SN6505A and SN6505B Evaluation Module

This document describes the SN6505A and SN6505B evaluation module (EVM). It allows designers to analyze and evaluate the SN6505A and SN6505B oscillator/power driver from TI.

In addition to the SN6505A and SN6505B, the EVM contains a small form-factor transformer, simple rectifier circuit, and voltage regulator. This combination simulates a complete isolated power supply system suitable for many different applications.

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1 Introduction

1.1 Overview

This SN6505A and SN6505B evaluation module allows the user to evaluate the performance and features of the SN6505A and SN6505B in an actual isolated power application. This includes the transformer, rectifier, and low-dropout (LDO) voltage regulator shown in Figure 1.

The complementary output signals (D1 and D2) from the SN6505x are ground-referenced, N-channel, power switches that drive the primary side of the center-tapped transformer. The secondary of the transformer has its center-tap referenced to an isolated ground, and the complementary outputs are rectified through a simple two-diode bridge. The make-before-break feature of the two driver outputs from the SN6505x ensures that only one side of the transformer is driven at a time. After being rectified, the dc voltage is smoothed and routed to the TPS76701QD voltage regulator. The regulator outputs a stable, regulated +5-Vdc output that is used to drive downstream circuitry.

The EVM is the SN6505x EVM which is configured for +5-Vdc/ input and +5-Vdc output.

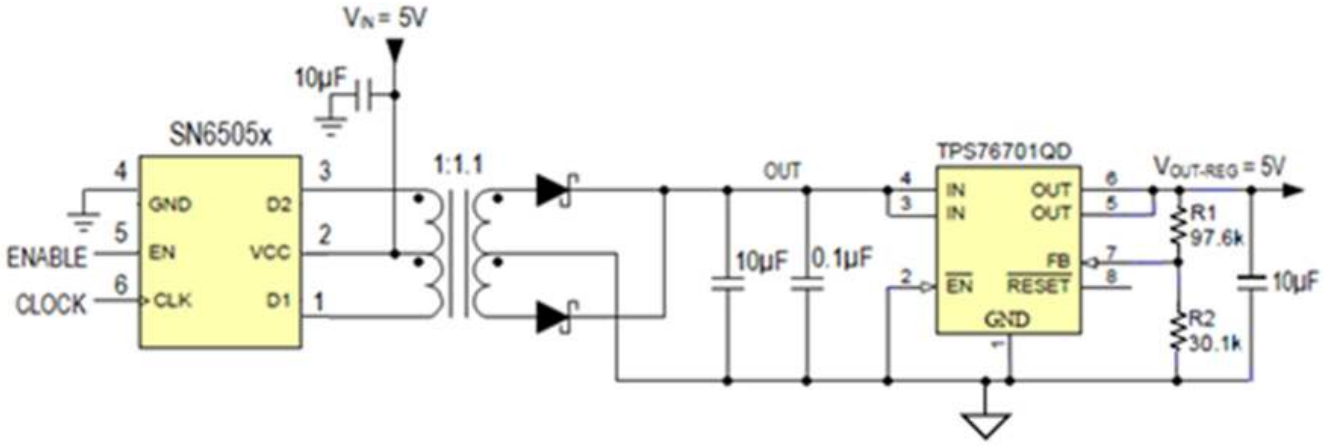

Figure 1. SN6505xEVM Pinout and Functional Block Diagram

1.2 SN6505xEVM Kit Contents

- SN6505xEVM Printed-Circuit Board
- SN6505xEVM Evaluation Module User's Guide
- SN6505x data sheet

2 Printed-Circuit Board

The SN6505xEVM printed-circuit board (PCB) contains an SN6505x, transformer, and voltage regulator. The board has separate and isolated grounds across the isolation transformer allowing evaluation of the isolated power supply system contained on the EVM. Although the transformer secondary can be wound to provide any isolated voltage, the EVM uses a transformer with a 1:1.1 turns ratio, ideal for generating the rectified voltage required by the TPS76701QD regulator.

Refer to the SN6505xEVM schematic and bill of materials (BOM) to become familiar with the PCB components and layout. The PCB files (Gerber/ODB) are available from TI on request.

2.1 SN6505xEVM Operation

2.1.1 Left-Side Operation: SN6505x and Transformer Primary

DC Power – The SN6505x (installed on the left-side of the isolation transformer) is operated using either a single +5-V (±10%), or single +5-V (±10%) dc power supply. On this EVM, the turns-ratio of the transformer is 1:1.1, providing a slight step-up voltage function. This allows evaluation of the system performance using a supply voltage anywhere within the range of +5-Vdc to 5.5-Vdc. The small amount of dc current required also allows operation of the EVM from a battery. The input dc power supply must be connected to the J1 terminal block on the left side of the EVM. No other controls are required to operate the EVM. The SN6505X oscillates and drives the transformer when dc voltage is applied.

2.1.2 Right-Side Operation

DC Output Power – The right side of the isolation transformer contains a two-diode rectifier, filter capacitors, and a voltage regulator. Because the purpose of the EVM is to generate isolated power across the transformer, a separate power supply on the right side of the EVM is unnecessary. The rectified, unregulated output voltage is observed at TP5. Monitor the output from the transformer while varying the input voltage to the SN6505X. The regulated output is available at TP7. Connect external circuitry and/or loading to evaluate the operating range, line regulation, load regulation, and efficiency of the EVM. Note that the ground reference on the right side of the transformer (GND2) is not connected to the ground of the SN6505X (GND1). This demonstrates the isolation feature of the EVM.

CAUTION

Although the transformer has an isolation rating of 2.5-kV_{rms} for 750315371 and 5-kV_{rms} for 750315240, the PCB provides only 50 V of isolation between GND1 and GND2 to prevent electrical shock or injury. Do not attempt to apply high voltage between GND1 and GND2

2.1.3 Functional Test Procedure

Please find the functional test procedure for the SN6505x EVM board.

1. Insert Shunt J5.
2. Connect 5-V , 200 mA Voltage source between TP1 (VIN) and TP2 (GND1)
3. Measure voltage with a DMM at TP5 (VOUT) w.r.t TP8 (GND2) should be greater than 5.5-V
4. Measure voltage with DMM at TP7 (VLDO) w.r.t. TP6 (GND2) should be between 4.9-V and 5.1-V.

2.2 Bill of Materials and Schematic

2.2.1 Bill of Materials

The bill of materials for the SN6505xEVM is shown in Table 1.

Table 1. SN6505xEVM Bill of Materials

Designator	Quantity	Value	Description	Package Reference	PartNumber	Manufacturer
PCB	1		Printed Circuit Board		INT008 (for SN6505ADBVR) INT021 (for SN6505BDBVR)	Any
C1, C4, C7	3	0.1-uF	CAP, CERM, 0.1 µF, 25 V, +/- 5%, X7R, 0603	0603	06033C104JAT2A	AVX
C2, C5, C8	3	1-uF	CAP, CERM, 1 µF, 50 V, +/- 10%, X5R, 0603	0603	GRM188R61H105 KAALD	MuRata
C3, C6, C9	3	10-uF	CAP, CERM, 10 µF, 35 V, +/- 10%, X5R, 0805	0805	GRM21BR6YA106 KE43L	MuRata
D1, D2	2	40-V	Diode, Schottky, 40 V, 1 A, SOD-123	SOD-123	1N5819HW-7-F	Diodes Inc.
H1, H2, H3, H4	4		Bumpon, Hemisphere, 0.25 X 0.075, Clear	75x250 mil	SJ5382	3M
J1, J2, J3, J4, J5	5		Header, 2.54 mm, 2x1, Gold, R/A, SMT	Header, 2.54 mm, 2x1, R/A, SMT	87898-0204	Molex
LBL1	1		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
R1	1	97.6k	RES, 97.6 k, 1%, 0.1 W, 0603	0603	CRCW060397K6F KEA	Vishay-Dale
R2	1	30.1k	RES, 30.1 k, 1%, 0.1 W, 0603	0603	CRCW060330K1F KEA	Vishay-Dale
SH-J5	1		Shunt, 100mil, Gold plated, Black	Shunt 2 pos. 100 mil	881545-2	TE Connectivity
T1	1	105 uH	Transformer, 105 uH, SMT	12.60x8.30mm	750315371 (for SN6505BDBVR)	Wurth Elektronik
		110 uH	Transformer, 110 uH, SMT	10.41x12.32mm	750315240 (for SN6505ADBVR)	Wurth Elektronik
TP1, TP2, TP3, TP4, TP5, TP6, TP7, TP8	8		Test Point, Miniature, SMT	Test Point, Miniature, SMT	5019	Keystone
U1	1		LOW-NOISE 1A TRANSFORMER DRIVERS FOR ISOLATED POWER SUPPLIES, DBV0006A	DBV0006A	SN6505BDBVR	Texas Instruments
			LOW-NOISE 1A TRANSFORMER DRIVERS FOR ISOLATED POWER SUPPLIES, DBV0006A	DBV0006A	SN6505ADBVR	Texas Instruments
U2	1		Single Output Fast Transient Response LDO, 1 A, Adjustable 1.5 to 5.5 V Output, 2.7 to 10 V Input, with Low IQ, 8-pin SOIC (D), -40 to 125 degC, Green (RoHS & no Sb/Br)	D0008A	TPS76701QD	Texas Instruments
FID1, FID2, FID3	0		Fiducial mark. There is nothing to buy or mount.	Fiducial	N/A	N/A

2.2.2 Schematic

Figure 2 shows the electrical schematic for the SN6505xEVM.

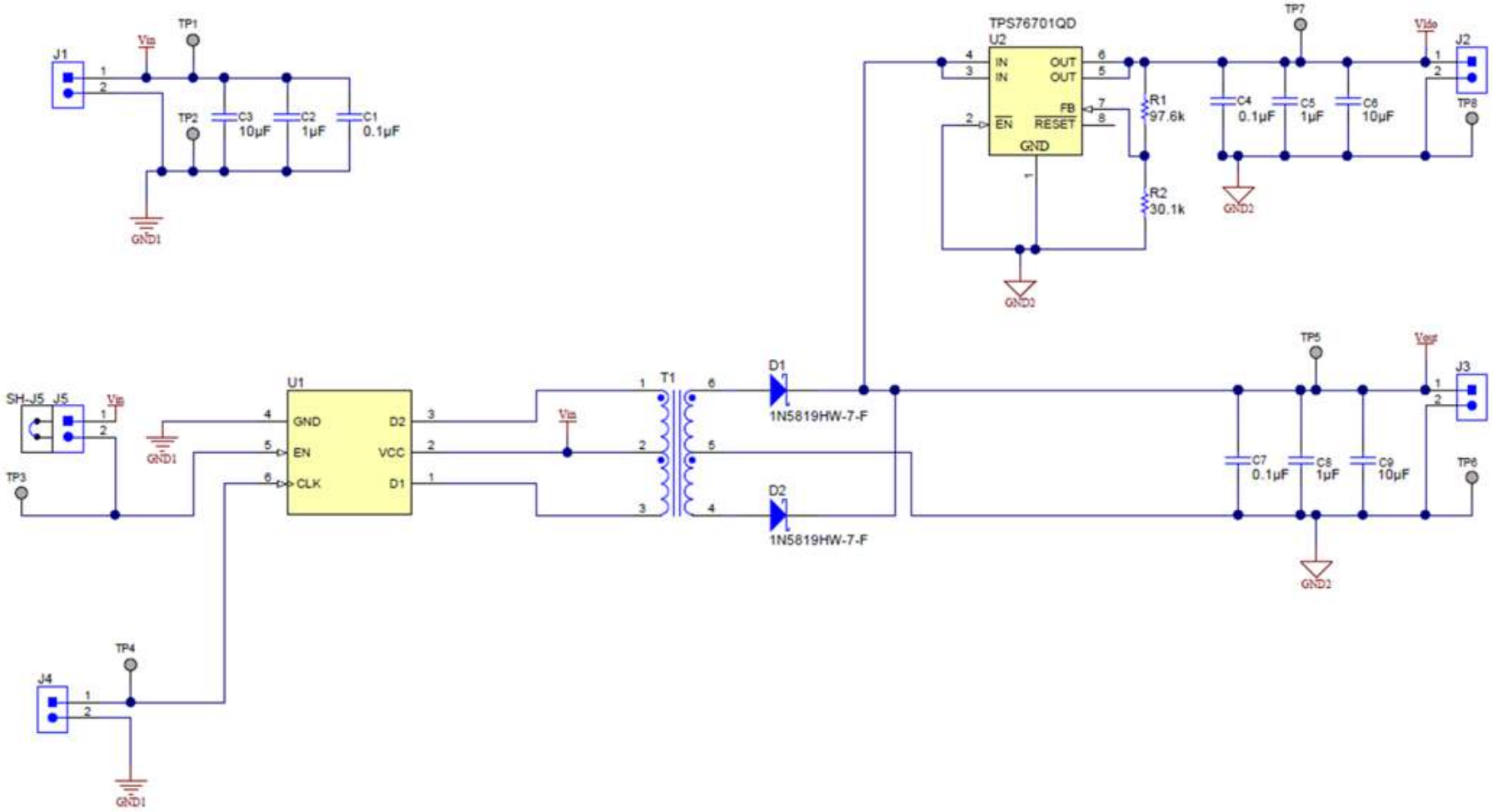

Figure 2. SN6505xEVM Schematic

3 SN6505xEVM Printed Circuit Board

Figure 3 through Figure 6 contain the PCB layout views.

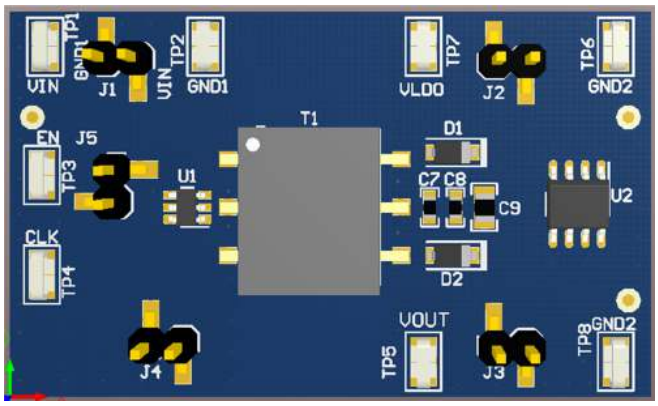

Figure 3. SN6505xEVM Top Layer View

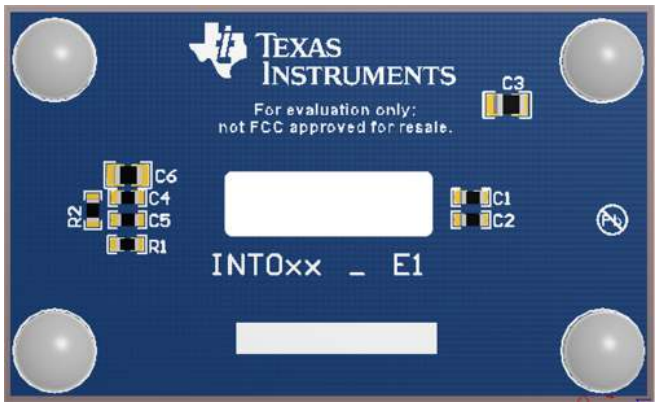

Figure 4. SN6505xEVM Bottom Layer View

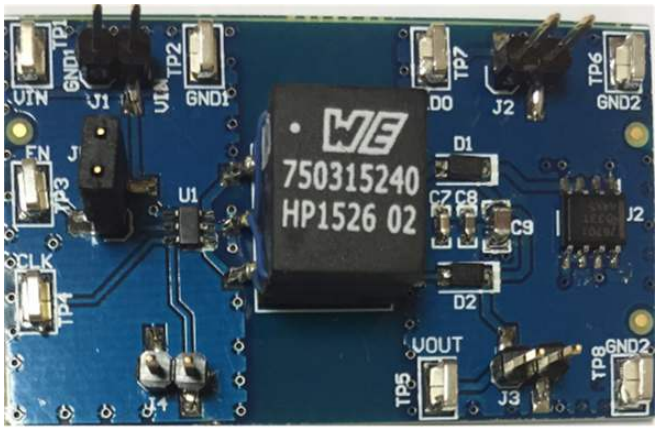

Figure 5. SN6505xEVM View

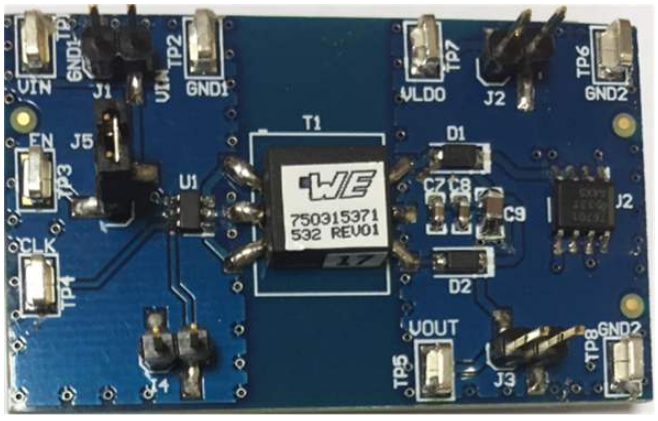

Figure 6. SN6505xEVM View

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

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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.

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      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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- *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*

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This device complies with Industry Canada license-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.

Concernant les EVMs avec appareils radio:

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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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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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