EVM User's Guide: TXV0106EVM TXV0108EVM

TXV010xEVM Evaluation Module

Description

The TXV-EVM is an easy-to-use platform to evaluate the functionality and performance of the TXV0106BQB and TXV0108RGY devices. The TXV-EVMs have optional circuits and jumpers to configure the device for different applications. The TXV0106BQB and TXV0108RGY devices offer options for both fixed and direction control low-skew, low jitter voltage translation, for 6-bit and 8-bit applications respectively. The outputs of the devices can be enabled and disabled through a dedicated output enable control feature.

Get Started

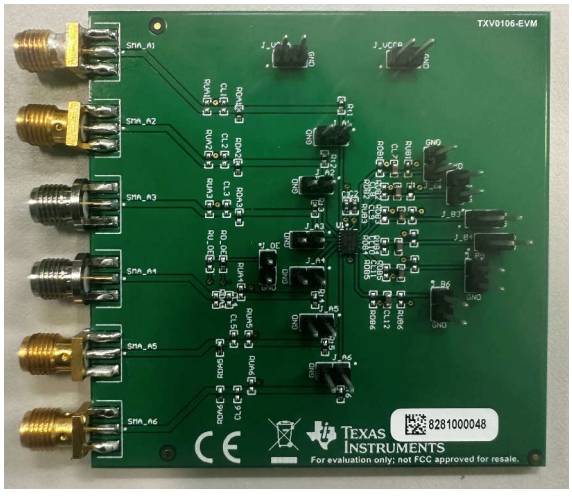
1. Order the EVM from ti.com (TXV0106-EVM or TXV0108-EVM)
   a. The ordered EVM is already preset for A to B voltage translation.
   b. Use short high-speed cables for optimized high-speed data throughput.
   c. Use active probes for optimized signal integrity.
2. Reference the user's guide for additional setup.
3. Evaluate the TXV devices per the user's system requirements.
4. Use E2E forums for any additional support.

Features

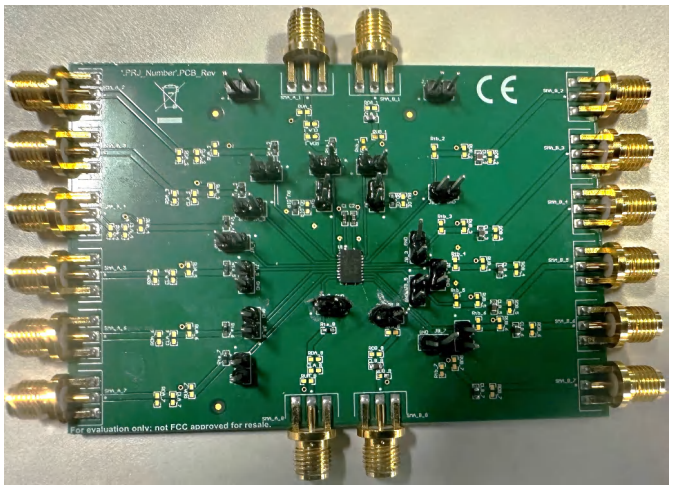
- SMA connectors for high-speed data throughput.
- 50Ω termination resistors for impedance control.
- $\overline{OE}$ control for disabling and enabling the outputs.
- DIR control for configuring A-to-B or B-to-A voltage translation (TXV0108-EVM).
- Pull-up or pull-down resistors for avoiding floating inputs.
- Flexibility for capacitive loading on all data IO pins.
- Jumper test points for probing input and output signals.
- Designed and optimized for skew measurements in the pico-second range.

Applications

- Medium or short range radar
- ADAS domain controller
- HVAC controller design
- Machine vision camera
- Rack sever motherboard
- IP telephone



TXV-EVM 6 Channel



TXV-EVM 8 Channel

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1 Evaluation Module Overview

1.1 Introduction

The TXV-EVM evaluates the operation of the low skew *TXV0106BQB* and *TXV0108RGY* devices.

The EVM also evaluates devices with similar foot prints such as SN74AVC8T245RHL, SN74AXC8T245RHL, SN74LVC8T245RHL and SN74LXC8T245RHL.

This user's guide describes the characteristics, operation, and use of the TXV-EVM evaluation module built for TXV low skew voltage translators. A complete printed-circuit board layout, schematic diagram, and bill of materials are included in this document.

1.2 Kit Contents

Table 3-2 lists the EVM bill of materials for both the TXV0106-EVM and TXV0108-EVM.

The TXV0106-EVM and TXV0108-EVM contains the populated components as shown in Figure 2-1 and the disclaimer.

1.3 Specification

Refer to the TXV or the Pin-to-Pin (P2P) data sheets for the device recommended conditions and specifications. See Table 2-3 for the corresponding data sheets.

1.4 Device Information

The TXV010x devices are 6-bit and 8-bit, dual-supply fixed and direction controlled low-skew voltage translation devices. The devices can be used for buffering, redriving, voltage translation, and power up isolation on timing-margin sensitive interfaces, such as Reduced Gigabit Media Independent (RGMII) signals between MAC and PHY.

Ax pins and the control pins (DIR, $\overline{OE}$) are referenced to V_{CCA} logic levels, and Bx pins are referenced to V_{CCB} logic levels. The devices can accept I/O voltages ranging from 1.65V to 3.6V.

There are two pinout options: *TXV0106/TXV0106-Q1* (6- bit fixed-direction voltage translator) and *TXV0108/TXV0108-Q1* (8-bit direction-configurable voltage translator).

DIR pin is only available for the 8-bit device, which can be compatible with the AXC8T , AVC8T, LXC8T and LVC8T devices depending on the application. A high on DIR allows data transmission from A to B and a low on DIR allows data transmission from B to A when $\overline{OE}$ is set to low. When $\overline{OE}$ is set to high, both Ax and Bx pins are in the high-impedance state. See the respective data sheets for more information.

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2 Hardware

2.1 EVM Features

The TXV devices feature the 6-channel fixed direction option and the direction control 8-channel option. The 8-ch option allows designers to configure the direction of data flow through the use of the direction control pin. The translators are designed for push-pull IOs. The physical boards are shown in Figure 2-1.

Table 2-1 shows a generic comparison between the AXC, AVC and TXV families.

Table 2-1. TXV, AVC and AXC Comparison

Parameter	TXV	AVC	AXC
Operating Range	1.65 V to 3.6 V	1.2 V to 3.6 V	0.65 V to 3.6 V
Max Drive Strength per Channel	12 mA	12 mA	12 mA
Icc Quiescent Current(8T)	22 µA	25 µA	55 µA
Input Leakage Current	1 µA	1 µA	1 µA
Max Data Rate(8T)	500 Mbps	320 Mbps	380 Mbps
T_r / T_f(1.8/3.3VccAB) at 15pF, 125MHz (typ)(1)	752 ps	1.2 ns	1.2 ns
t_{SKO} (1.8/3.3,VccA/B) @15pF, 125MHz (typ)(1) (2)	130 ps	147 ps	168 ps
t_{PD} (1.8/3.3,VccA/B) @15pF 125MHz (typ)(1)	1.9 ns	2.2 ns	3.0 ns

(1) Note, parameters emphasized as typical (typ) are from bench measurements with the EVM while all other parameters are from the respective 8-ch data sheets.
(2) Values have been de-skewed per the TXV0108-EVM's differences. See Table 3-1.

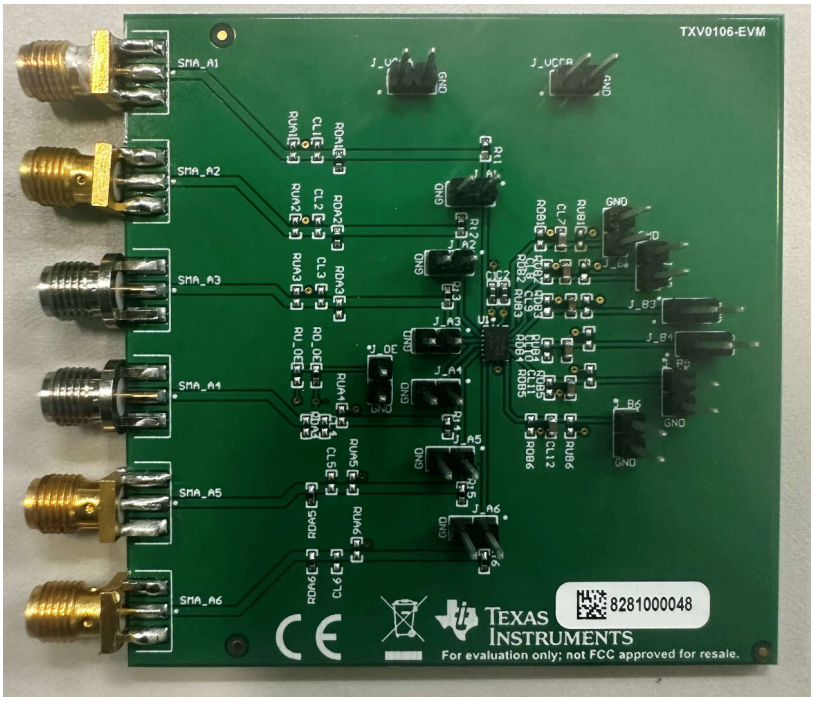

Figure 2-1. TXV-EVM 6 Channel

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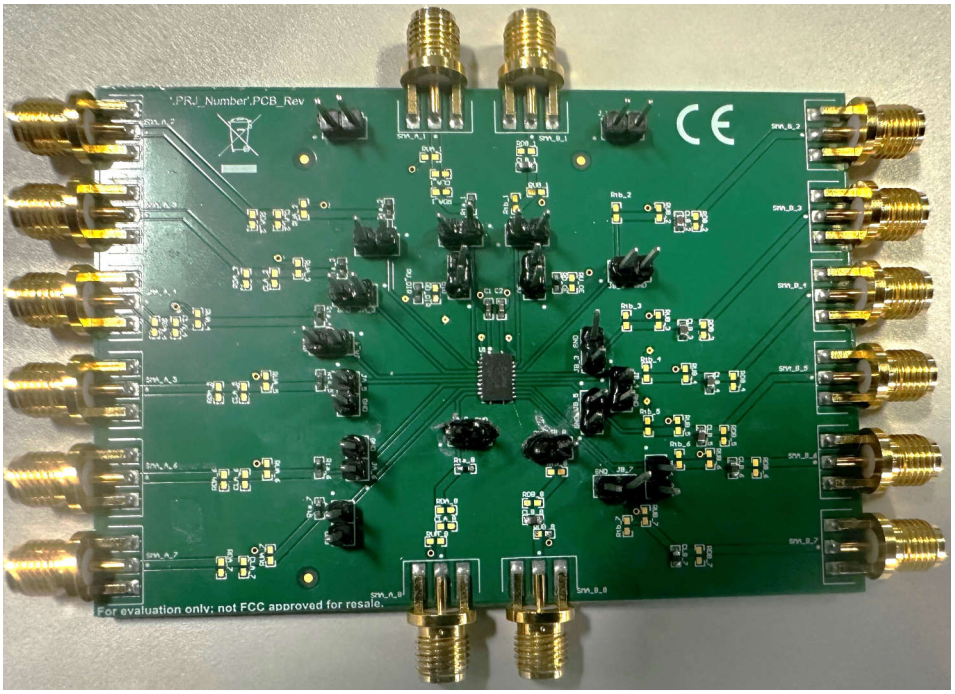

Figure 2-2. TXV-EVM 8 Channel

The various packages which the EVM supports are listed in Table 2-2.

Table 2-2. EVM Package Options

Version	Package	Device Populated
6-Channel	BQB	*TXV0106BQB*
8-Channel	RGY, RHL	*TXV0108RGY*

The TXV-EVM is not built as a single-purpose EVM. The TXV-EVM supports all devices with P2P compatibility listed in Table 2-3.

Table 2-3. Supported Devices

	Supported Devices	Order Samples
6-Channel	TXV0106	TXV0106 samples
	TXV0106-Q1	TXV0106-Q1 samples
8-Channel	SN74AXC8T245	SN74AXC8T245 samples
	SN74AXC8T245-Q1	SN74AXC8T245-Q1 samples
	SN74AVC8T245	SN74AVC8T245 samples
	SN74AVC8T245-Q1	SN74AVC8T245-Q1 samples
	SN74LVC8T245	SN74LVC8T245 samples
	SN74LVC8T245-Q1	SN74LVC8T245-Q1 samples
	SN74LXC8T245	SN74LXC8T245 samples
	SN74LXC8T245-Q1	SN74LXC8T245-Q1 samples
	TXV0108	TXV0108 samples
	TXV0108-Q1	TXV0108-Q1 samples

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2.2 Hardware Description

2.2.1 Headers

The EVMs have standard 100-mil headers for the power supplies, inputs and outputs pins (as well as the output enable and direction pin if applicable), with the signal and power and ground sides labeled for easy connection as shown in Figure 2-1. The silkscreen indicates the pin function.

2.2.2 Bypass Capacitors

C1 and C2 are the bypass capacitors for V_{CCA} and V_{CCB}, each with a value of 0.1µF.

2.2.3 Pull-up and Pull-down Resistors and Capacitive Loading

The DIR (applicable to the 8-ch version) and $\overline{OE}$ pins are inputs for the devices and must never be left floating. The CMOS inputs must be held at a known state, either V_{CC} or ground, to verify proper device operation. Refer to *Implications of Slow or Floating CMOS Inputs* (SCBA004). The default state of the DIR pin for the EVM is referenced to V_{CCA} using a 10 kΩ pull-up resistor while the $\overline{OE}$ pins are pulled to GND using a 10 kΩ pull-down resistors for A to B translation.

The EVM has the flexibility for pull-ups (RUA for the A-side, RUB for the B-side, RU_DIR for the direction pin, RU_OE for the $\overline{OE}$ pin), pull-downs (RDA for the A-side, RDB for the B-side, RDA_DIR for the direction pin and RD_OE for the $\overline{OE}$ pin) for the IOs and control pins, with the option of connecting the inputs and outputs to V_{CC} using pull-up resistors, to ground using pull-down resistors, or directly to GND via jumper on the header pins.

The inputs and outputs also have the option of connecting capacitors to the outputs. For example, CLA on the A-side when translating from B to A, or CLB on the A-side when translating from A to B. Note that inputs A1, A2, A5, A6 (for TXV0106-EVM) and A2-A7 (for TXV0108-EVM) are populated with RDA1, 2, 5, 6 (TXV0106-EVM) and RDA_2 through RDA_7 (TXV0108-EVM) with 1-MΩ pull-downs as unused pins by default. Remove the populated pull-downs when using the respective IOs.

Note that, the EVMs do not have IO capacitors pre-populated.

Table 2-4 lists the populated pull-up and pull-down resistors.

Table 2-4. Pull-up and Pull-down Resistors

Device	Pin	Pullup (10 kΩ)	Pulldown (10 kΩ)	Pulldown (1 MΩ)
Six Channel(1)	A1, A2, A5, A6			RDA1, RDA2, RDA5 and RDA6
	$\overline{OE}$		RD_OE	
Eight Channel(2)	A2 through A7			RDA_2 through RDA_7
	$\overline{OE}$		RD_OE	
	DIR	RU_DIR		

(1) Six channel considering TXV0106.
(2) Eighth channel considering TXV0108, SN74AVC8T245 or SN74AXC8T245.

2.2.4 SMA Connectors

The edge-mounted SMA connector option is provided for each of the channel versions on data IO pins (A-ports for TXV0106-EVM and A and B ports for TXV0108-EVM) for high-speed operation and skew measurements.

Pairs of SMA connectors come installed on the A3 and A4 for the data input pairs of the 6-channel device option and A1, B1, A8 and B8 for the data IO pairs of the 8-channel device option, as shown in Figure 2-1.

The corresponding A-port header pins come installed with 50-Ω termination resistors for impedance control. All other data IO pins also have the uninstalled SMA connector option with the 50-Ω termination resistors to the corresponding A-port headers as shown in Section 3.1.

For the TXV0106-EVM, all B1-B6 output traces are matched for 0 ps board skew. For TXV0108-EVM, outputs can have negligible skew differences as shown in Table 3-1.

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2.2.5 Set-up and Measurements

The TXV devices are optimized for low skew applications such as RGMII interface between MAC and PHY. The EVMs have been optimized with options to measure skew. For skew measurements, the default state of the board with the SMA connectors populated can be used corresponding to the shortest PCB traces ready to be tested, For example, A3 and A4 as inputs for TXV0106-EVM and A1 and A8 as inputs for TXV0108-EVM ready to be tested.

Figure 2-3 shows typical rise / fall time, output skew and duty cycle distortion (DCD) measurements from the TXV0108-EVM (with the TXV0108 device). C1 (ch A1) and C2 (ch A8) are both inputs while C3 (ch B1) and C4 (ch B8) are the corresponding outputs respectively.

The scope shot highlights typical RGMII application with timing budget for rise and fall times <750ps (C4 as B8 output), output skew (C4, C3 as B8, B1 outputs) <400ps, DCD (C4 as B8 output) <5% of 50% and propagation delay t_{PD} (C2, C4 as A8 input, B8 output) < 2ns for 1.8V to 3.3V at 125MHz with no load populated at the CLB_outputs.

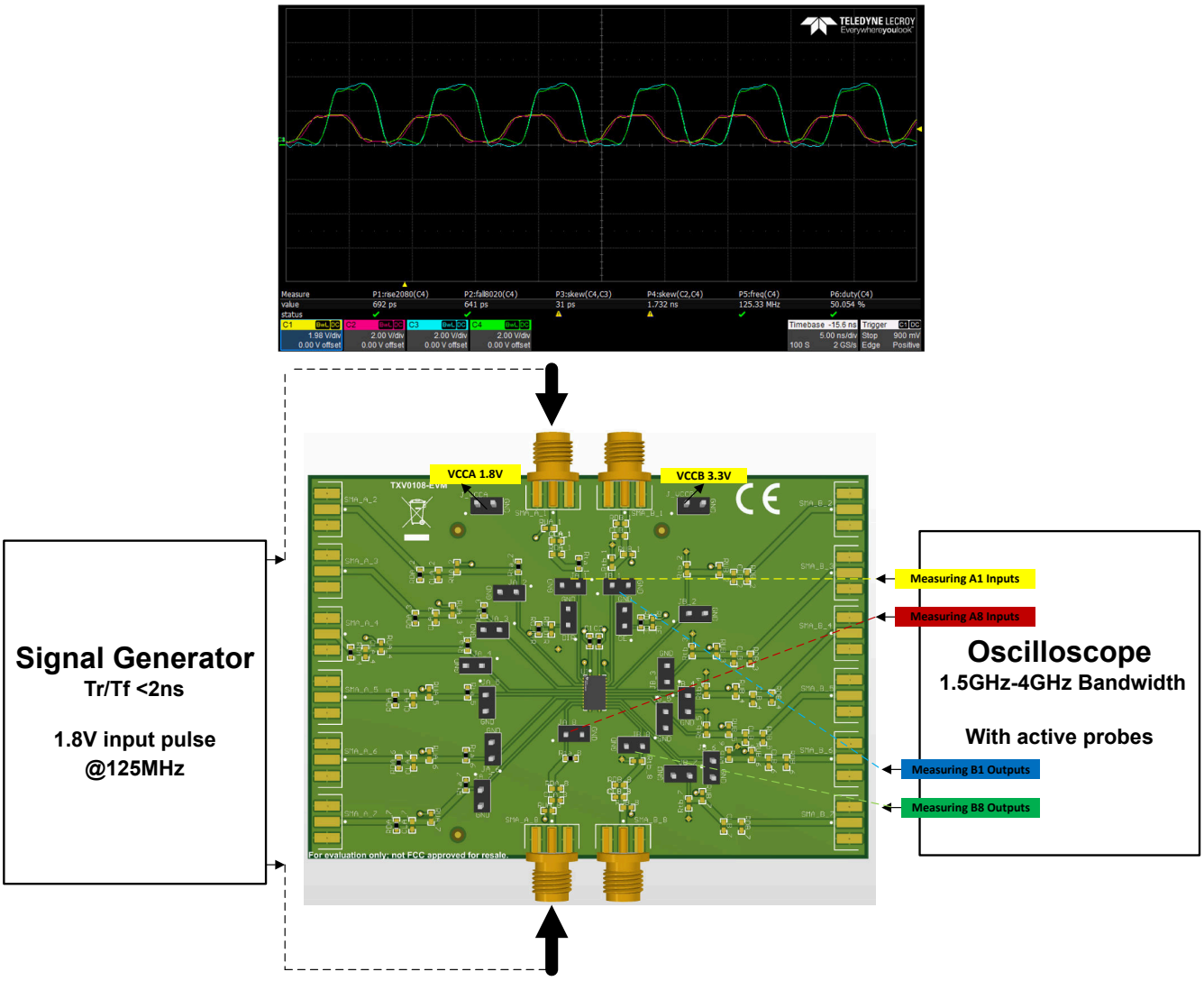

Figure 2-3. TXV0108-EVM with TXV0108RGY, 1.8V to 3.3V Translation

The signals are generated from two signal generator ports as shown in Figure 2-3 using short high-speed cables, connected to the edge-mounted SMA_A_1 and SMA_A_8 connectors and terminated at the 50-Ω termination resistors for the data inputs A1 & A8.

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The corresponding input headers JA_1 & JA_8 are used to probe the input signals using active probes. The corresponding output headers JB_1 & JB_8 are used to probe the output signals using active probes (note that probes can add additional capacitance). CLB gives the option to include additional capacitive load conditions for further evaluations.

For B-to-A Translation:

- Pull DIR low to GND.
- Make sure the 50-Ω termination resistors on Rta_1 & Rta_8 are depopulated.
- Make sure the 50-Ω termination resistors for Rtb_1 & Rtb_8 are populated.
- Connect the input signal to SMA_B_1 & SMA_B_8.
- Measure the outputs at JA_1 & JA_8.
- Use CLA for additional capacitive loading.

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3 Hardware Design Files

3.1 Schematic

TXV0106-EVM Schematic illustrates the EVM schematics. Increase the zoom level for clarity.

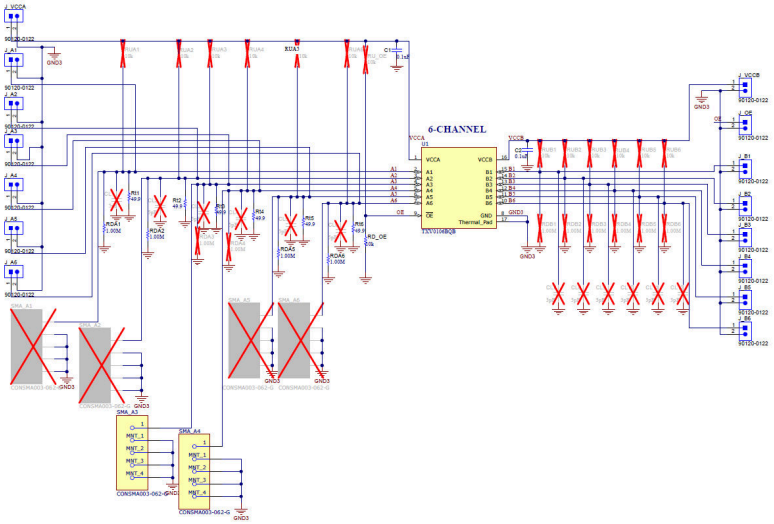

Figure 3-1. TXV0106-EVM Schematic

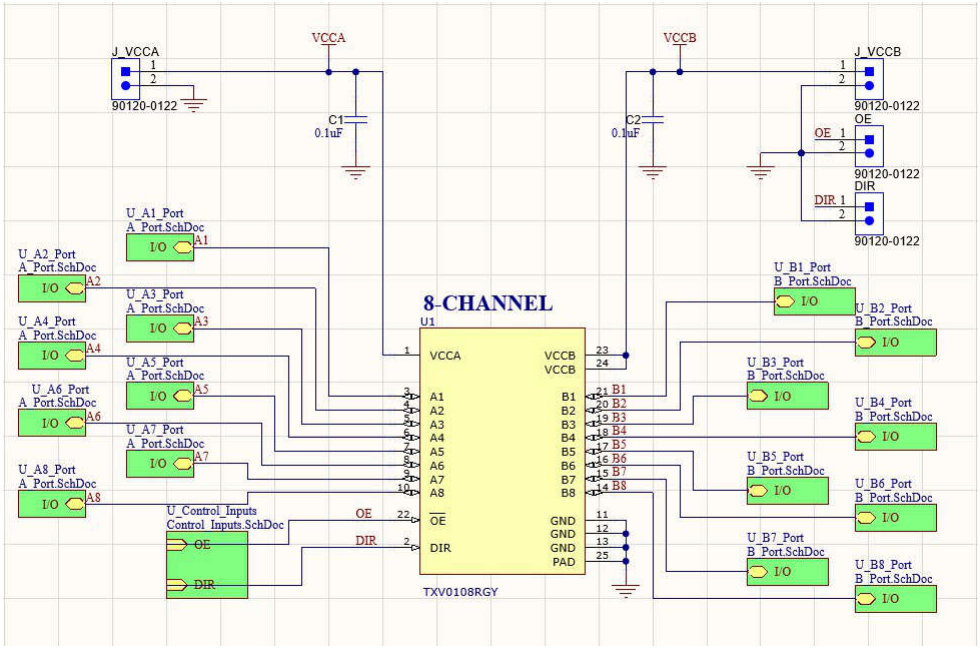

Figure 3-2. TXV0108-EVM Schematic

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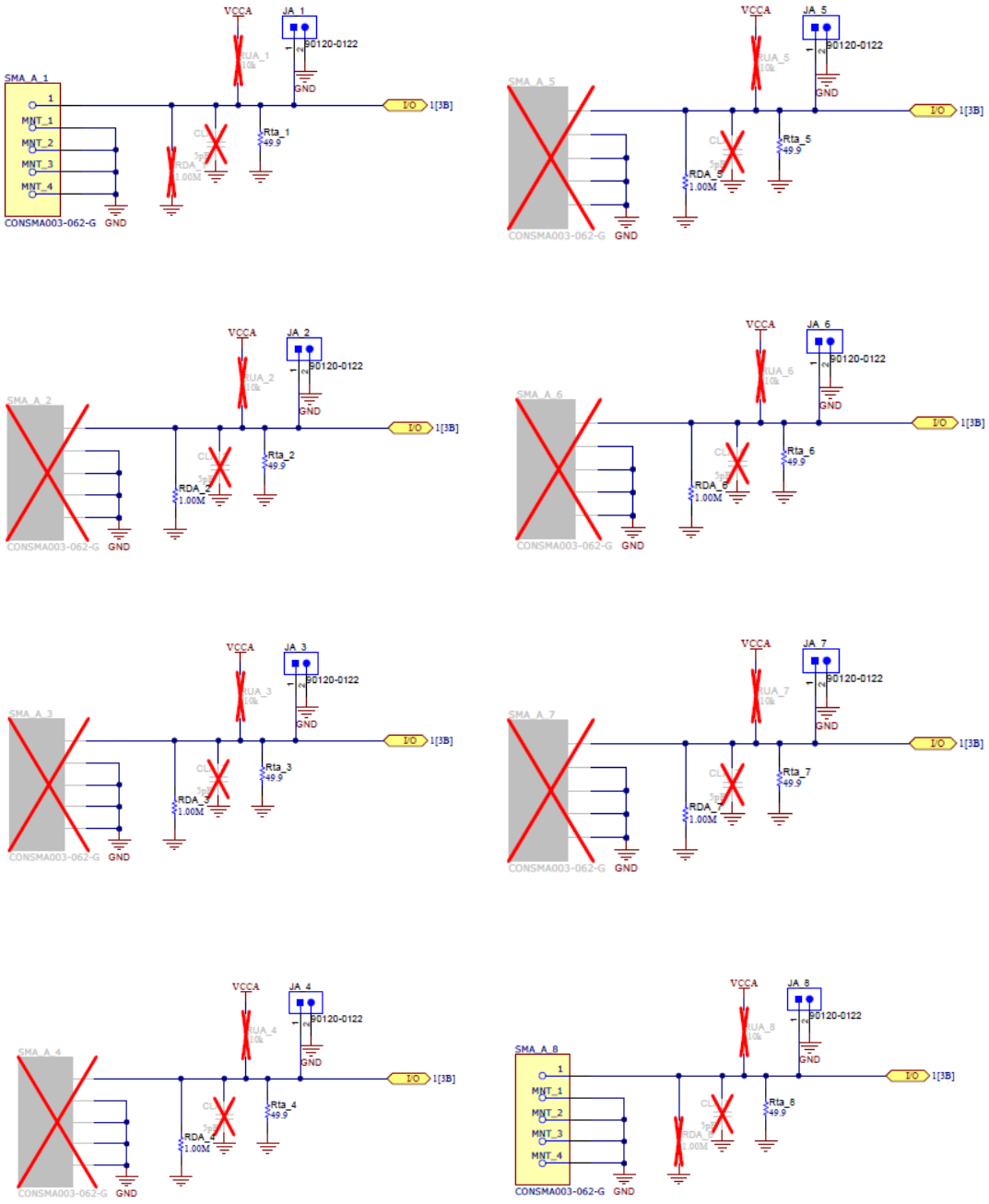

Figure 3-3. TXV0108-EVM A-Ports

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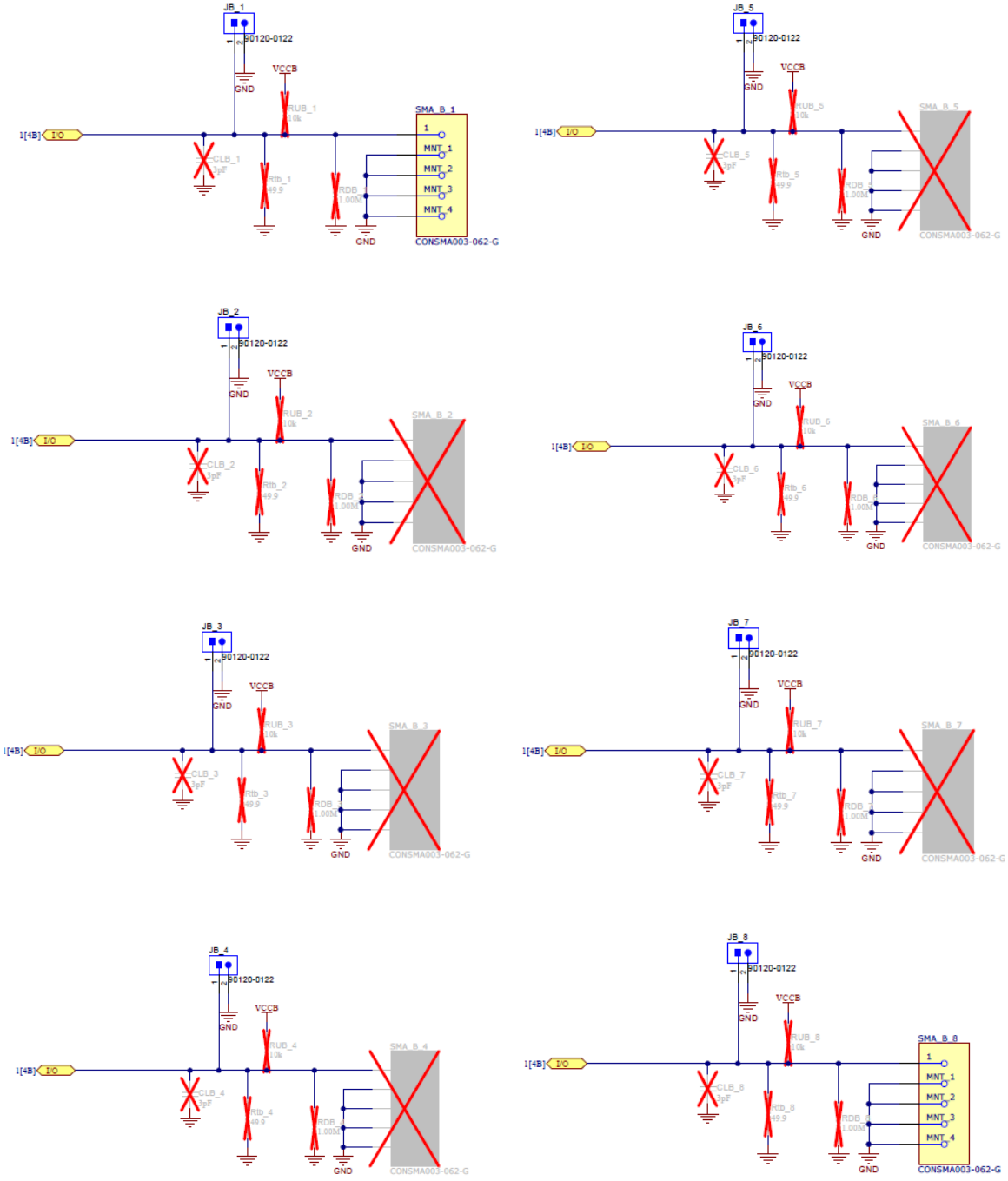

Figure 3-4. TXV0108-EVM B-Ports

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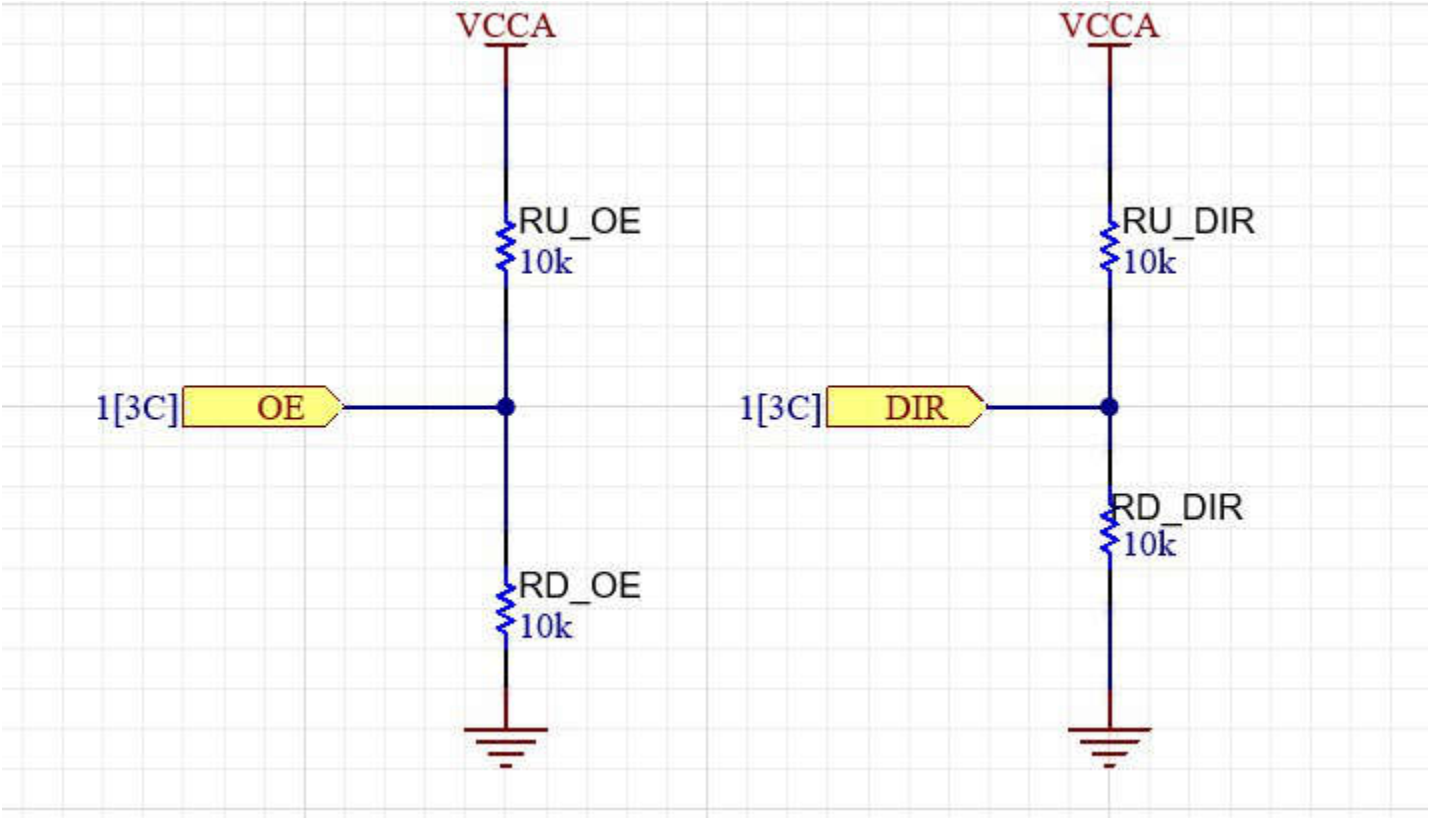

Figure 3-5. TXV0108-EVM Control Inputs

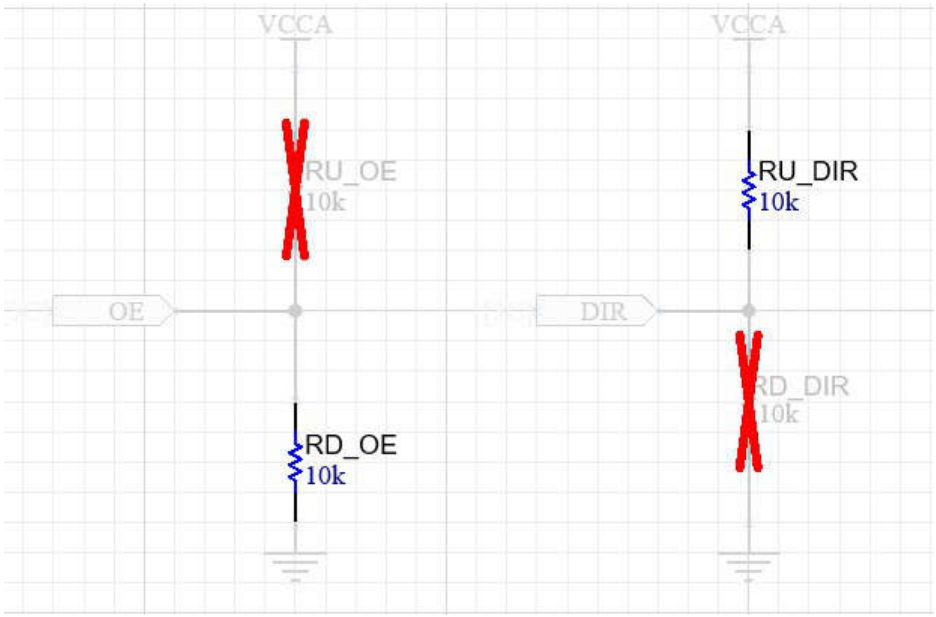

Figure 3-6. TXV0108-EVM Control Inputs (as populated)

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3.2 PCB Layout

Section 3.2 illustrates the EVM layouts. Increase zoom level for clarity.

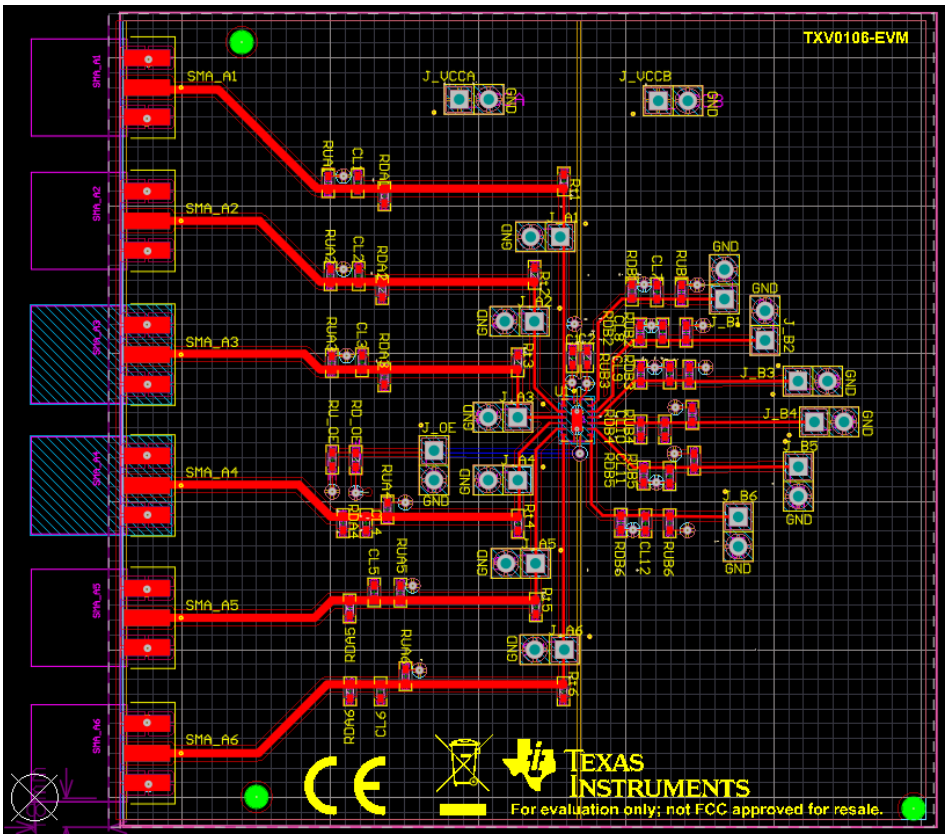

Figure 3-7. TXV0106-EVM Layout

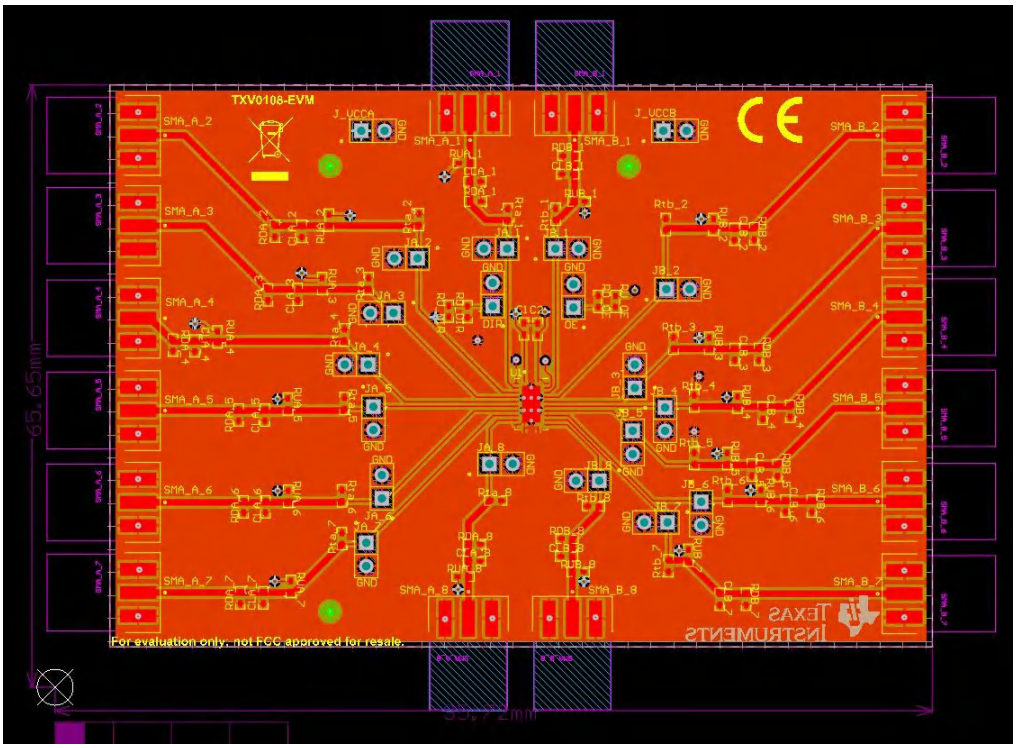

Figure 3-8. TXV0108-EVM Layout

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The approximate EVM traces and the round trip delays are listed in Table 3-1 for de-skew purposes.

Table 3-1. Board Trace Length And The Respective Delays

	TXV0106-EVM				TXV0108-EVM			
I/O Pins	Total trace length	Trace length from device to headers	Total delay	Delay from device to headers	Total trace length	Trace length from device to headers	Total delay	Delay from device to headers
A1	2.3 inches	0.7 inches	260ps	81ps	1.3 inches	0.7 inches	147ps	76ps
A2	1.9 inches	0.5 inches	215ps	53ps	2.3 inches	0.9 inches	257ps	98ps
A3	1.6 inches	0.2 inches	184ps	35ps	1.9 inches	0.8 inches	217ps	72ps
A4	1.7 inches	0.4 inches	196ps	39ps	1.8 inches	0.8 inches	200ps	93ps
A5	2 inches	0.6 inches	225ps	67ps	1.6 inches	0.6 inches	184ps	67ps
A6	2.4 inches	0.8 inches	270ps	94ps	1.8 inches	0.9 inches	201ps	80ps
A7	N/A	N/A	N/A	N/A	1.9 inches	1 inch	217ps	97ps
A8	N/A	N/A	N/A	N/A	1 inch	0.4 inches	111ps	32ps
B1	0.8 inches	0.8 inches	84ps	84ps	1.3 inches	0.8 inches	140ps	79ps
B2	0.8 inches	0.8 inches	84ps	84ps	2.2 inches	0.7 inches	246ps	77ps
B3	0.8 inches	0.8 inches	84ps	84ps	1.9 inches	0.6 inches	209ps	70ps
B4	0.8 inches	0.8 inches	84ps	84ps	1.7 inches	0.6 inches	191ps	70ps
B5	0.8 inches	0.8 inches	84ps	84ps	1.8 inches	0.5 inches	200ps	52ps
B6	0.8 inches	0.8 inches	84ps	84ps	1.7 inches	0.8 inches	192ps	79ps
B7	N/A	N/A	N/A	N/A	2 inches	0.9 inches	222ps	77ps
B8	N/A	N/A	N/A	N/A	1 inch	0.5 inches	114ps	55ps

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3.3 Bill of Materials

Table 3-2 lists the EVM bill of materials for both TXV0106-EVM and TXV0108-EVM.

Table 3-2. Bill of Materials

Designator	Qty	Value	Description	Package Reference	Part Number	Manufacturer
!PCB1	2		Printed Circuit Board			Any
C1, C2	4	0.1uF	CAP, CERM, 0.1µF, 16V, +/- 10%, X7R, 0402	0402	0402YC104KAT2A	AVX
DIR, J_VCCA, J_VCCB, JA_1, JA_2, JA_3, JA_4, JA_5, JA_6, JA_7, JA_8, JB_1, JB_2, JB_3, JB_4, JB_5, JB_6, JB_7, JB_8, OE	35		Header, 100mil, 2x1, Tin, TH	Header 2x1	90120-0122	Molex
RD_OE, RU_DIR	3	10k	RES, 10 k, 5%, 0.063 W, AEC-Q200 Grade 0, 0402	0402	CRCW040210K0JNED	Vishay-Dale
RDA1, RDA2, RDA5, RDA6, RDA_2, RDA_3, RDA_4, RDA_5, RDA_6, RDA_7	10	1.00M	RES, 1.00M, 1%, 0.063 W, 0402	0402	RC0402FR-071ML	Yage10 America
SMA_A3, SMA_A4, SMA_A_1, SMA_A8, SMA_B_1, SMA_B_8	6		Connector, SMA Jack	CONN_SMA_RCPT	CONSMA003-062-G	Linx Technologies
Rt1 , Rt2, Rt3, Rt4, Rt5, Rt6, Rta1, Rta2, Rta3, Rta4, Rta5, Rta6, Rta7, Rta8	14	50	RES, 49.9, 1%, 0.063 W, AEC-Q200 Grade 0, 0402	0402	CRCW040249R9FKED	Vishay-Dale
U1 - TXV0106	1		6-Bit Low-Skew Voltage Translator	WQFN16	TXV0106BQB	Texas Instruments
U1 - TXV0108	1		8-Bit Low-Skew Voltage Translator	VQFN24	TXV0108RGY	Texas Instruments

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4 Additional Information

Trademarks

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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 semiconductors 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 DEGREDATION 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/lsds/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。

https://www.ti.com/ja-jp/legal/notice-for-evaluation-kits-delivered-in-japan.html

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.

【無線電波を送信する製品の開発キットをお使いになる際の注意事項】 開発キットの中には技術基準適合証明を受けていないものがあります。 技術適合証明を受けていないもののご使用に際しては、電波法遵守のため、以下のいずれかの措置を取っていただく必要がありますのでご注意ください。

1. 電波法施行規則第6条第1項第1号に基づく平成18年3月28日総務省告示第173号で定められた電波暗室等の試験設備でご使用いただく。
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。

なお、本製品は、上記の「ご使用にあたっての注意」を譲渡先、移転先に通知しない限り、譲渡、移転できないものとします。

上記を遵守頂けない場合は、電波法の罰則が適用される可能性があることをご留意ください。 日本テキサス・インスツルメンツ株式会社

東京都新宿区西新宿 6 丁目 2 4 番 1 号

西新宿三井ビル

3.3.3 *Notice for EVMs for Power Line Communication:* Please see http://www.tij.co.jp/lsds/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。https://www.ti.com/ja-jp/legal/notice-for-evaluation-kits-for-power-line-communication.html

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.

4.4 User assumes all responsibility and liability to determine whether the EVM is subject to any applicable international, federal, state, or local laws and regulations related to User's handling and use of the EVM and, if applicable, User assumes all responsibility and liability for compliance in all respects with such laws and regulations. User assumes all responsibility and liability for proper disposal and recycling of the EVM consistent with all applicable international, federal, state, and local requirements.

5. *Accuracy of Information:* To the extent TI provides information on the availability and function of EVMs, TI attempts to be as accurate as possible. However, TI does not warrant the accuracy of EVM descriptions, EVM availability or other information on its websites as accurate, complete, reliable, current, or error-free.

6. *Disclaimers:*

6.1 EXCEPT AS SET FORTH ABOVE, EVMS AND ANY MATERIALS PROVIDED WITH THE EVM (INCLUDING, BUT NOT LIMITED TO, REFERENCE DESIGNS AND THE DESIGN OF THE EVM ITSELF) ARE PROVIDED "AS IS" AND "WITH ALL FAULTS." TI DISCLAIMS ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, REGARDING SUCH ITEMS, INCLUDING BUT NOT LIMITED TO ANY EPIDEMIC FAILURE WARRANTY OR IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE OR NON-INFRINGEMENT OF ANY THIRD PARTY PATENTS, COPYRIGHTS, TRADE SECRETS OR OTHER INTELLECTUAL PROPERTY RIGHTS.

6.2 EXCEPT FOR THE LIMITED RIGHT TO USE THE EVM SET FORTH HEREIN, NOTHING IN THESE TERMS SHALL BE CONSTRUED AS GRANTING OR CONFERRING ANY RIGHTS BY LICENSE, PATENT, OR ANY OTHER INDUSTRIAL OR INTELLECTUAL PROPERTY RIGHT OF TI, ITS SUPPLIERS/LICENSORS OR ANY OTHER THIRD PARTY, TO USE THE EVM IN ANY FINISHED END-USER OR READY-TO-USE FINAL PRODUCT, OR FOR ANY INVENTION, DISCOVERY OR IMPROVEMENT, REGARDLESS OF WHEN MADE, CONCEIVED OR ACQUIRED.

7. *USER'S INDEMNITY OBLIGATIONS AND REPRESENTATIONS.* USER WILL DEFEND, INDEMNIFY AND HOLD TI, ITS LICENSORS AND THEIR REPRESENTATIVES HARMLESS FROM AND AGAINST ANY AND ALL CLAIMS, DAMAGES, LOSSES, EXPENSES, COSTS AND LIABILITIES (COLLECTIVELY, "CLAIMS") ARISING OUT OF OR IN CONNECTION WITH ANY HANDLING OR USE OF THE EVM THAT IS NOT IN ACCORDANCE WITH THESE TERMS. THIS OBLIGATION SHALL APPLY WHETHER CLAIMS ARISE UNDER STATUTE, REGULATION, OR THE LAW OF TORT, CONTRACT OR ANY OTHER LEGAL THEORY, AND EVEN IF THE EVM FAILS TO PERFORM AS DESCRIBED OR EXPECTED.

8. *Limitations on Damages and Liability:*

   8.1 *General Limitations*. IN NO EVENT SHALL TI BE LIABLE FOR ANY SPECIAL, COLLATERAL, INDIRECT, PUNITIVE, INCIDENTAL, CONSEQUENTIAL, OR EXEMPLARY DAMAGES IN CONNECTION WITH OR ARISING OUT OF THESE TERMS OR THE USE OF THE EVMS , REGARDLESS OF WHETHER TI HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES. EXCLUDED DAMAGES INCLUDE, BUT ARE NOT LIMITED TO, COST OF REMOVAL OR REINSTALLATION, ANCILLARY COSTS TO THE PROCUREMENT OF SUBSTITUTE GOODS OR SERVICES, RETESTING, OUTSIDE COMPUTER TIME, LABOR COSTS, LOSS OF GOODWILL, LOSS OF PROFITS, LOSS OF SAVINGS, LOSS OF USE, LOSS OF DATA, OR BUSINESS INTERRUPTION. NO CLAIM, SUIT OR ACTION SHALL BE BROUGHT AGAINST TI MORE THAN TWELVE (12) MONTHS AFTER THE EVENT THAT GAVE RISE TO THE CAUSE OF ACTION HAS OCCURRED.

   8.2 *Specific Limitations.* IN NO EVENT SHALL TI'S AGGREGATE LIABILITY FROM ANY USE OF AN EVM PROVIDED HEREUNDER, INCLUDING FROM ANY WARRANTY, INDEMITY OR OTHER OBLIGATION ARISING OUT OF OR IN CONNECTION WITH THESE TERMS, , EXCEED THE TOTAL AMOUNT PAID TO TI BY USER FOR THE PARTICULAR EVM(S) AT ISSUE DURING THE PRIOR TWELVE (12) MONTHS WITH RESPECT TO WHICH LOSSES OR DAMAGES ARE CLAIMED. THE EXISTENCE OF MORE THAN ONE CLAIM SHALL NOT ENLARGE OR EXTEND THIS LIMIT.

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.

10. *Governing Law:* These terms and conditions shall be governed by and interpreted in accordance with the laws of the State of Texas, without reference to conflict-of-laws principles. User agrees that non-exclusive jurisdiction for any dispute arising out of or relating to these terms and conditions lies within courts located in the State of Texas and consents to venue in Dallas County, Texas. Notwithstanding the foregoing, any judgment may be enforced in any United States or foreign court, and TI may seek injunctive relief in any United States or foreign court.

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