mm, VQFN package.

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1 Overview

The SN65HVD01 has a robust 3.3-V driver and receiver in a small package for demanding low-power industrial applications. The bus pins are robust to ESD events, with high levels of protection to Human-Body Model and IEC Contact Discharge specifications. Separate voltage supplies allow powering the data and enable controls from 1.8 V to 3.3 V, while the bus signals operate from a 3.3-V supply. The driver differential outputs and the receiver differential inputs are connected internally to form a bus port suitable for half-duplex (two-wire bus) communication. These devices all feature a wide common-mode voltage range making the devices suitable for multi-point applications over long cable runs. These devices are characterized from –40°C to 125°C.

2 EVM Setup and Precautions

Figure 1 shows the schematic of the EVM. The EVM board has headers labeled from JMP1 to JMP4, screw terminal blocks labeled TB1, TB2, and TB3, and 13 test points to probe various signals. These headers support device evaluation for a wide range of system configurations.

- There are several GND connection options using TB1 and TB2. This allows ground connections from the power supply unit (PSU) and from the signal generator. These terminals represent the ground potential of the device-under-test and the entire EVM.
- A single 5-V supply on TB1 is used to power the board when JMP2 and JMP3 are shunted. A dual-output LDO creates 3.3-V and 1.8-V rails for VCC and VL, respectively. If other voltages are desired, JMP2 and JMP3 can be left open, and VCC and VL can be supplied from external sources applied to 3p3V and 1p8V on TB1.
- JMP1 contains three signals (SLR, DE, and /RE) which can be shunted to VL, but are pulled low when left open. For normal fast operation, only DE should be shunted to VL.

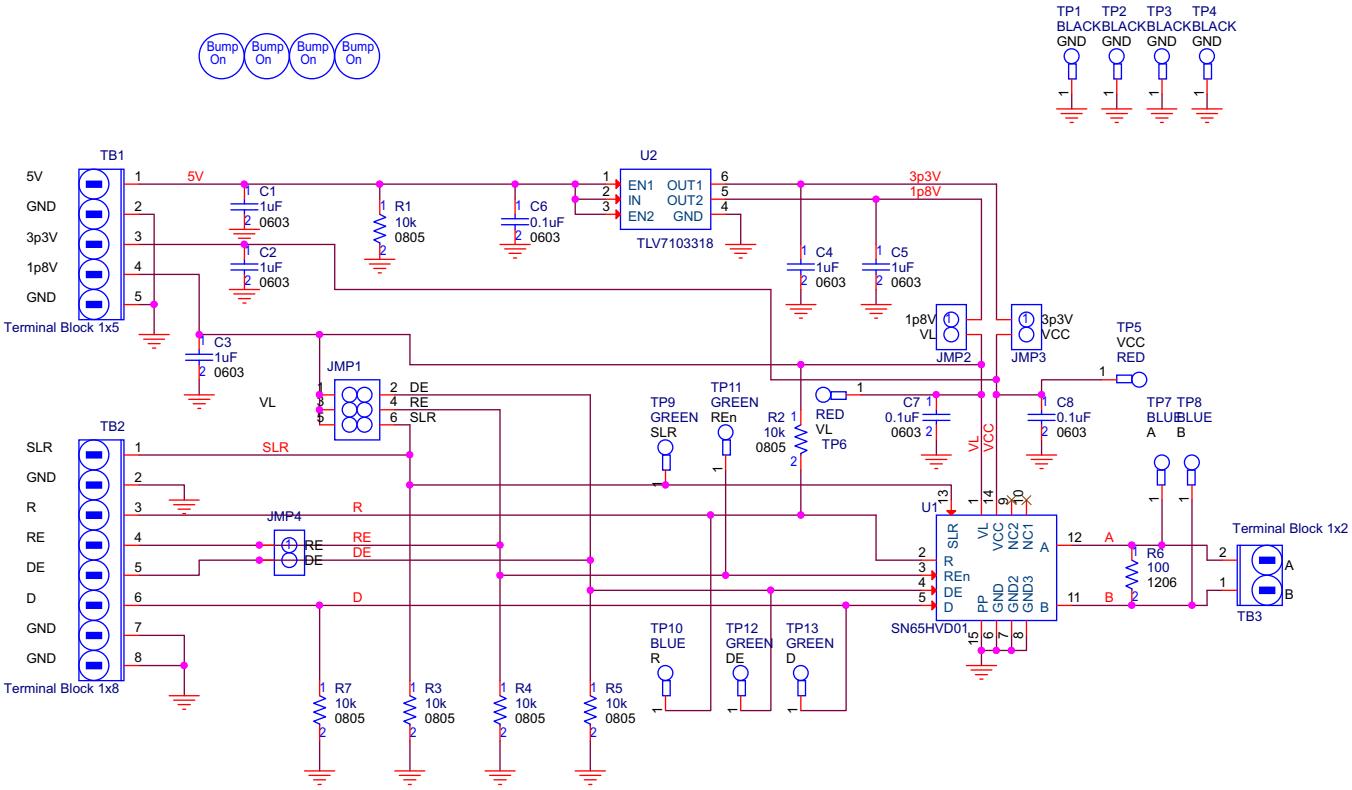

Figure 1. SN65HVD01-EVM Schematic Diagram

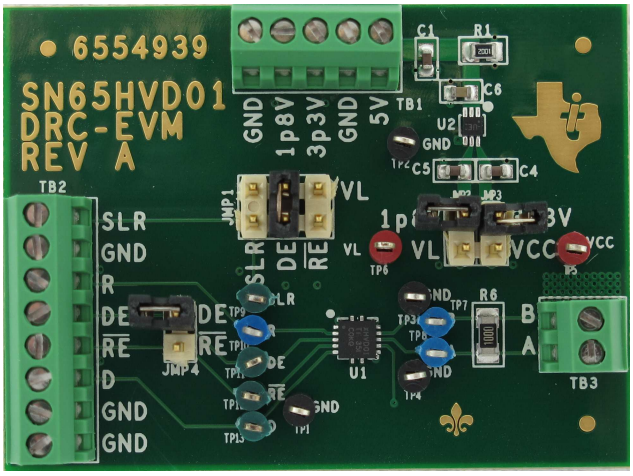

Figure 2. SN65HVD01-EVM Top View

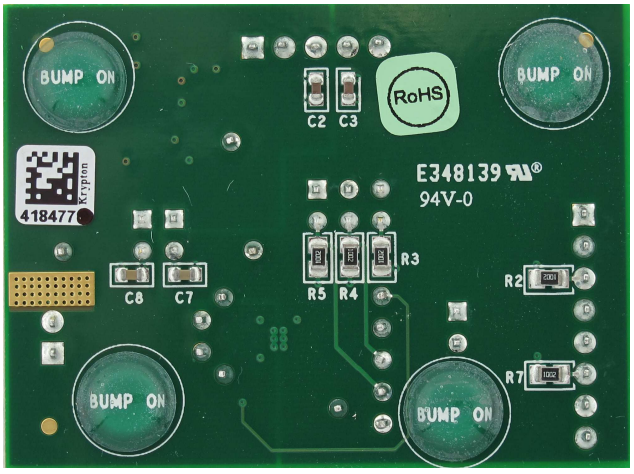

Figure 3. SN65HVD01-EVM Bottom View

TB2 provides stimulation points for the data and control signals, or headers through which the control and data signals for the SN65HVD01 device are applied. TP9-TP13, and TP7-TP8 are probe points, or test points at which these signals can be measured.

The EVM does not include a 50-Ω resistor to GND for the data signal input, D. Because signal generators have a typical source impedance of 50 Ω, the output signal of the signal generators is twice the required signal voltage, and assumes that an on-board 50-Ω resistor divides this voltage down to the correct signal level.

Without this resistor; however, this voltage divider action is not accomplished, and the generator output voltage must be reduced to ½ of the desired input voltage (1.8 V to 3.3 V) to avoid damaging the transceiver inputs.

Care must taken when using the DE and /RE control signals. If using JMP1, DE can be shunted, /RE can be left open, and the control signals can receive the correct voltage. However, if using an external source directly and not using the on-board regulator care must be used to provide the correct voltage level to these signals.

Instead of using signal generators, the EVM can directly interface to the microcontroller I/O. Then the non-assembled 50-Ω resistors are of no concern. However, for proper operation, ensure that the high-level input voltage $V_{IH} \geq 2$ V and the low-level input voltage $V_{IL} \leq 0.8$ V.

3 Powering Up the EVM and Taking Measurements

The generally recommended procedure for taking measurements is listed:

1. Install the required ground connections.
2. Connect the oscilloscope with the respective probe points you want to measure.
3. Adjust the power-supply to 5 V.
4. Adjust the generator outputs for a 1.65-V maximum output signal level if powering the enable control and data signals at 3.3 V, or 0.9-V if powering the signals at 1.8 V. If using a microcontroller check the logic switching levels of the controller I/O.
5. Connect the power supply conductor with the 5-V terminal of TB1.

NOTE: When using the on-board regulator a 5-V source can be applied to this terminal. If supplying power directly adjust this voltage to the appropriate level.

6. Connect signal conductors from the controller or the generator with their corresponding EVM inputs at TB2.

3.1 Measurements

1. **Standard Transceiver Configuration**

Normal transceiver operation requires both the driver and the receiver sections being active. Therefore, the receiver enable pin ($\overline{RE}$) must be at logic low potential and the driver enable pin (DE) at logic high. This is accomplished by putting a shunt on DE of JMP1 and leaving /RE open.

Transmit data entering at the D-input terminal appear as the differential output voltage ($V_{OD} = V_A - V_B$) on the bus wires, A and B. Sensing the data traffic in the transmit direction is possible through the active receiver.

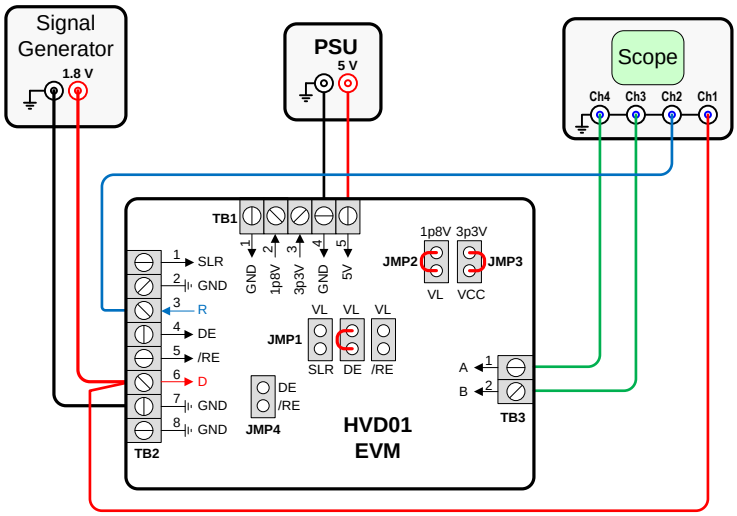

Figure 4. SN65HVD01-EVM Setup for Normal Transceiver Operation

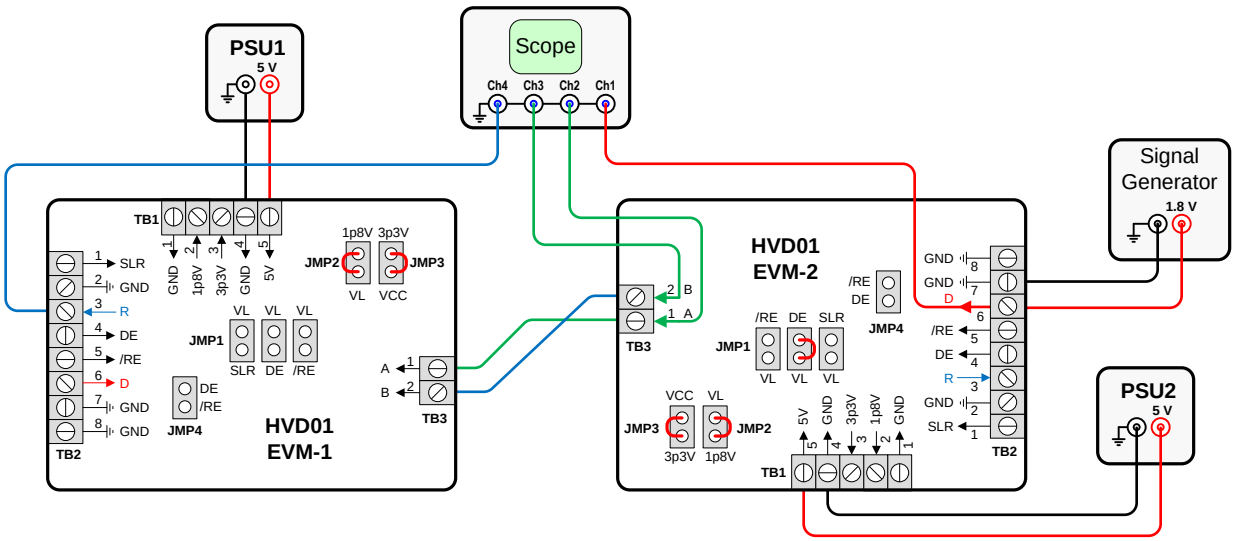

Figure 5. SN65HVD01-EVM Configurations: On the Left as Receiver EVM (HVD01 EVM-1), On the Right as Transmitter EVM (HVD01 EVM-2)

For detailed information on the device parameters see the SN65HVD01 data sheet (SLLSEH0).

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For EVMs **not** subject to the above rules, this evaluation board/kit/module is intended for use for ENGINEERING DEVELOPMENT, DEMONSTRATION OR EVALUATION PURPOSES ONLY and is not considered by TI to be a finished end product fit for general consumer use. It generates, uses, and can radiate radio frequency energy and has not been tested for compliance with the limits of computing devices pursuant to part 15 of FCC or ICES-003 rules, which are designed to provide reasonable protection against radio frequency interference. Operation of the equipment may cause interference with radio communications, in which case the user at his own expense will be required to take whatever measures may be required to correct this interference.

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User Power/Frequency Use Obligations: This radio is intended for development/professional use only in legally allocated frequency and power limits. Any use of radio frequencies and/or power availability of this EVM and its development application(s) must comply with local laws governing radio spectrum allocation and power limits for this evaluation module. It is the user's sole responsibility to only operate this radio in legally acceptable frequency space and within legally mandated power limitations. Any exceptions to this are strictly prohibited and unauthorized by Texas Instruments unless user has obtained appropriate experimental/development licenses from local regulatory authorities, which is responsibility of user including its acceptable authorization.

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

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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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.

For EVMs annotated as IC – INDUSTRY CANADA Compliant

This Class A or B digital apparatus complies with Canadian ICES-003.

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

Concerning EVMs including radio transmitters

This device complies with Industry Canada licence-exempt RSS standard(s). 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.

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.

Cet appareil numérique de la classe A ou B est conforme à la norme NMB-003 du Canada.

Les changements ou les modifications pas expressément approuvés par la partie responsable de la conformité ont pu vider l'autorité de l'utilisateur pour actionner l'équipement.

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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.

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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If you use this product in Japan, you are required by Radio Law of Japan to follow the instructions below with respect to this product:

1. Use this product 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 this product only after you obtained the license of Test Radio Station as provided in Radio Law of Japan with respect to this product, or
3. Use of this product only after you obtained the Technical Regulations Conformity Certification as provided in Radio Law of Japan with respect to this product. Also, please do not transfer this product, unless you give the same notice above to the transferee. Please note that if you could not follow the instructions above, you will be subject to penalties of Radio Law of Japan.

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