10-Output Low Jitter Low Power Differential to LVCMOS Clock Buffer - Evaluation Board

The CDCLVC1310 is a highly versatile, low jitter and low power clock fan out buffer, which distributes up to ten low jitter LVCMOS clock outputs. The clock is derived from one of three inputs, whose primary and secondary inputs feature differential or single-ended signals and the third input is a crystal input.

This evaluation module (EVM) is designed to demonstrate the electrical performance of the CDCLVC1310. Throughout this document, the acronym EVM and the phrases evaluation module and evaluation board are synonymous with the CDCLVC1310EVM. Figure 1 and Figure 2 illustrate the CDCLVC1310EVM.

For optimum performance, the board is equipped with 50-Ω SMA connectors and well-controlled 50-Ω impedance microstrip transmission lines.

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1 Features

- Easy-to-use evaluation board to fan out low phase-noise clocks
- Easy device setup
- Fast configuration
- Control pins configurable through jumpers
- Board powered at 2.5-/3.3-V for VDD and at 1.5-/1.8-/2.5-/3.3-V for VDDO
- Single-ended or differential input clocks or crystal input

2 Signal Path and Control Circuit

The CDCLVC1310EVM supports single-ended and differential inputs up to 200 MHz. For more information about the CDCLVC1310, see the CDCLVC1310 data sheet available for download from the TI Web site (www.ti.com).

3 Getting Started

The CDCLVC1310EVM has self-explanatory labeling and uses similar naming conventions as the CDCLVC1310 product data sheet. In this user's guide, all words in ***boldface and italic print*** reflect the actual labeling on the EVM.

4 Power Supply Connections

Connect the first power-supply source to the banana plug labeled ***VDD***. Connect the second power-supply source to the banana plug labeled ***VDDO***, and connect the ground of both power-supply sources to ***GND***. Decoupling capacitors and a ferrite bead isolate the EVM power from the CDCLVC1310 device power pins.

The CDCLVC1310EVM can use a core supply voltage (VDD) of 2.375 V to 3.465 V. For output supply voltage (VDDO) the CDCLVC1310EVM can use voltages of 1.35 V to 3.465 V.

5 Input Clock Selection

The CDCLVC1310EVM offers users the option of receiving either a differential or single-ended clock as the clock input. A third option is to use a crystal as clock input. Therefore, the board offers three inputs (***PRI_IN, SEC_IN*** and XTAL input). Both the ***PRI_IN*** and the ***SEC_IN*** input can handle single-ended or differential clocks. To use one of these inputs with a single-ended clock it is recommended to use the recommended LVCMOS input configuration [see the CDCLVC1310 (SCAS917) data sheet].

In the default state, ***PRI_IN*** is not terminated and ***SEC_IN*** is terminated with the recommended LVCMOS input configuration.

Any of the three input clocks can be selected using jumper J42 ***(IN_SEL0***) and J43 (***IN_SEL1***). When both jumpers are shorted to GND, PRI_IN is selected. When J42 is shorted to VDD and J43 is shorted to GND, SEC_IN is selected. When J42 is shorted to GND and J43 is shorted to VDD, crystal input is selected. When both jumpers are shorted to VDD, the crystal oscillator stage is bypassed and the input can be driven by a LVCMOS input clock.

Table 1. Input Selection

J43 (IN_SEL1)	J42 (IN_SEL0)	INPUT CHOSEN
1-2	1-2	PRI_IN
1-2	2-3	SEC_IN
2-3	1-2	XTAL/Overdrive(1)
2-3	2-3	XTAL Bypass(2)

(1) This mode enables the XTAL-Oscillator. It can be used to overdrive the XTAL-Oscillator with a LVCMOS input (max 50-MHz).
(2) This mode is only XTAL Bypass (max 50-MHz).

6 Output Clock

The CDCLVC1310 generates ten LVCMOS outputs. The outputs can be terminated with a Thevenin termination. It is possible to place a capacitive load at the outputs.

In default state the outputs have a 39-Ω series termination. This termination is fitted for 3.3-V VDDO supply.

7 Bill of Materials

Table 2. Bill of Materials

Qty	Value	Designator	PKG/Case	Manufacturer	Part Number
1	Short RJ1-1 and RJ1-2 with 0 Ω resistor	RJ1	Short RJ1-1 and RJ1-2		2-star_res
1	Short RJ2-1 and RJ2-2 with 0 Ω resistor	RJ2	Short RJ2-1 and RJ2-2		3-star_res
13	STIFTLEISTE 2.54MM OFFEN VERTIKAL 2POL	J31, J32, J33, J34, J35, J36, J38, J39, J40, J41, J48, J49, J50		HARWIN	M20-9990246
2	STIFTLEISTE 2.54MM OFFEN VERTIKAL 3POL	J42, J43		HARWIN	M20-9990346
10		C1, C2, C3, C4, C5, C6, C7, C8, C9, C10			
2	10 pF, 50V, 10%	C62, C63	CAP, SMT, 0402	AVX	04025A100KATA
6	0.1 µF, 16V, 10%	C36, C45	CAP, SMT, 0402	AVX	0402YC104KAT2A
1		C66			
6	0.01 µF, 16V, 10%	C49, C51, C53, C55, C57, C59	CAP, SMT, 0402	AVX	0402YC105KAT2A
2	1.0 µF, 6.3V, 20%, X5R	C35, C44	CAP, SMT, 0402	PANASONIC	ECJ-0EB0J105M
10	0 Ω, JUMPER	C11, C12, C13, C14, C15, C16, C17, C18, C19, C20, C24, C25, C28, C29	RES 0.0 Ω 1/10W 0402 SMD	PANASONIC	ERJ-2GE0R00X
7	1000 pF, 50V, 10%, X7R	C37, C46, C50, C52, C54, C56, C58	CAP, SMT, 0402	PANASONIC	ECJ-0EB1H102K
6		C22, C23, C26, C27, C64, C65			
2	10 µF, 10V, +80~–20%, Y5V	C38, C40	CAP, SMT, 0805	TDK	C2012Y5V1A106Z
2	1 µF, 10V, +80~–20%, Y5V	C39, C41	CAP, SMT, 0805	Kemet	C0805C105Z8VACTU
4	4.7 µF, 16V, 10%, X5R	C33, C34, C42, C43	CAP, SMT, 1206	KEMET	C1206C475K4PAC
7	SMA JACK RECEPTACLE, END LAUNCH, 0.062PCB, GOLD	SMA2, SMA4, SMA6, SMA10, SMA15, SMA16, SMA18	CON, SMA, THU	JOHNSON COMPONENTS	142-0701-801
9		SMA1, SMA3, SMA5, SMA7, SMA8, SMA9, SMA11, SMA13, SMA17			
1	CDCLVC1310RHB	S1	Differential to LVCMOS Buffer	TI	CDCLVC1310RHB
1	25 MHZ	Q1	Crystal 25.000MHz 18pF SMD	ECS Inc	ECS-250-18-5PX-F-TR
1		Q2			
2	FERRITE, 50Ω at 100 MHz	L1, L2	FILTER, SMT1206	MURATA ERIE	BLM31PG500SN1L
3	BANANA JACK	J57, J58, VDD0	Conn Jack Banana UNINS Panel Mount	Emerson Network Power Connectivity Solutions	108-0740-001
2		LED1, LED2			
12		R200, R202, R208, R210, R220, R230, R231, R232, R233, R234, R235, R236			
26		R11, R12, R13, R14, R15, R16, R17, R18, R19, R20, R21, R22, R23, R24, R25, R26, R27, R28, R29, R30, R201, R203, R204, R206, R207, R209			
2	1000 Ω, 1%, 100ppm	R211, R212	RES, SMT, 0402	Panasonic - ECG	ERA-W27J102X
2	100 Ω, 1%, 100ppm	R214, R215	RES, SMT, 0402	VISHAY / DALE	CRCW04021000F100
1	49.9 Ω, 1/16W, 1%, 100ppm	R213	RES, SMT, 0402	VISHAY / DALE	CRCW040249R9F

Table 2. Bill of Materials (continued)

Qty	Value	Designator	PKG/Case	Manufacturer	Part Number
4		R205, R221, R226, R227			
10	39 Ω, 1%, 1/16W	R1, R2, R3, R4, R5, R6, R7, R8, R9, R10	RES, SMT, 0402	PANASONIC	ERJ-2RKF39R0X
2	49.9 Ω	R222, R223	RESISTOR, SM, 1/10w, 1%	DALE	CRCW080549R9F
2	86.6 Ω	R224, R225	RESISTOR, SM, 1/10w, 1%	DALE	CRCW080586R6F
4			Screw	Building Fasteners	PMS 440 0038 PH
4			Standoff	Keystone Electronics	3481

8 Schematics

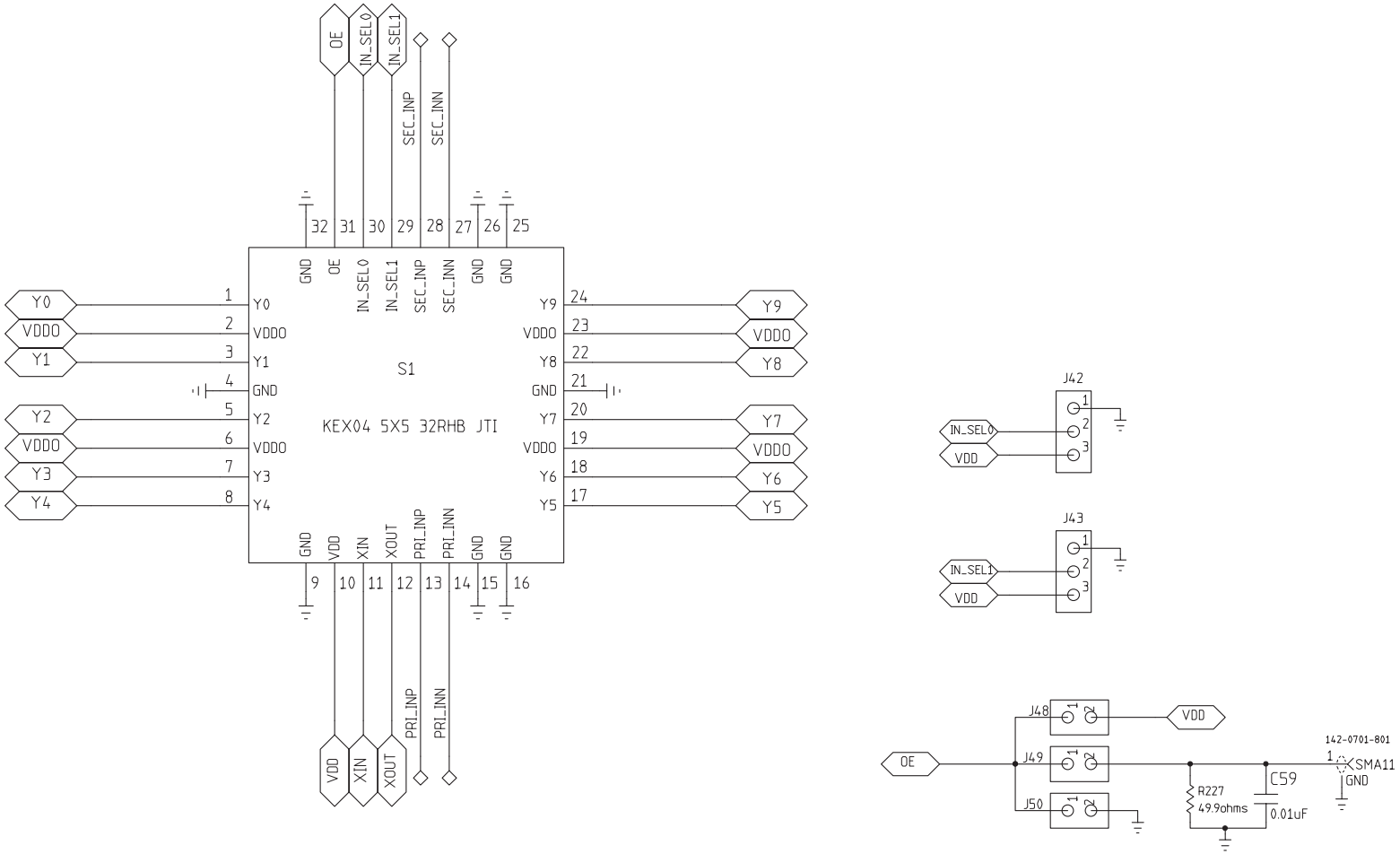

Figure 1. Schematic – CDCLVC1310 and Control Pins (Page 1 of 5)

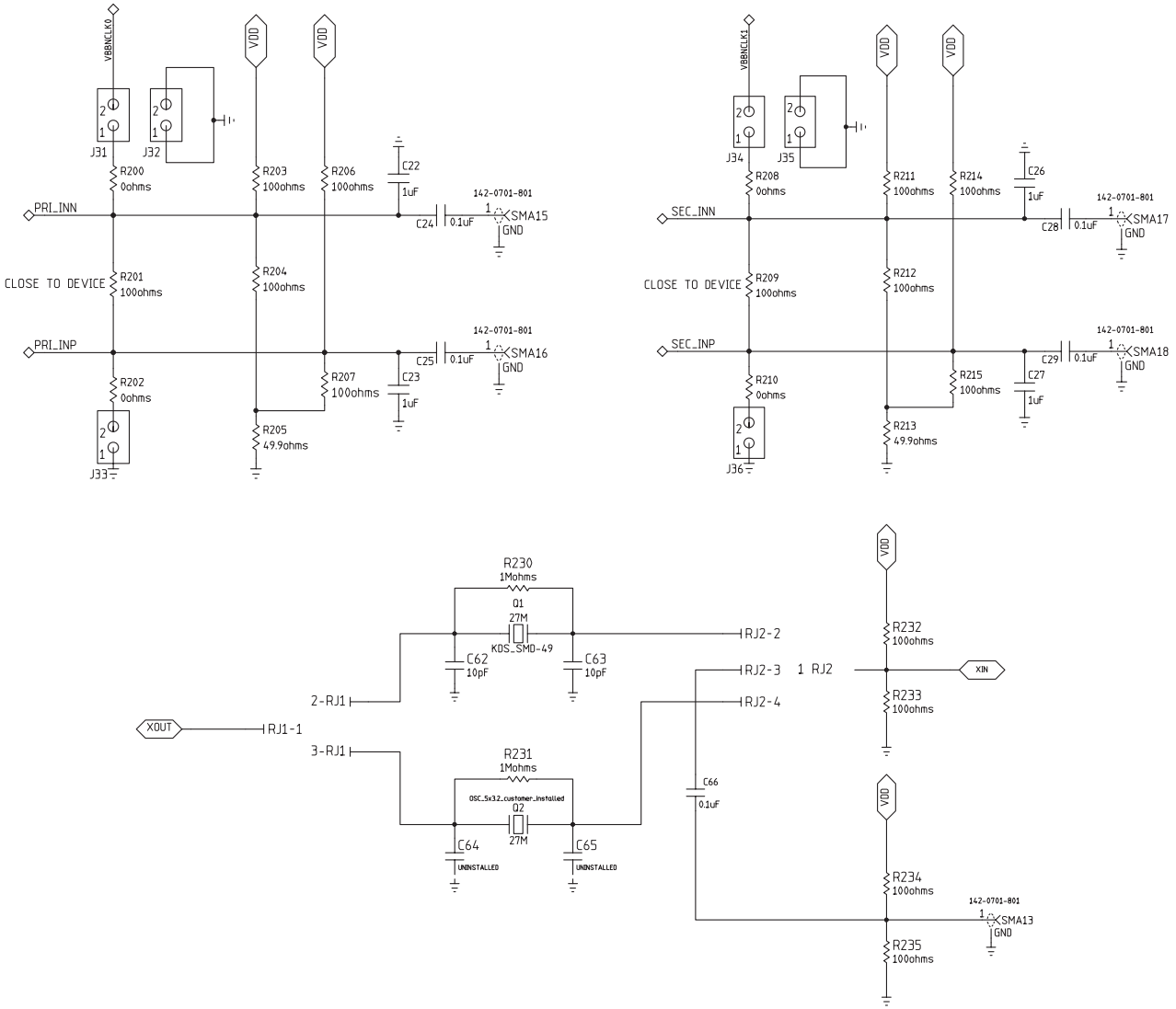

Figure 2. Schematic – Inputs (Page 2 of 5)

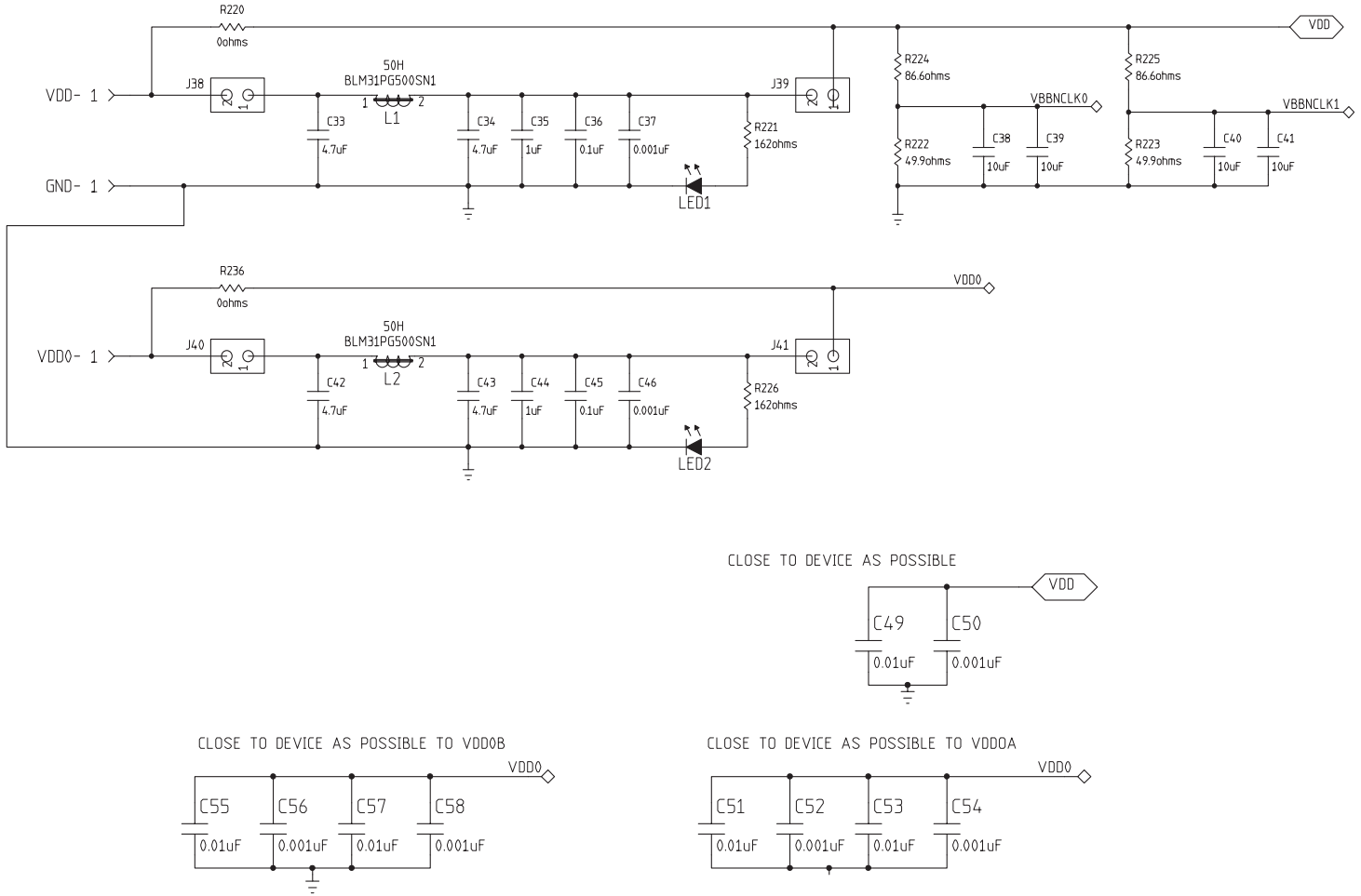

Figure 3. Schematic – Power Supply Filter Networks (Page 3 of 5)

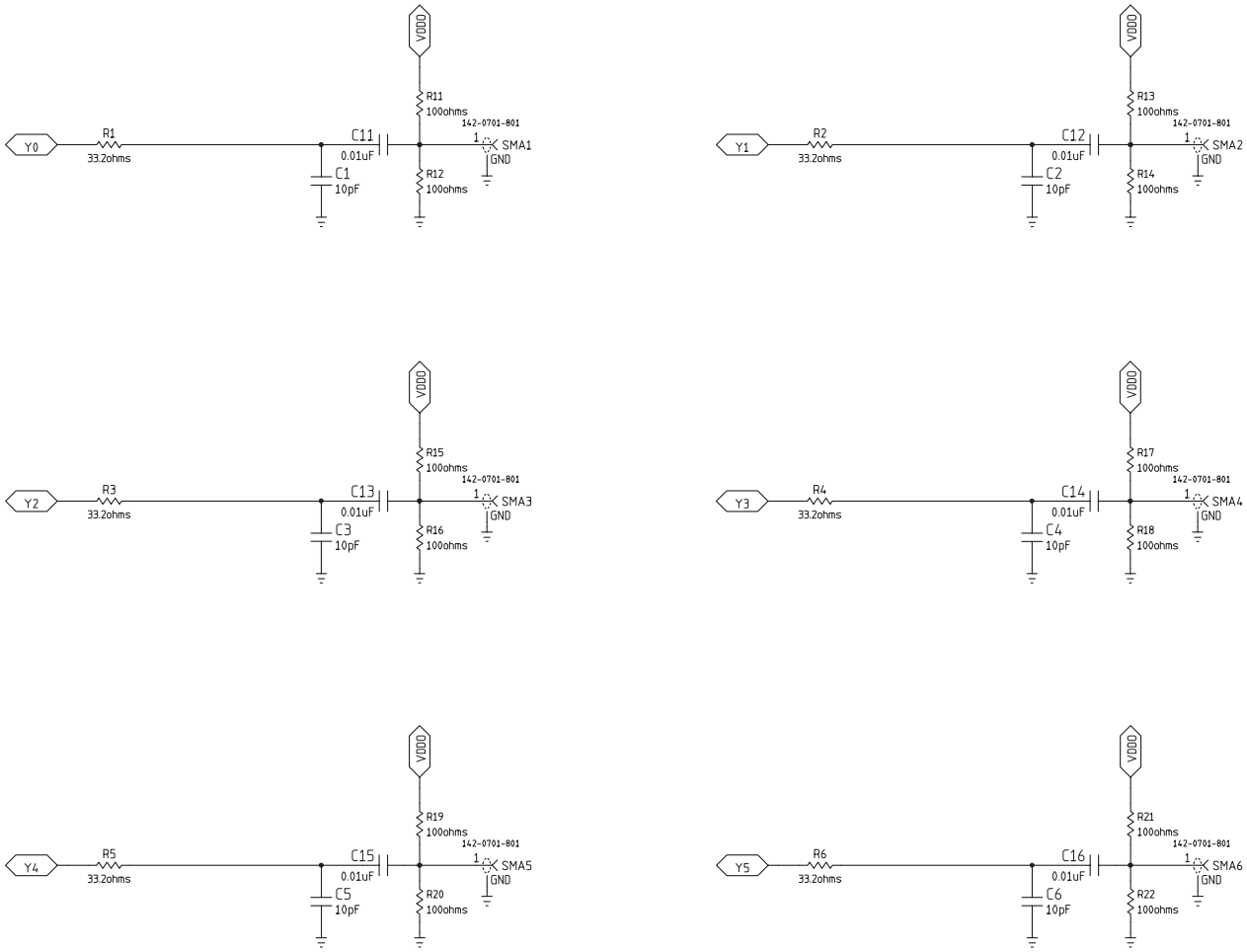

Figure 4. Schematic – Outputs Y0 to Y4 (Page 4 of 5)

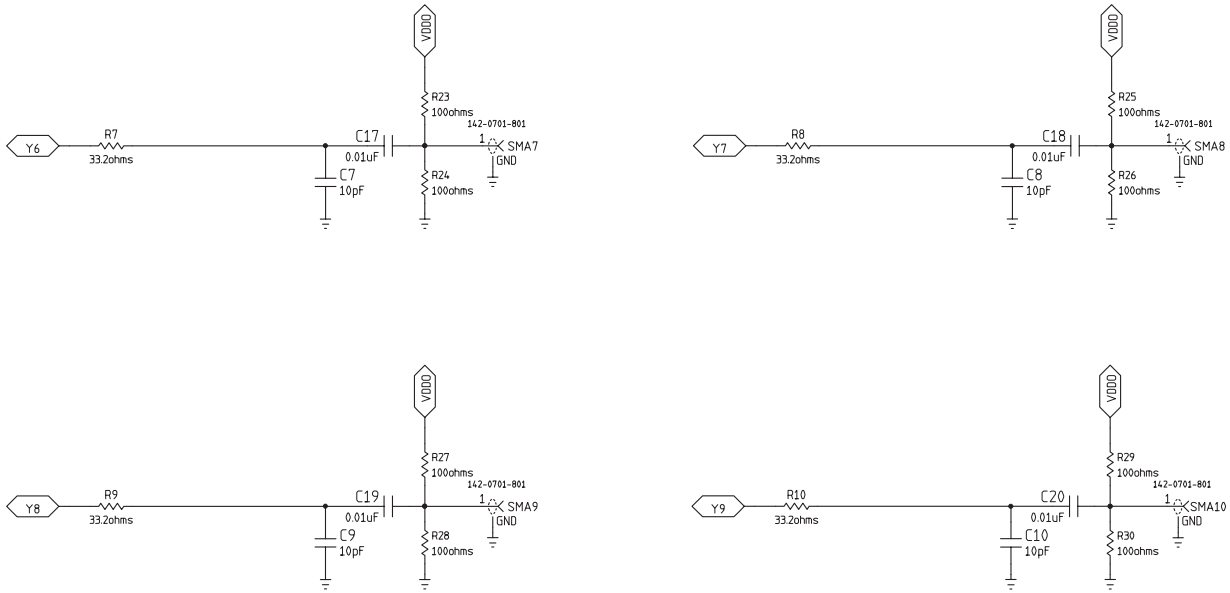

Figure 5. Schematic – Outputs Y5 to Y9 (Page 5 of 5)

8.1 Reference

1. CDCLVC1310 data sheet (SCAS917)

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It is important to operate this EVM within the input voltage range of 2.375 V to 3.466 V and the output voltage range of 1.35 V to 3.465 V .

Exceeding the specified input range may cause unexpected operation and/or irreversible damage to the EVM. If there are questions concerning the input range, please contact a TI field representative prior to connecting the input power.

Applying loads outside of the specified output range may result in unintended operation and/or possible permanent damage to the EVM. Please consult the EVM User's 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, some circuit components may have case temperatures greater than 85°C. The EVM is designed to operate properly with certain components above 85°C as long as the input and output ranges are maintained. These components include but are not limited to linear regulators, switching transistors, pass transistors, and current sense resistors. These types of devices can be identified using the EVM schematic located in the EVM User's Guide. When placing measurement probes near these devices during operation, please be aware that these devices may be very warm to the touch.

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General Statement for EVMs including a radio

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.

FCC Interference Statement for Class B EVM devices

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.

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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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This development kit is NOT certified as Confirming to Technical Regulations of Radio Law of Japan

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.

Texas Instruments Japan Limited
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2. You have full and exclusive responsibility to assure the safety and compliance of your products with all such laws and other applicable regulatory requirements, and also to assure the safety of any activities to be conducted by you and/or your employees, affiliates, contractors or designees, using the EVM. Further, you are responsible to assure 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.
3. You will employ reasonable safeguards to ensure that your use of the EVM will not result in any property damage, injury or death, even if the EVM should fail to perform as described or expected.
4. You will take care of proper disposal and recycling of the EVM's electronic components and packing materials.

Certain Instructions. It is important to operate this EVM within TI's recommended specifications and environmental considerations per the user guidelines. Exceeding the specified EVM ratings (including but not limited to input and output voltage, current, power, and environmental ranges) may cause property damage, personal injury or death. If there are questions concerning these ratings please 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 result in unintended and/or inaccurate operation and/or possible permanent damage to the EVM and/or interface electronics. Please consult the EVM User's 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, some circuit components may have case temperatures greater than 60°C as long as the input and output are maintained at a normal ambient operating temperature. These components include but are not limited to linear regulators, switching transistors, pass transistors, and current sense resistors which can be identified using the EVM schematic located in the EVM User's Guide. When placing measurement probes near these devices during normal operation, please be aware that these devices may be very warm to the touch. As with all electronic evaluation tools, only qualified personnel knowledgeable in electronic measurement and diagnostics normally found in development environments should use these EVMs.

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