TEXAS INSTRUMENTS

TLK2201 Serdes EVM Kit Setup and Usage

User's Guide

July 2000

Mixed Signal DSP Solutions

SLLU011

IMPORTANT NOTICE

Texas Instruments and its subsidiaries (TI) reserve the right to make changes to their products or to discontinue any product or service without notice, and advise customers to obtain the latest version of relevant information to verify, before placing orders, that information being relied on is current and complete. All products are sold subject to the terms and conditions of sale supplied at the time of order acknowledgment, including those pertaining to warranty, patent infringement, and limitation of liability.

TI warrants performance of its semiconductor products to the specifications applicable at the time of sale in accordance with TI's standard warranty. Testing and other quality control techniques are utilized to the extent TI deems necessary to support this warranty. Specific testing of all parameters of each device is not necessarily performed, except those mandated by government requirements.

Customers are responsible for their applications using TI components.

In order to minimize risks associated with the customer's applications, adequate design and operating safeguards must be provided by the customer to minimize inherent or procedural hazards.

TI assumes no liability for applications assistance or customer product design. TI does not warrant or represent that any license, either express or implied, is granted under any patent right, copyright, mask work right, or other intellectual property right of TI covering or relating to any combination, machine, or process in which such semiconductor products or services might be or are used. TI's publication of information regarding any third party's products or services does not constitute TI's approval, warranty or endorsement thereof.

Read This First

About This Manual

The Texas Instruments TLK2201 Serdes evaluation module (EVM) board is used to evaluate the TLK2201 device(VQFP) and associated optical interface (GBIC Module) for point-to-point data transmission applications.

The board enables the designer to connect 50-Ω parallel buses to both transmitter and receiver connectors. Using high speed PLL technology, the TLK2201 serializes and transmits data along one differential pair. The receiver part of the device deserializes and presents data on the parallel bus. The high-speed (up to 1.6 Gbps) data lines interface to four 50-Ω controlled-impedance SMA connectors. The designer can either use this copper interface or, with small solder modifications, send the high-speed data to a GBIC-compatible laser module for an optical interface (not provided).

How to Use This Manual

This document contains the following chapters:

Chapter 1 – Introduction

Chapter 2 –Typical Test and Setup Configurations

Appendix A – Schematics, Board Layouts, and GBIC Configuration

Contents

Figures

Tables

Chapter 1

Introduction

The Texas Instruments (TI) TLK2201 Serdes evaluation module (EVM) board is used to evaluate the TLK2201 device (VQFP) and associated optical interface (gigabit interface connector (GBIC) optics module) for point-to-point data transmission applications.

The board enables the designer to connect 50-Ω parallel buses to both the transmitter and receiver parallel connectors. Using high speed PLL technology, the TLK2201 serializes data and transmits this data along a differential pair. The receiver part of the device deserializes and presents the data on the parallel bus. For proper use of this device, users must provide dc-balanced encoded data on the parallel bus (that is, 8b/10b). The high-speed (up to 1.6 Gbps) data lines interface to four 50-Ω controlled-impedance SMA connectors. The designer can either use this copper interface directly or use steering resistors to direct the high-speed side to the 75-Ω GBIC-compatible optical interface.

The board can be used to evaluate device parameters while acting as a guide for high-speed board layout. The evaluation board can be used as daughterboards that are plugged into new or existing designs. Since the TLK2201 operates over a wide range of frequencies, the designer will need to optimize the design for the frequency of interest. Additionally, the designer may wish to use buried transmission lines and provide additional noise attenuation and EMI suppression to optimize the end product.

Topic **Page**

As the frequency of operation increases, the board designer must take special care to ensure that the highest signal integrity is maintained. To achieve this, the board's impedance is controlled to 50 Ω (75 Ω for the GBIC interface) for both the high-speed differential serial and parallel data connections. In addition, board impedance mismatches are reduced by designing the component pad size to be as close as possible to the width of the connecting transmission lines. Vias are minimized and, when necessary, placed as close as possible to the device drivers. Since the board contains both serial and parallel transmission lines, care was taken to control both impedance and trace-length mismatch (board skew).

Overall, the board layout is designed and optimized to support high-speed operation. Thus, understanding impedance control and transmission-line effects is crucial when designing high-speed boards.

Some of the advanced features offered by this board include:

- PCB (printed-circuit board) is designed for high-speed signal integrity.
- Flexibility–the PCB can be configured for copper or optical interfaces.
- SMA and parallel fixtures are easily connected to test equipment.
- All input/output signals are accessible for rapid prototyping.
- Analog and digital power planes can be supplied through separate banana jacks for isolation, or can be combined using ferrite bridging networks.
- Series termination resistors provide parallel RD outputs.
- Onboard capacitors provide ac coupling of high-speed signals.

1.1 TLK2201 EVM Kit Contents

- TLK2201 EVM board (TLK2201 Rev 1.0)
- TLK2201 EVM kit documentation (this document)

1.2 TLK2201 EVM Board Configuration

The TLK2201 EVM board gives the developer various options for operation, many of which are jumper-selectable. Other options can be either soldered into the EVM or connected through input connectors.

The TX and RX parallel connectors, P3 and P5 of Figures A–8 and A–10 in Appendix A, provide a connection for both transmitted and received parallel-data busing. The reference clock is supplied through SMA connector J11, and jumper J10 must be installed between pins 1 and 2. A direct clock connection can also be made to J10 between the center and ground pins. The high-speed serial data is transmitted through SMA connectors J1 and J2. The received recovered clock (RBC0 and RBC1) is output through header P5. Received data connects through SMA connectors J3 and J4 on the RX side of the board. Header J9 provides static signals (normally pulled high) to configure the device for different modes of operation. Header J7 is for the optical transceiver's configuration and error checking. Refer to your specific GBIC-module documentation for proper configuration of this header.

The power planes are split three ways to provide power to different parts of the board. This prevents coupling of switching noise between the analog and digital sections of the TLK2201, and provides voltage isolation for the laser section. The laser section of the board requires 5 V (GBIC-dependent) and is energized through the V_{CC} connector. The V_{DD} and V_{DDA} connectors require 2.5 V and are joined together by removable jumpers TP1 and TP3 that are installed in the default configuration. Thus, only the V_{DD} connection is necessary to energize the TLK2201 device in the default configuration. In all sections of the board, the ground planes are common and each ground plane is tied together at every component ground connection. See Appendix A, Schematics, Board Layouts, and BGIC Configurations, for detailed schematic and layout.

The board is normally delivered in a default configuration that requires external clock and data inputs. The TLK2201 is shipped with jumpers for default operation. Table 1–1 shows the default configuration for sending data.

Table 1–1. Default Transceiver-Board Configuration as Shipped

Designator	Function	Condition
J10	REF CLK SEL	Jumper installed – provides a method of supplying a input clock to the board
J9	RBCMODE	Jumper not installed (logic 1) – for a 1/10 baud-rate clock on RBC0 (a non-DDR mode)
J9	ENABLE	Jumper not installed (logic 1) – this pulls up the enable pin for normal operation
J9	SYNC_EN	Jumper installed (logic 0) – disables the TLK2201 comma-detection circuitry
J9	LOOPEN	Jumper installed (logic 0) – disables the TLK2201 internal loopback mode
J9	TEST_EN	Jumper installed (logic 0) – disables the TLK2201 test mode
J9	PRBSEN	Jumper installed (logic 0) – disables the TLK2201 PRBS internal production test mode
J9	MODESEL	Jumper installed (logic 0) – puts the parallel buses in a 10-bit mode (disables the DDR mode)
TP1, TP3	VDD– bridge –VDDA	Joins the V_{DD} and V_{DDA} power planes
C14, C15	TX ac-coupling capacitors	These capacitors (normally installed) are provided to ac-couple the transmitted signal.
C22, C23	RX ac-coupling capacitors	These capacitors (normally installed) are provided to ac-couple the received signal.
C18, C19	TX ac-coupling to GBIC	These capacitors (normally not installed) are provided to ac-couple the TLK2201 transmitted data to the 75-Ω GBIC interface.
C20, 21	RX ac-coupling to GBIC	These capacitors (normally not installed) are provided to ac-couple the 75-Ω GBIC receiver data to the TLK2201.

Table 1–2. Configuration Changes Necessary for DC Coupling of the High-Speed Signals

Designator	Function	Condition or Changes Necessary for DC Coupling
C14, C15	TX AC coupling capacitors	Install zero-ohm resistors
C16, C17	RX AC coupling capacitors	Install zero-ohm resistors

Chapter 2

Test and Setup Configurations

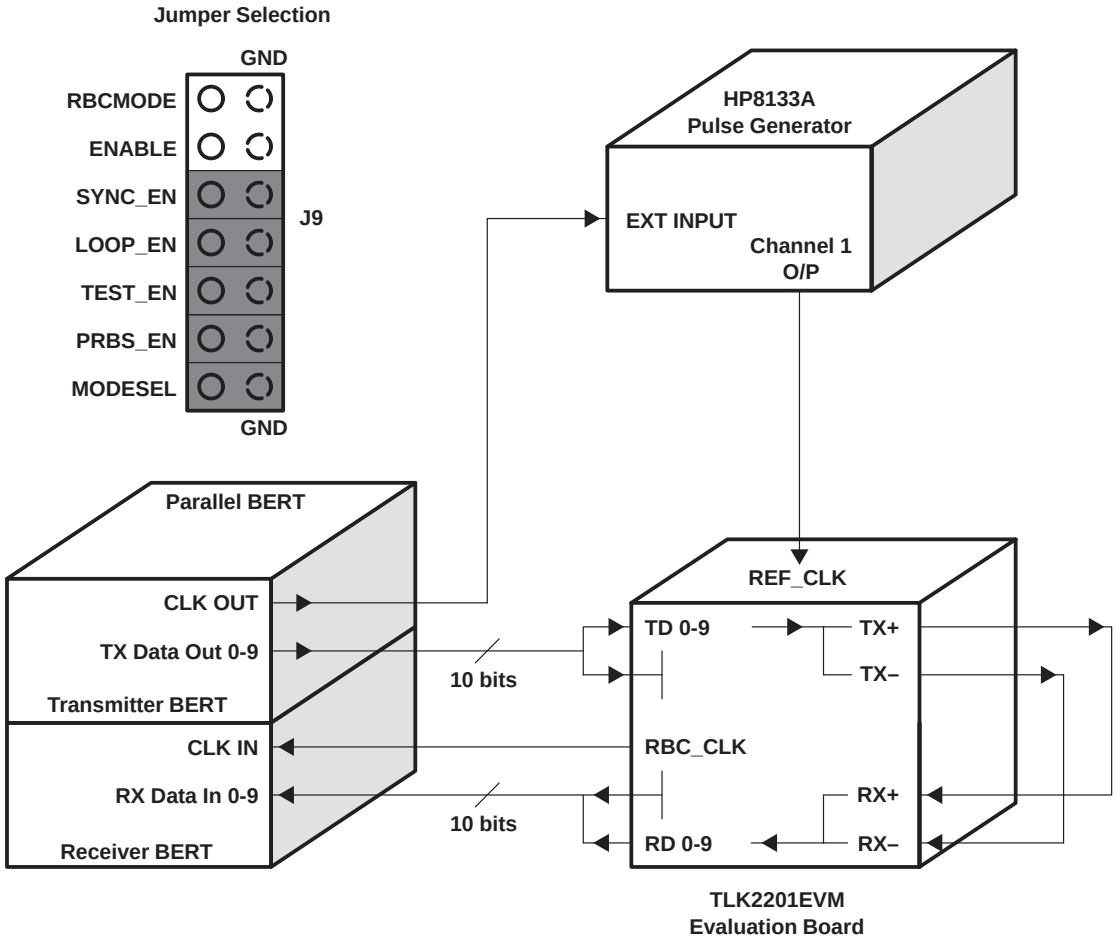
This chapter presents the typical test and setup configurations used to evaluate and test the transceiver. The printed-circuit board construction and characteristics are included in the second section of this chapter.

Topic **Page**

2.1 Typical Test and Setup Configurations

The following configurations are used to evaluate and test the TLK2201 transceiver. The first configuration is an external serial loopback of the high-speed signals shown in Figure 2–1. The serial loopback allows the designer to evaluate most of the functions of the transmitter and receiver sections of the TLK2201 device. To test a system, a parallel-bit error-rate tester (BERT) generates a predefined dc-balanced parallel-bit pattern. The pattern is connected to the transmitter through parallel connectors TD0–TD9 (TD0–TD4 for DDR mode). The TLK2201 device serializes and presents the data on the high-speed serial pair. The serial TX data is then looped back to the receiver side and the device deserializes and presents the data on the receive side RD0–RD9 (RD0–RD4 for DDR mode). The data is received by the BERT and compared against the transmitted pattern and monitored for valid data and errors. If any bit errors are received, a bit-error rate is evaluated at the parallel-receive BERT.

Figure 2–1. TLK2201 External Serial Loopback Test Configuration



If a parallel BERT is not available, the designer can take advantage of the built-in-test mode of the device, see Figure 2–2. If the designer asserts the PRBSEN pin high, a pseudo random bit pattern will be transmitted. This pin also puts the receiver in a mode to detect a valid PRBS pattern. A valid pattern is indicated by the SYNC_PASS pin indicating high. This test only validates the high-speed serial portion of the device and system interconnects. The PRBS pattern is compatible with most serial BERT test equipment. This function allows the operator to isolate and test the transmitter and receiver independently. A typical configuration is shown in Figure 2–3. The dashed lines represent optional connections that can be made for monitoring eye patterns and measuring jitter.

Figure 2–2. TLK2201EVM Serial PRBS Self-Test Configuration

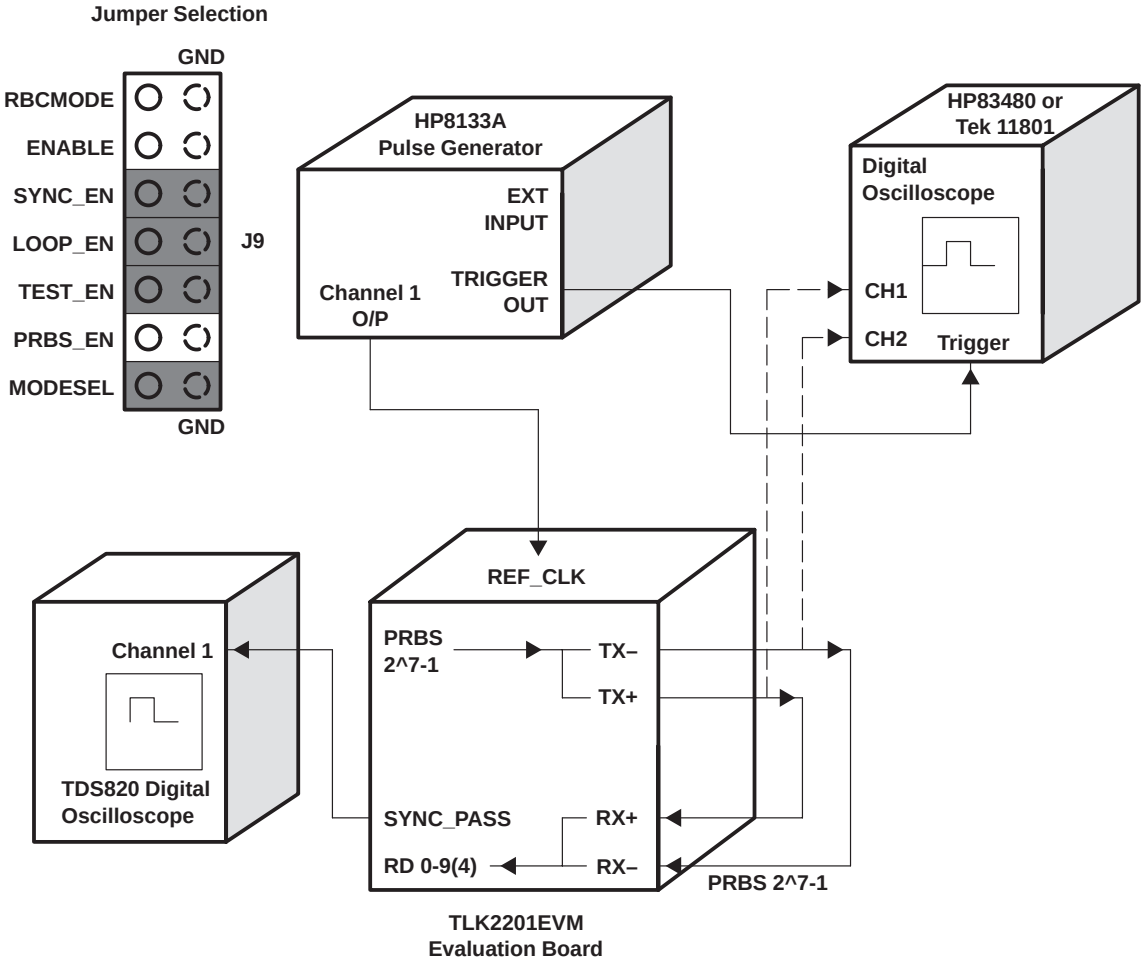
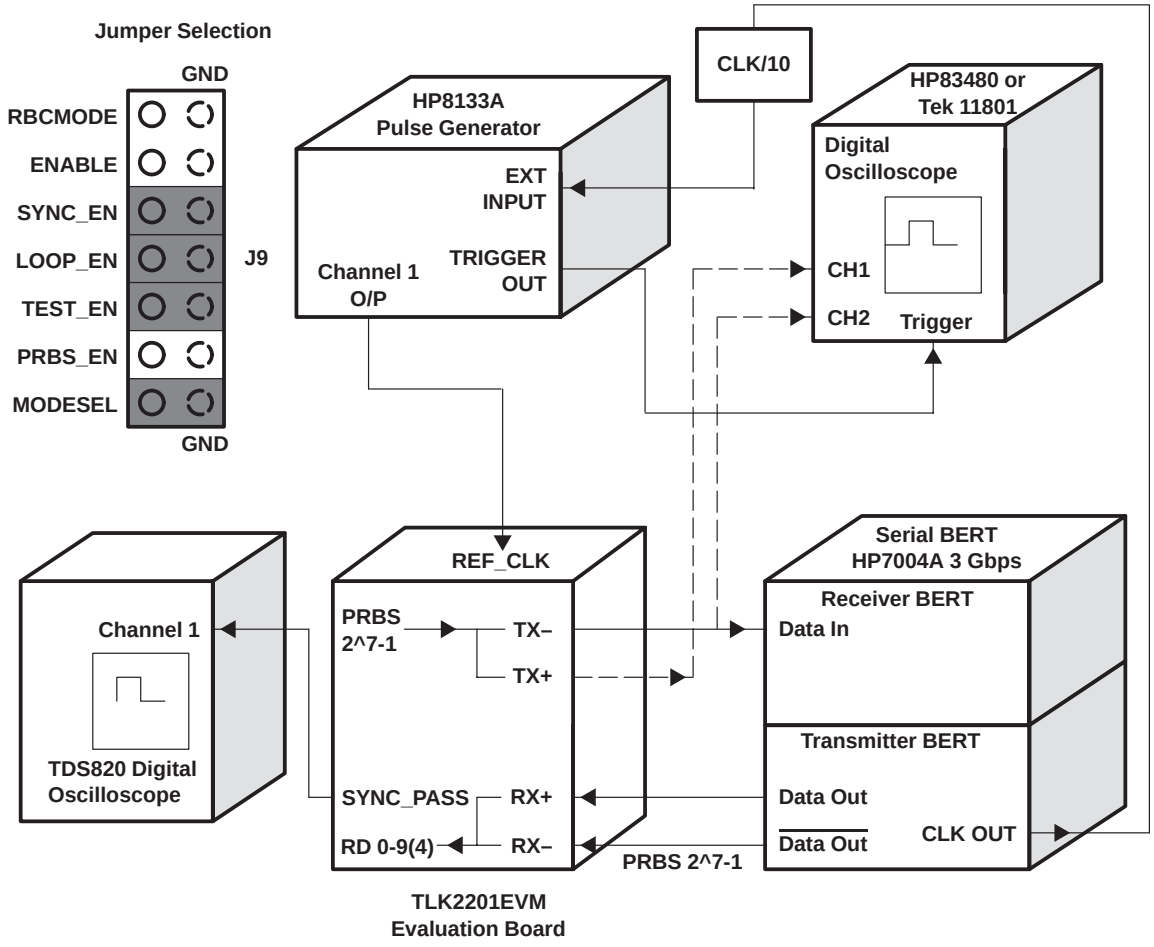


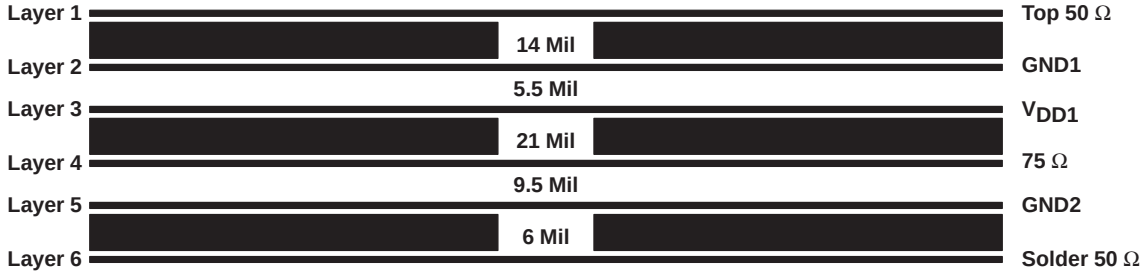
Figure 2–3. TLK2201EVM Serial PRBS BERT Test Configuration



2.2 PCB Construction and Characteristics

The PCB characteristics are calculated and based on the layer construction and trace width of the board.

Figure 2–4. TLK2201EVM Layer Construction



Notes:
1) All cores consist of 1 oz Cu.
2) Trace width
A) 25 mils (for 50-Ω layer 1)
B) 11.8 mils (for 75-Ω layer 4)
C) 11.8 mils (for 50-Ω layer 6)
3) Overall board thickness is 62 mils ±5 mil
4) Copper and solder mask adds approximately 10 mils to the overall board thickness
5) Impedance is 50 Ω ±10%
6) Material is G-Tek. Dielectric constant = 3.9
7) For overall thickness: add 1.2 to 1.4 mils for each metal layer in the stack

Appendix A

Schematics, Board Layouts, and GBIC Configurations

This appendix contains the schematics, bill of materials, and board layouts for the TLK2201EVM transceiver board.

Figure A–1. TLK2201EVM Transceiver Schematic

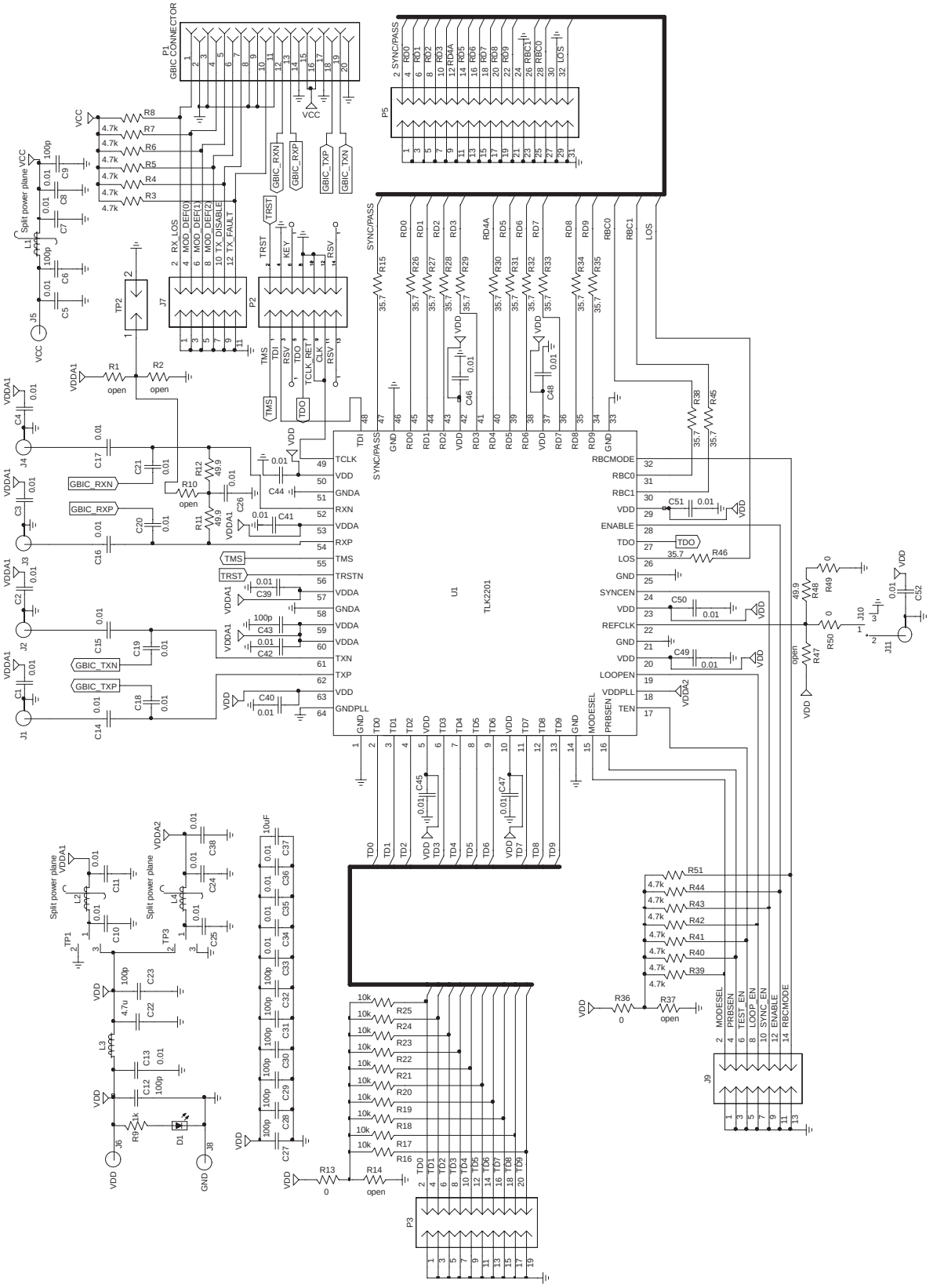


Figure A–2. Optical Transceiver Configuration

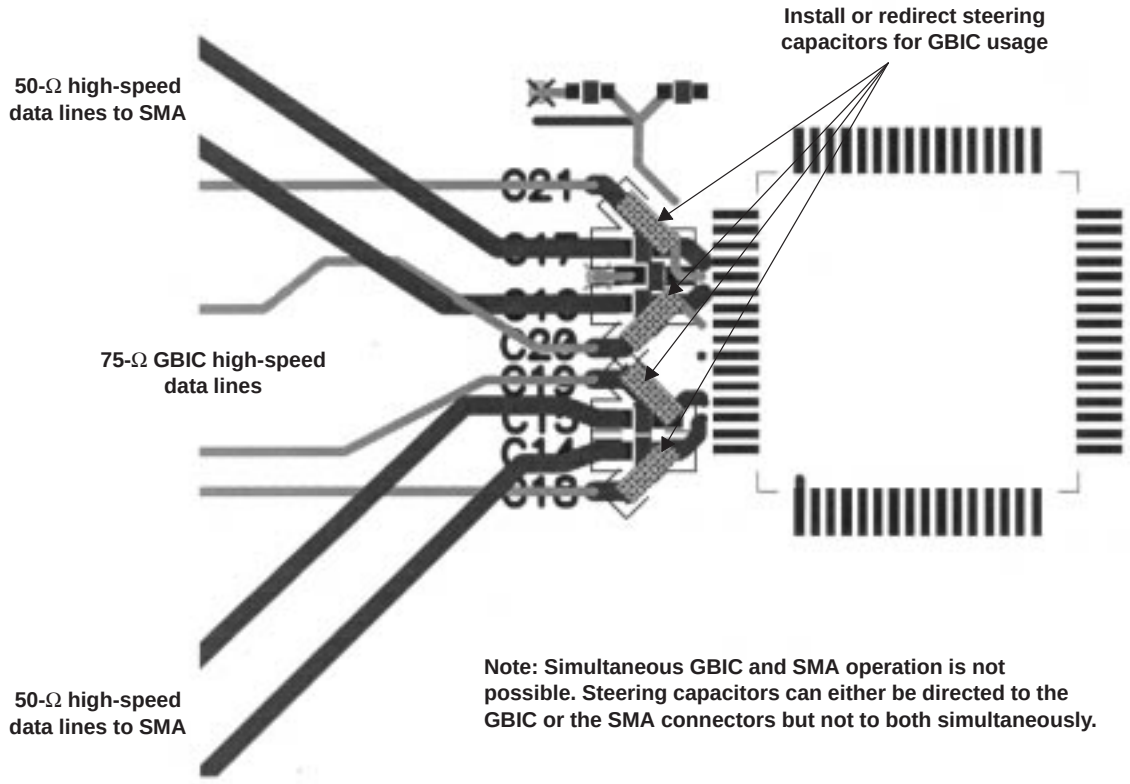


Table A–1. TLK2201EVM Transceiver Bill of Materials

1	1	Digi-Key	S2011–12–ND	J7	2X12 Header	0.1x0.1 Centers
2	1	Digi-Key	S2011–14–ND	J9	2X14 Header	0.1x0.1 Centers
3	1	Digi-Key	S2011–20–ND	P3	2X20 Header	0.1x0.1 Centers
4	1	Digi-Key	S1111–32–ND	P5	2X32 Jumper	0.1x0.1 Centers
5	3	Newark	39N867	J5,J6,J8	Banana jack	
6	39	Digi-Key	PCC1784CT–ND	C1–C5, C7, C8, C10, C11, C13, C14–C21, C24–C26, C33–C36, C38–C42, C44–C52	Capacitor, SMT603	10 V, 10%, 0.01 μF
7	1	Digi-Key	PCC1842CT–ND	C22	Capacitor, SMT0805	10 V, 20%, 4.7 μF
8	1	Digi-Key	PCC1894CT–ND	C37	Capacitor, SMT1210	10 V, 10%, 10 μF
9	4	Digi-Key	240–1018–1ND	L1–L4	Ferrite bead 805 500 mA	600 Ω at 100 MHz
10	1	Digi-Key	S1111–02–ND	TP2	1x2 Header	Header, 1x2, 0.1 center
11	1	AMP	787653	P1	GBIC Connector	N/A
12	4	Digi-Key	P0.0JCT–ND	R13, R36, R49, R50	Resistor, SMT, 0402	0.0 Ω
13	13	Digi-Key	P4.75KLCT–ND	R3–R8, R39–R44, R51	Resistor, SMT, 0402	4.7 kΩ
14	10	Digi-Key	P10.0KLCT–ND	R16–R25	Resistor, SMT, 0402	10.0 kΩ
15	3	Digi-Key	P49.9LCT–ND	R11, R12, R48	Resistor, SMT, 0402, 1% 1/16W 50 V	49.9 Ω
16	6	N/A	N/A	R1, R2, R10, R37, R14, R47	Resistor, SMT, 0402 1% 1/16W 50 V	Open
17	14	Digi-Key	P35.7LCT–ND	R15, R26–R35, R38, R45, R46	Resistor, SMT, 0402 1% 1/16W 50 V	35.7 Ω
18	5	Newark	142–0711–821	J11, J1–J4	SMA end launch	
19	4	Newark	92N4922	STANDOFF	Standoff 0.5’ 4–40 thread	
20	4	Newark	30F082		Machine screw 4–40 x 3/8’	
21	1	TI	TLK2201	U1	TI TLK2201 DUT	64 pin VQFP
22	1	Digi-Key	P1kLCT–ND	R9	Resistor, SMT, 0402 1% 1/16W 50 V	1 kΩ
23	1	3M	3M2514–6002UB	P2	IDC14M 2x14 header	0.1x0.1 centers
24	1	Digi-Key	L62711CT–ND	D1	SMT LED red	
25	11	Digi-Key	PCC101ACVCT–ND	C6, C9, C12, C23, C27–C32, C43	Capacitor, SMT 0603	50 V, 5%, 100 pF

Figure A–3. Top Layer 1

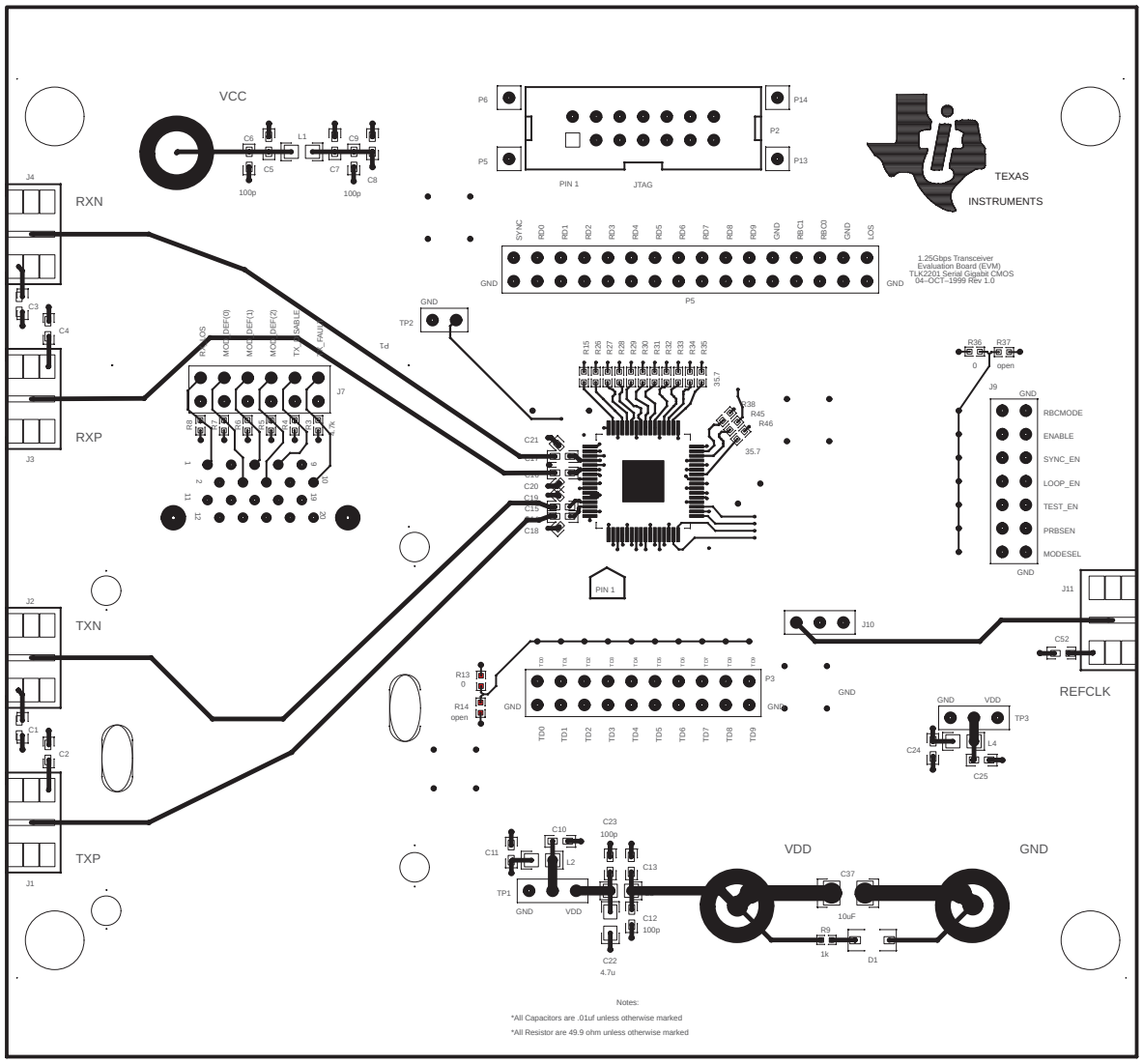


Figure A–4. GND Layers 2 and 5

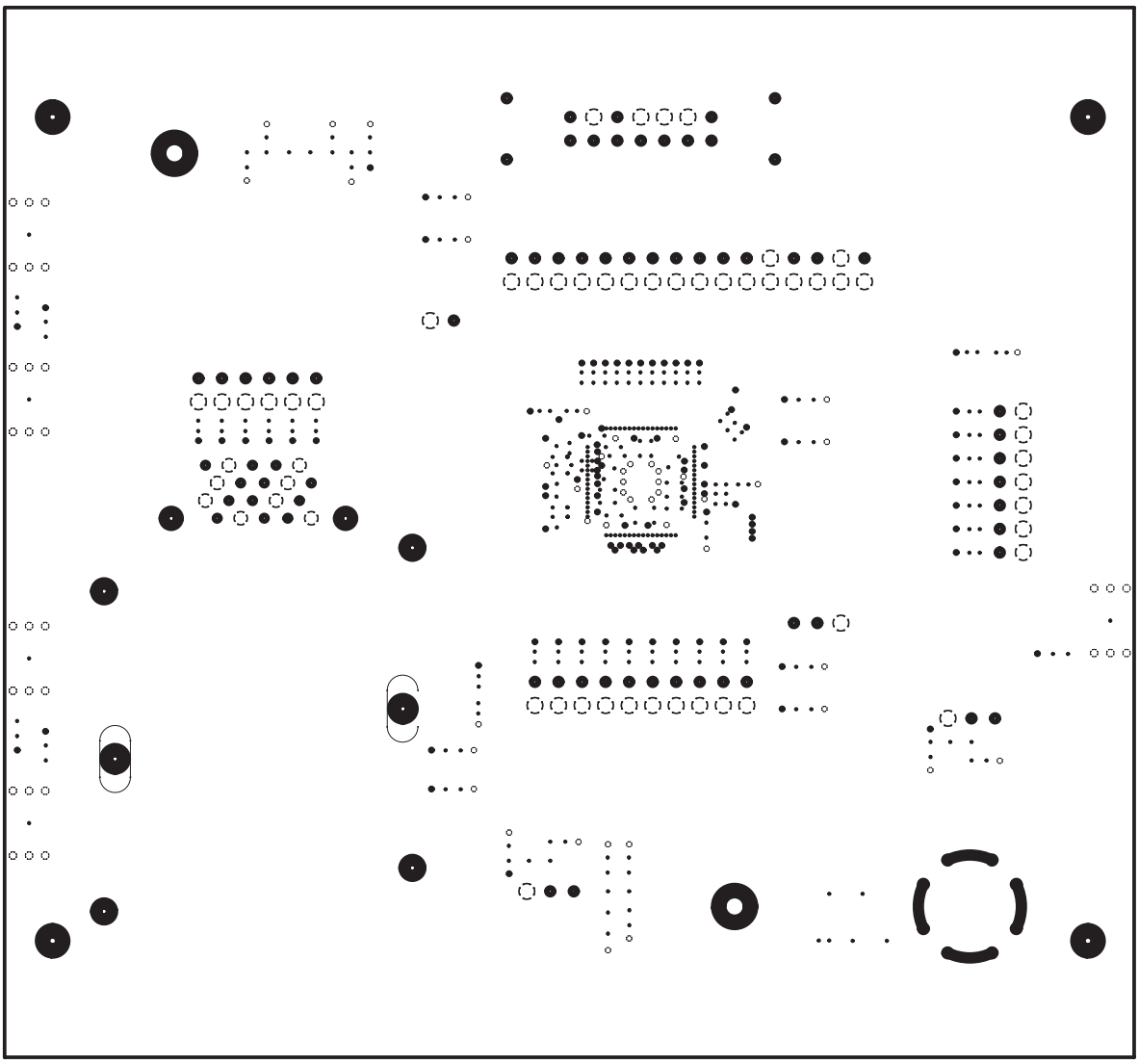


Figure A–5. Power Plane Layer 3

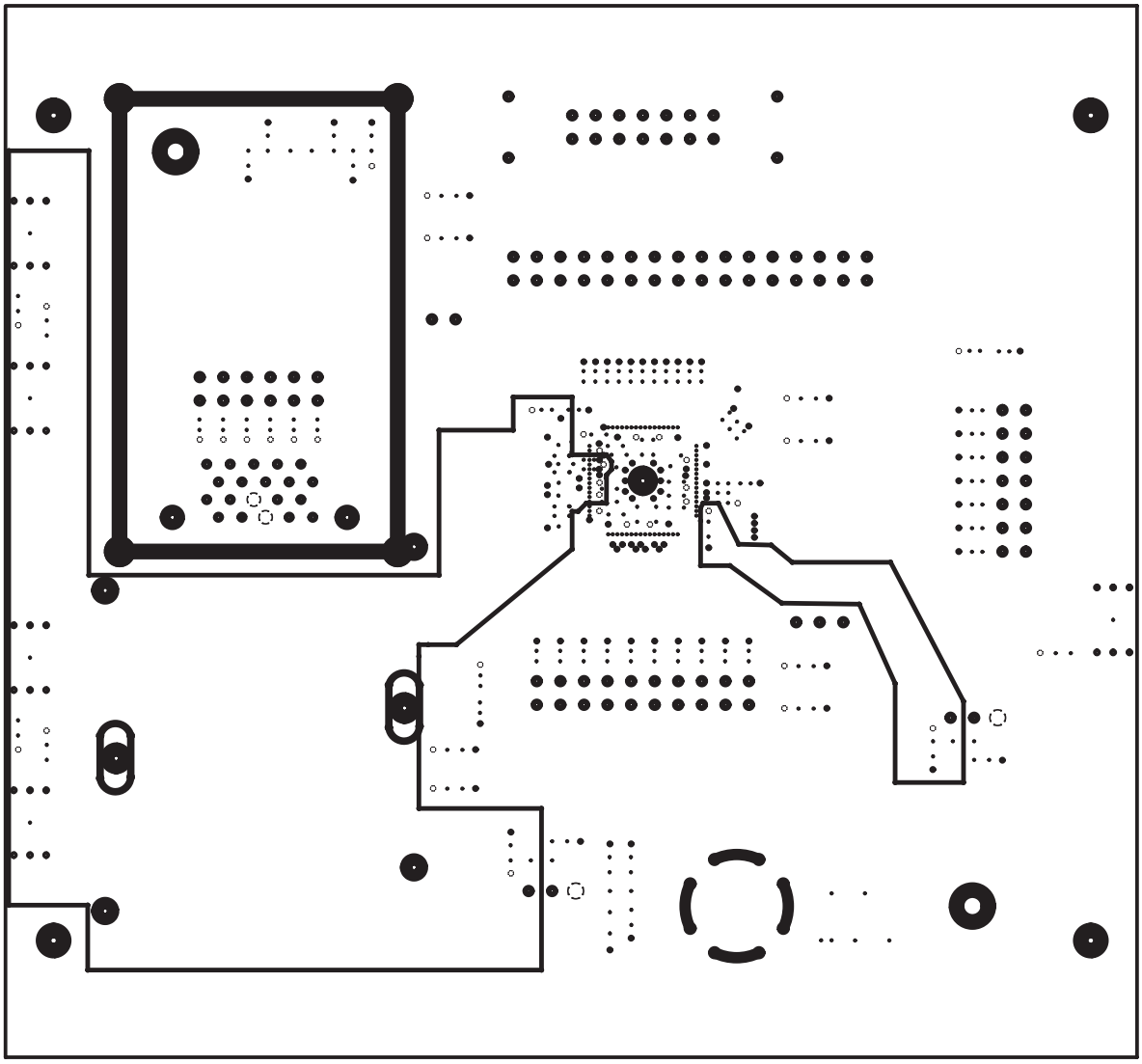


Figure A–6. GBIC and JTAG Layer 4

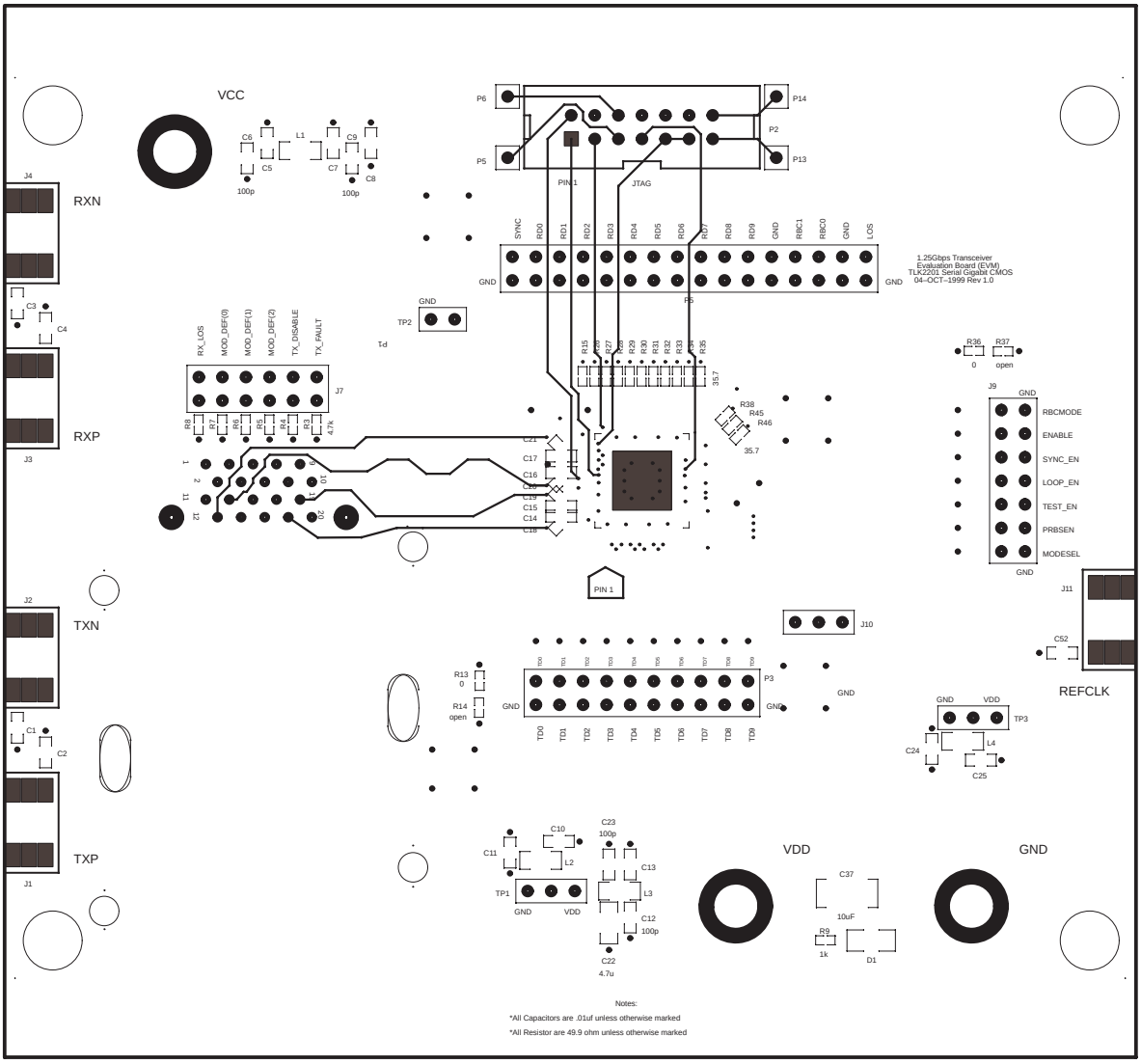
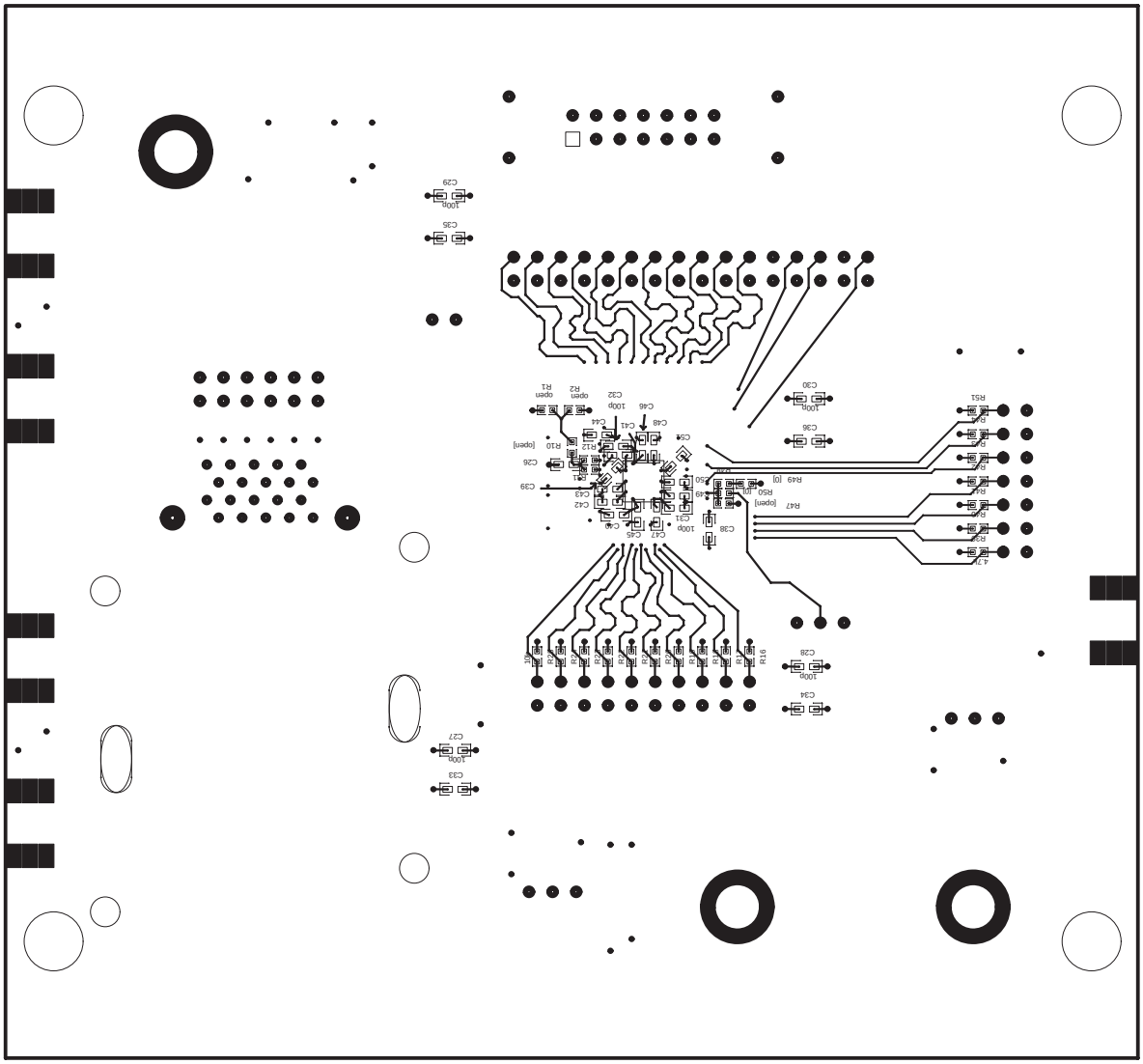


Figure A–7. Bottom Layer 6



Стандарт Электрон Связь

Мы молодая и активно развивающаяся компания в области поставок электронных компонентов. Мы поставляем электронные компоненты отечественного и импортного производства напрямую от производителей и с крупнейших складов мира.

Благодаря сотрудничеству с мировыми поставщиками мы осуществляем комплексные и плановые поставки широчайшего спектра электронных компонентов.

Собственная эффективная логистика и склад в обеспечивает надежную поставку продукции в точно указанные сроки по всей России.

Мы осуществляем техническую поддержку нашим клиентам и предпродажную проверку качества продукции. На все поставляемые продукты мы предоставляем гарантию .

Осуществляем поставки продукции под контролем ВП МО РФ на предприятия военно-промышленного комплекса России , а также работаем в рамках 275 ФЗ с открытием отдельных счетов в уполномоченном банке. Система менеджмента качества компании соответствует требованиям ГОСТ ISO 9001.

Минимальные сроки поставки, гибкие цены, неограниченный ассортимент и индивидуальный подход к клиентам являются основой для выстраивания долгосрочного и эффективного сотрудничества с предприятиями радиоэлектронной промышленности, предприятиями ВПК и научно-исследовательскими институтами России.

С нами вы становитесь еще успешнее!

Наши контакты:

Телефон: +7 812 627 14 35

Электронная почта: sales@st-electron.ru

Адрес: 198099, Санкт-Петербург, Промышленная ул, дом № 19, литера Н, помещение 100-Н Офис 331