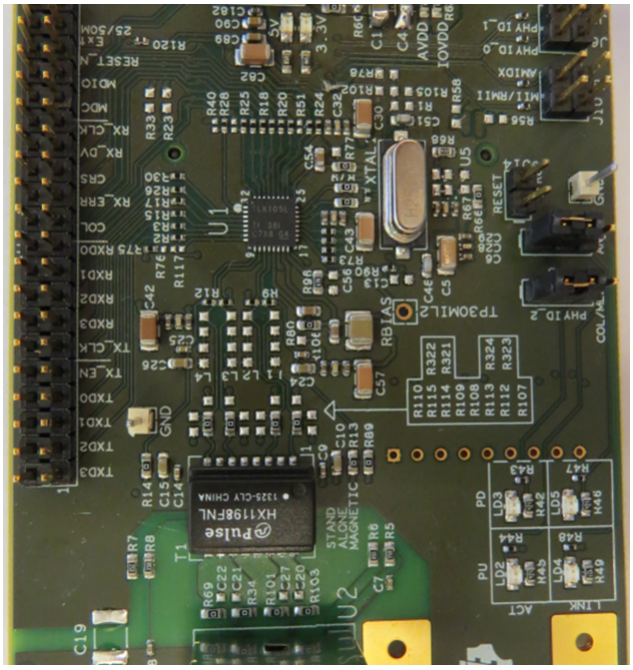
User's Guide
SLLU200–July 2014

TLK10xL EVM

This user guide details the characteristics, operation, and use of the Industrial Ethernet TLK10xLEVM (EVM). The EVM enables Texas Instruments customers to quickly design and market systems using the TLK105L, TLK106L, TLK105, and TLK106 devices. This document also includes schematic diagrams, a printed-circuit board (PCB) layout, board assembly and board marking drawings, and a bill of materials (BOM).



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1 Features

- TLK10xL reference design supporting TLK105L, TLK106L, TLK105, and TLK106
- Low power consumption:
  - Single supply < 275 mV
  - Dual supply < 200 mW
- Programmable power back off, reducing PHY power up to 20% in systems with shorter cables
- Error-Free 100Base-T operation up to 150 meters under typical conditions
- Error-free 10Base-T operation up to 300 meters under typical conditions
- Variable I/O voltage range: 1.8 V to 3.3 V

2 Applications

- Industrial networks and factory automation
- Motor and motion control

3 Description

The Industrial Ethernet TLK10xLEVM enables TI customers to quickly design and market systems using the TLK105L, TLK106L, TLK105, and TLK106 devices. Use a design similar to the EVM circuit to expedite product development. TLK10xLEVM can be operated using only a single voltage (5-V DC jack, J82). On default configurations, all other voltages are regulated on-board and internally produced.

The EVM kit contains:

- TLK10xLEVM unit
- Printed copy of this user's guide

4 System Description

Effective and simple Ethernet design has made it the most popular networking solution at the physical and data link levels. With high-speed options and a variety of media types to choose from, Ethernet is efficient and flexible. These factors and the low cost of Ethernet hardware have made Ethernet an attractive option for industrial networking applications. Also, the opportunity to use open protocols such as TCP/IP-over-Ethernet networks offers the possibility of a level of standardization and interoperability. The result has been an ongoing shift toward the use of Ethernet for industrial control and automation applications. Ethernet is increasingly replacing proprietary communications.

The TLK10xLEVM reference design enables TI customers to quickly design and release to market systems using TI industrial Ethernet PHY transceiver devices. The TLK10xLEVM has been designed in a small (2.6 in x 3.7 in) form factor which makes it easy to fit into any of the present products. The reference design platform demonstrates the advanced performance of the TLK10xL Ethernet PHY transceiver devices.

The design supports 10/100 Base-T and is compliant with the IEEE 802.3 standard. The reference design operates from a single power supply (5 V with on-board regulator) or from a dual power supply (1.55 V supplied from external source). On the single supply option, only the 5-V jack (J82) is connected (default mode of operation), while all other voltages required for the Ethernet PHY transceiver are on-board regulated and internally generated within the device.

5 Design Features

Table 1 lists the design features of the EVM.

Table 1. Design Features

Feature	Description
Ethernet PHY	The TLK10xL Ethernet PHY features: • Industrial temperature rating: –40°C to +85°C (TLK106L and TLK106 support up to 105°C) • Configurable PHY Addresses: jumper and resistor strapping options, supporting address space 00-31h (5 bits, default address 0x1) • MII or RMII – jumper strapping option
Power consumption	Single Supply < 275 mW Dual Supply < 200 mW
Power supply	The device is designed for power-supply flexibility and can operate with a single 3.3-V power supply. The following are the possible power input options: • 5 V from external DC jack connector and on-board regulator to generate 3.3 V • 3.3-V DC input through the serial connectors (J11/J13) and internally regulate the 1.55-V supply • Both 3.3-V DC and 1.55-V DC supplied, through the serial connectors (J11/J13)
MAC - Controller interface	• 40-pin header allowing customers to plug their own MAC to the TLK10xLEVM using DC wires, and using these as a MAC interface • 2x 50 pin serial connectors to accommodate all MII/RMII interface signals
Clock	• 25-MHz crystal with internal oscillator (default) • Operation with 25-MHz OSC • External clock supported through pin 37 of J12 header
Status LEDs	Two LEDs (configured as PU or PD)
AFE supported	• Default operation, separate magnetic, Pulse HX1198FNL • Integrated magnetic, Pulse J3011G21DNLT • Transformer-less operation • Fiber operation, Avago HFBR-58036AQZ

6 General Block Diagram

Figure 1 shows the general block diagram of the EVM.

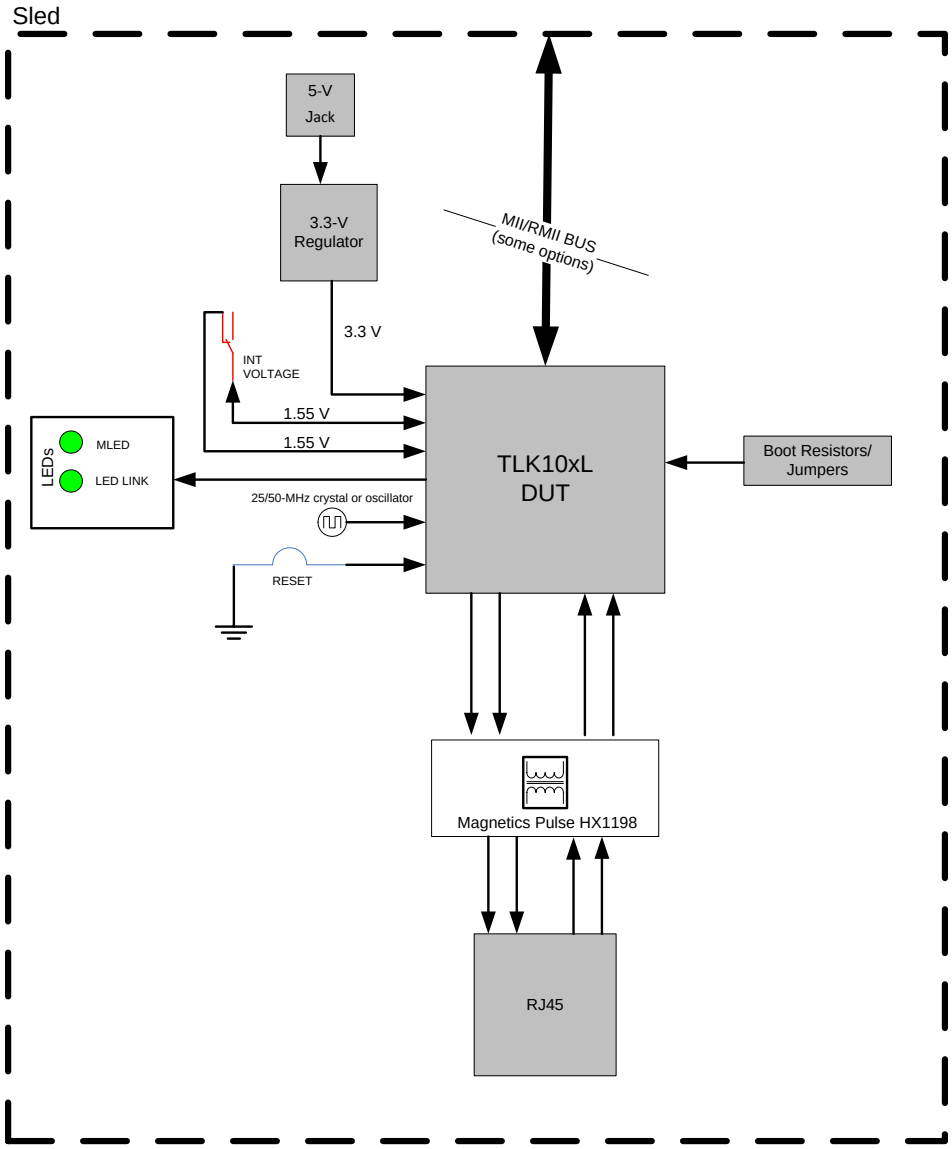


Figure 1. General Block Diagram

6.1 Power Supply Options

The TLK10xLEVM has several power supply options. The default option is feeding 5 V to the DC jack. This option uses an on-board 3.3-V regulator and the TLK in single-supply mode. Another option is feeding the TLK10xLEVM's voltages through the serial connectors (J11/J13). In this mode, all voltages can be supplied separately.

6.2 Serial Management and MAC Interfaces

The TLK10xLEVM supports a few options for serial management (MDIO/MDC) and for MII/RMII as MAC Interfaces. The easiest option is to connect the MDIO/MDC pins (35/33 pins) on the 40-pin header (J12) and one GND pin to an Ethernet MAC. This option allows read/write registers, activating force transmission, and configuring loops to the TLK. Another option is to connect the entire MII interface to an Ethernet MAC, allowing full testing of the TLK with a working system.

RMII interface to the MAC is also possible in the same way, but needs to share the 50M clock with the MAC. Sharing a 50M clock is done by connecting the *Ext 25/50M* pin (pin 37) of the 40-pin header (J12) to the same clock source of the MAC. Some modifications to the TLK10xLEVM are required in order to share the 50M clock.

6.3 MDI modes

The TLK10xLEVM supports the following MDI options:

1. Default RJ45 with standalone magnetic (Pulse HX1198FNL)
2. RJ45 with integrated magnetic (Pulse J3011G21DNLT, not mounted)
3. Fiber transceiver operation (Avago HFBR-5803, not mounted)
4. Transformer-less operation

All modes are configured by connecting the required resistors and components to the TLK10xLEVM.

6.4 LED Options

The TLK10xL supports two LEDs, one of the LEDs as a configurable multi-LED. Operation of MLED (COL pin) is configured using register writings. The TLK LEDs can operate as current source (when connected to pull-down) or current sink (when connected to pull-up).

6.5 Bootstrap Options/Jumpers

Some TLK10xL configurations are made through bootstrap options; using selection with jumpers or using resistors population.

The TLK10xLEVM can support the following jumper configurations:

- PHY_ID0
- PHY_ID1
- PHY_ID2
- AMDIX Disable
- MII/RMII Mode
- AN_0

The TLK10xLEVM can support the following resistor configurations:

- PHY_ID3
- PHY_ID4
- LED Mode

6.6 Clock Options

The TLK10xLEVM supports the following clock options:

- 25 MHz from crystal is the default configuration
- 25 MHz from OSC can be configured by board modifications
- External clock can be supplied by the 40-pin header (J12)

7 Power Supply Modes

7.1 Default Configuration

When using default configuration, only 5 V should be connected to the TLK10xLEVM, allowing the on-board regulator to supply the required 3.3-V supplies to the TLK which is using its internal LDO to supply 1.55 V.

8 Serial Management and MII/RMII Interfaces

8.1 Serial Management for Standalone TLK10xLEVM

Minimal operation with the TLK10xLEVM would be to just connect MDIO/MDC and GND pins to a MAC with MDIO/MDC capabilities. This allows the user to read/write registers and configure the TLK10xL to the different loopback modes and activate the TLK10xL for basic testing.

This mode doesn't allow full MII interface – transferring packets between the MAC and TLK10xL. For such operation, connect all MII signals (see Section 8.2.1).

8.1.1 Serial Management – Block Diagram

For using the MDIO/MDC interface on the TLK10xLEVM, no changes are required. Simply connect pins 31 and 33 of J12 (40-pin header) to the MAC and one GND pin.

NOTE: For stable registers reading more than one GND connection should be shared between the boards.

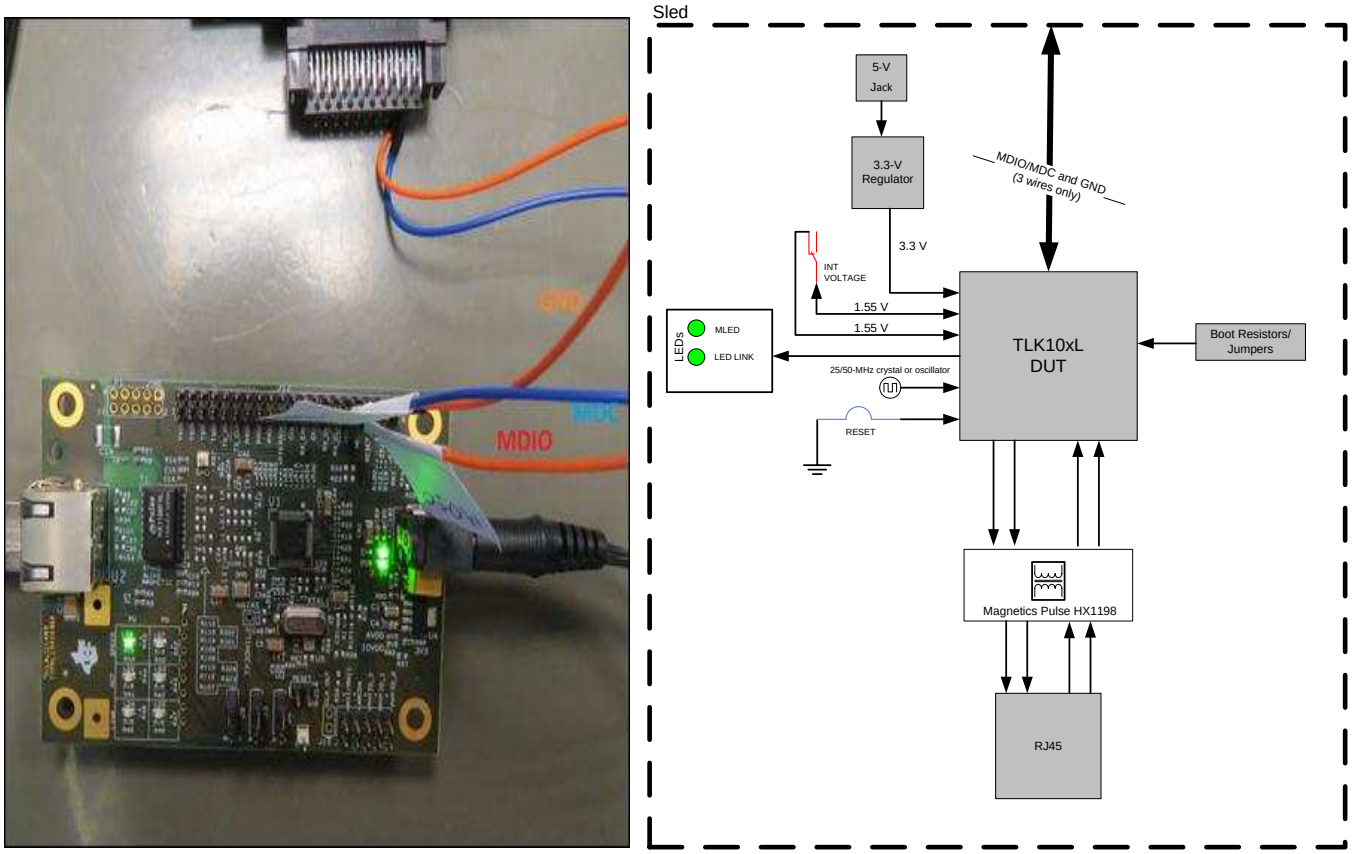


Figure 2. MDIO/MDC Interface Block Diagram

8.2 MII Interface

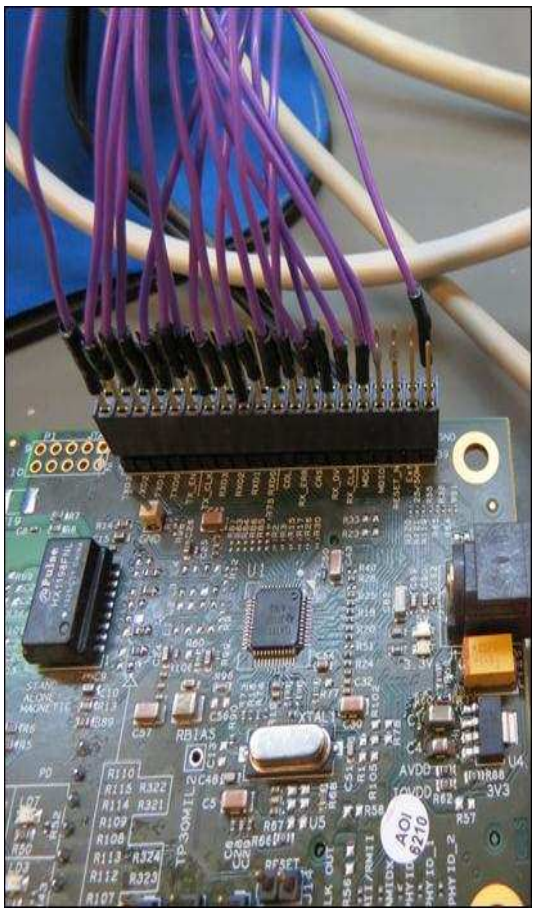
8.2.1 MII Interface Connection for Standalone TLK10xLEVM

The TLK10xLEVM can be connected to any MAC system, by routing the MII signals to the 40-pin header (J12). In this mode full system testing can be done with transferring packets between the MAC and the TLK10xL.

8.2.2 MII Interface – Block Diagram

No changes are required to use the MII interface on the TLK10xLEVM with any MAC system. Simply connect the relevant pins of J12 (40-pin header) to the MAC and GND pins.

NOTE: For operation, more than one GND connection should be shared between the boards.



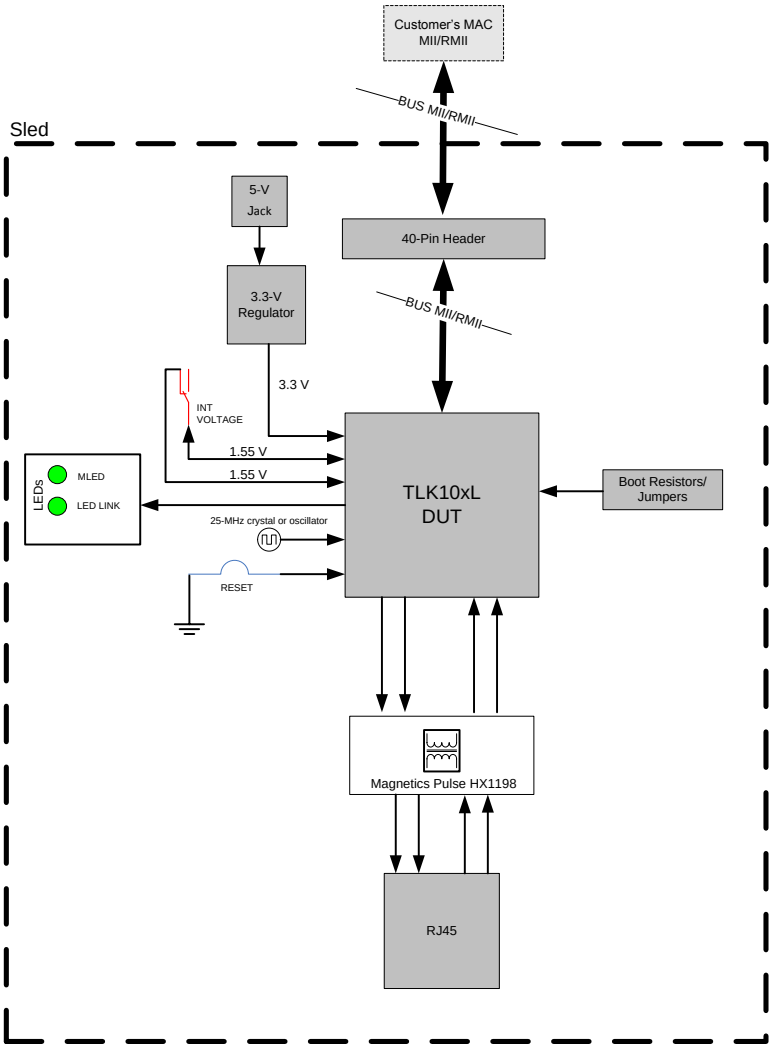


Figure 3. MII Interface Block Diagram

8.3 RMII Interface

8.3.1 RMII Interface Connection for Standalone TLK10xLEVM

The TLK10xLEVM can be connected to any MAC system, by routing the RMII signals to the 40-pin header (J12). In this mode full system testing can be done, with transferring packets between the MAC and the TLK10xL.

8.3.2 RMII Interface – Block Diagram

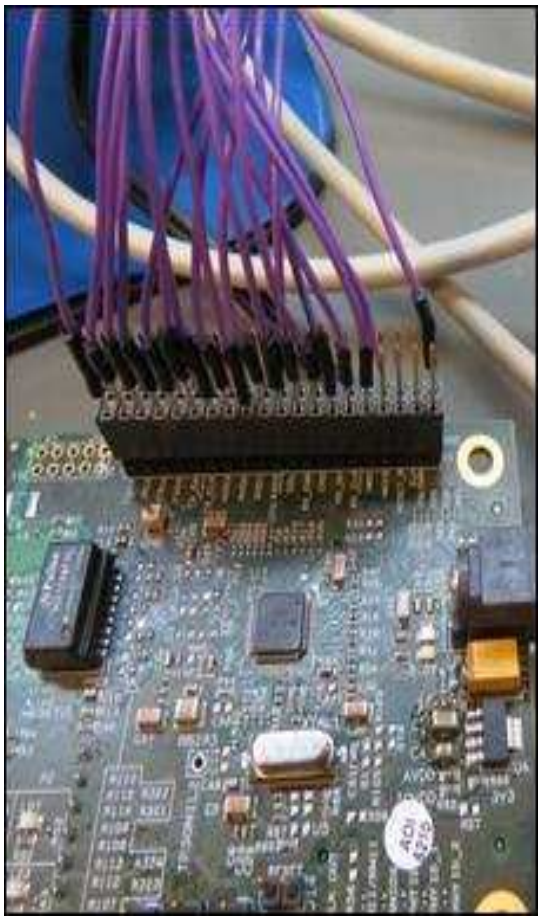
To use the RMII interface on the TLK10xLEVM with any MAC system, a few changes are required to route shared clock to the TLK10xL:

- Connect 0R to R78

- Disconnect R71 and R72
- Connect the shared 50M clock to the *Ext 25/50M* pin (pin 37) of the 40-pin header (J12) and to the MAC.

Beside the previous changes, simply connect the relevant pins of J12 (40-pin header) to the MAC and GND pins.

NOTE: For operation, more than one GND connection should be shared between the boards. Please also refer to the TLK105L, TLK106L datasheet (SLLSEE3) for RMII working mode and requirements on the shared clock (50 MHz) and strap pin (RX_DV).



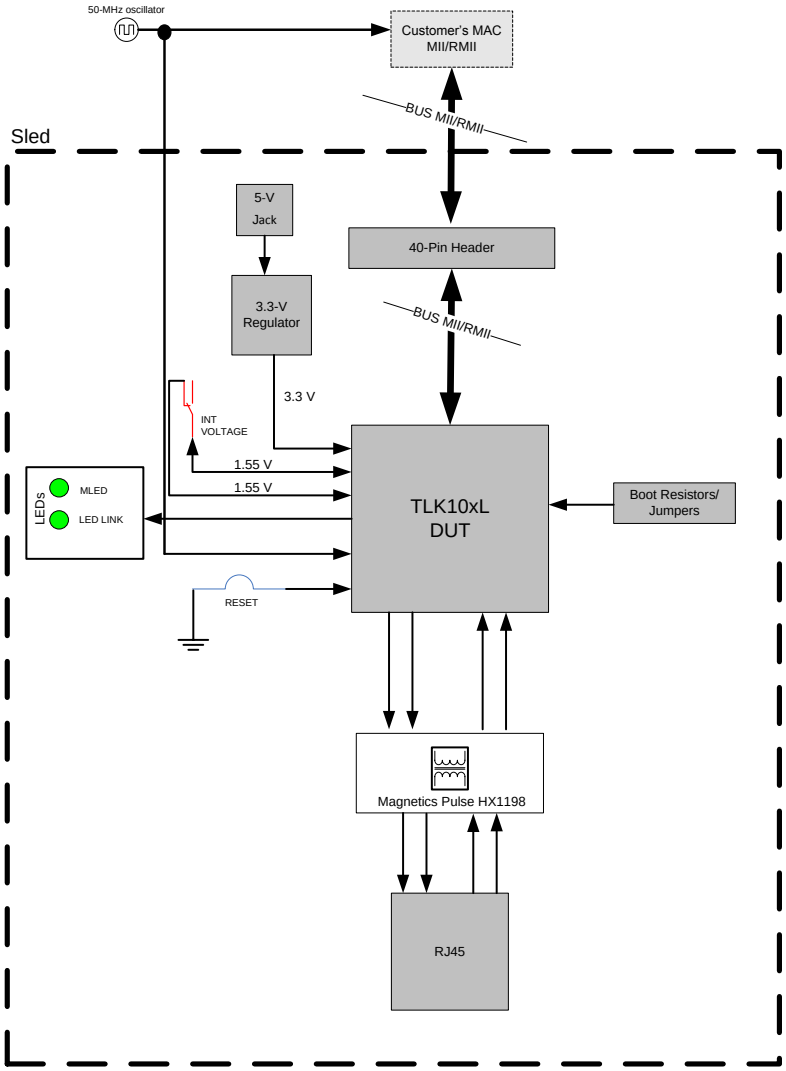


Figure 4. RMII Interface Block Diagram

9 MDI Modes

9.1 Default Configuration – Separate Magnetic and RJ45 Connector

The TLK10xLEVM supports few MDI options. The default configuration is for the TLK10xL to use RJ45 with standalone magnetic (Pulse HX1198FNL).

For this working mode no changes are required to the TLK10xLEVM (default configuration).

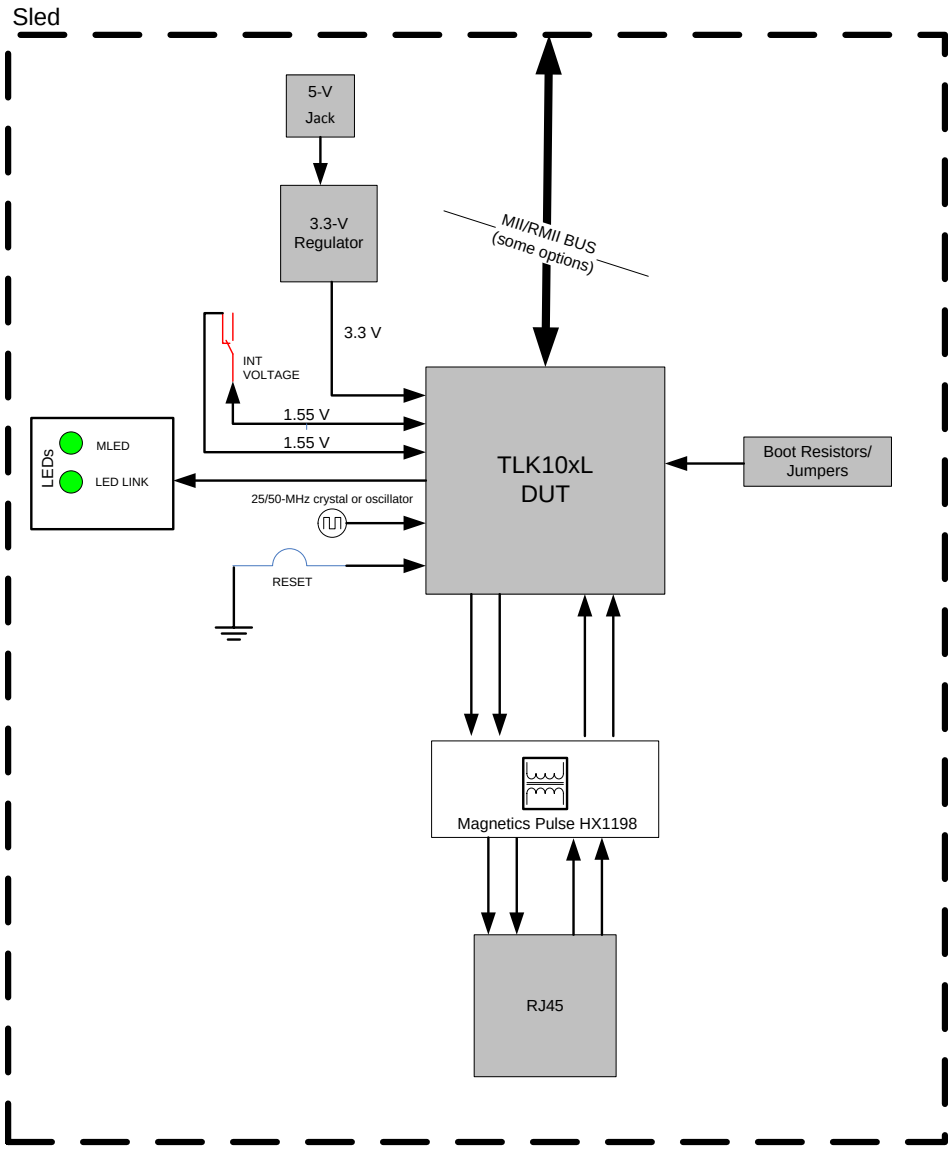


Figure 5. Separate Magnetic with RJ45 Block Diagram

9.2 Fiber Transceiver Operation

The TLK10xL family of devices support Fiber mode. Please follow datasheet recommendations on how to configure the TLK10xL for fiber mode. Please note that TTLK10x version (non-L) do not support fiber mode.

Working with Fiber transceiver (Avago HFBR-5803, not mounted) is possible on the TLK10xLEVM.

The footprint for the Fiber transceiver option is found on the bottom of the TLK10xLEVM.

In order to work with integrated magnetic, the following modifications are required to the TLK10xLEVM:

- Connect 0R to the following resistors:
  - R323, R324, R321, R322
- Connect 130R to the following resistors:
  - R337, R339, R394, R396
- Connect 82R to the following resistors:
  - R338, R340, R395, R397

- Connect 100 nF to the following capacitors:
  - C17, C18, C251, C253, C254
- Connect 10 nF to C231
- Mount L14 and L15 with Ferrite-Bead 120R, 800 mA, 0805
- Disconnect the following resistors:
  - R112, R113, R114, R115 (0R)
  - R11, R12 (49.9R)
- Disconnect the following capacitors:
  - C23, C24
- U24 should be connected – Avago HFBR-5803 Fiber transceiver
- Remove T1 (separate magnetic)

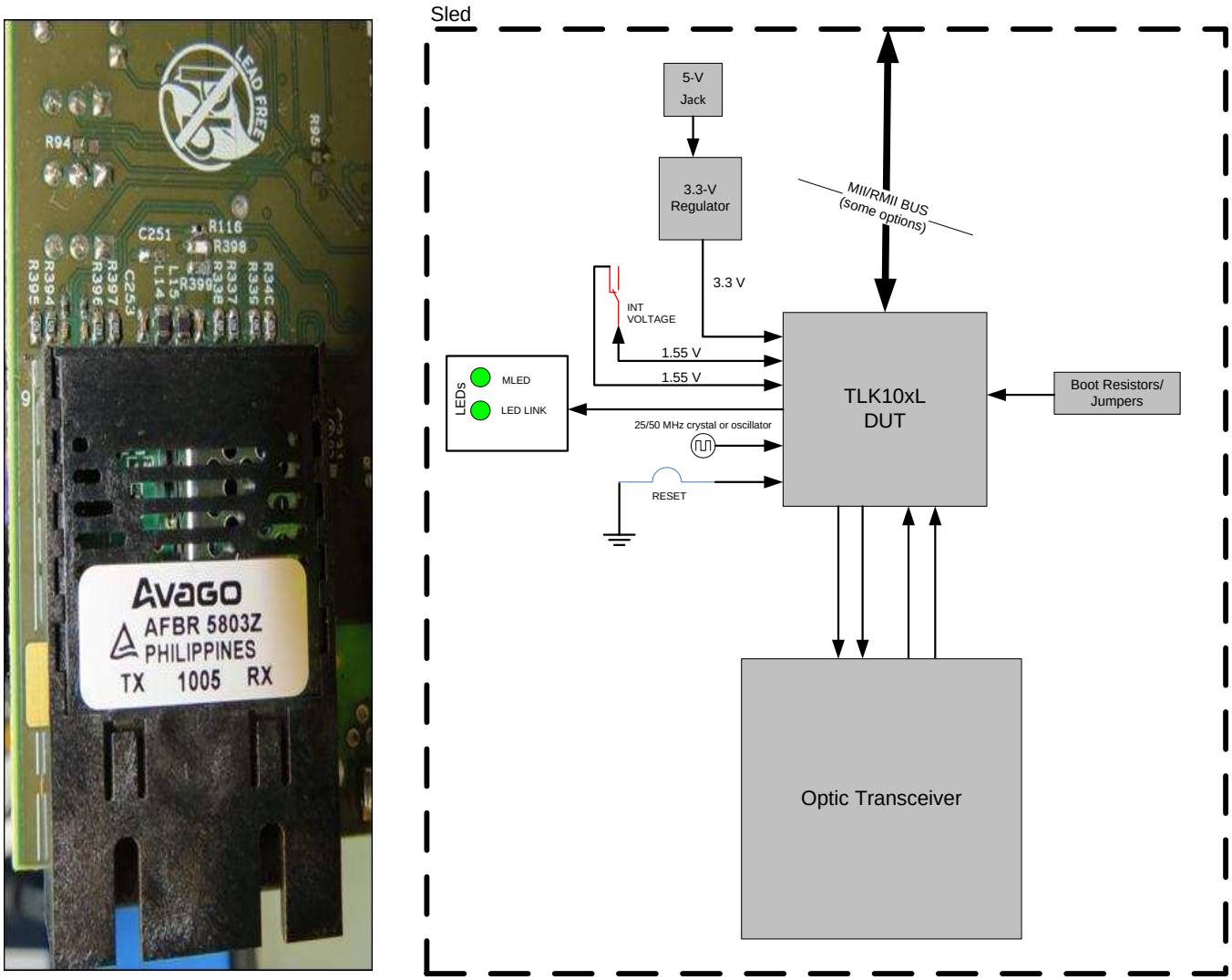


Figure 6. Optic Transceiver Block Diagram

9.3 Integrated Magnetic with RJ45 Connector

The TLK10xLEVM can operate using RJ45 with integrated magnetic (Pulse J3011G21DNLT, not mounted). The footprint for the integrated magnetic option is found on the bottom of the TLK10xLEVM.

In order to work with integrated magnetic, the following modifications are required to the TLK10xLEVM:

- Connect 0R to the following resistors:
  - R104, R81, R94, R95
  - R107, R108, R109, R110
- Connect 100 nF to the following capacitors:
  - C11, C12
- Disconnect the following resistors:
  - R112, R113, R114, R115
  - R101, R103, R34, R69
- Connect J1 - Pulse J3011G21DNLT integrated magnetic
- U2 (RJ45 connector) must be removed before trying to solder J1

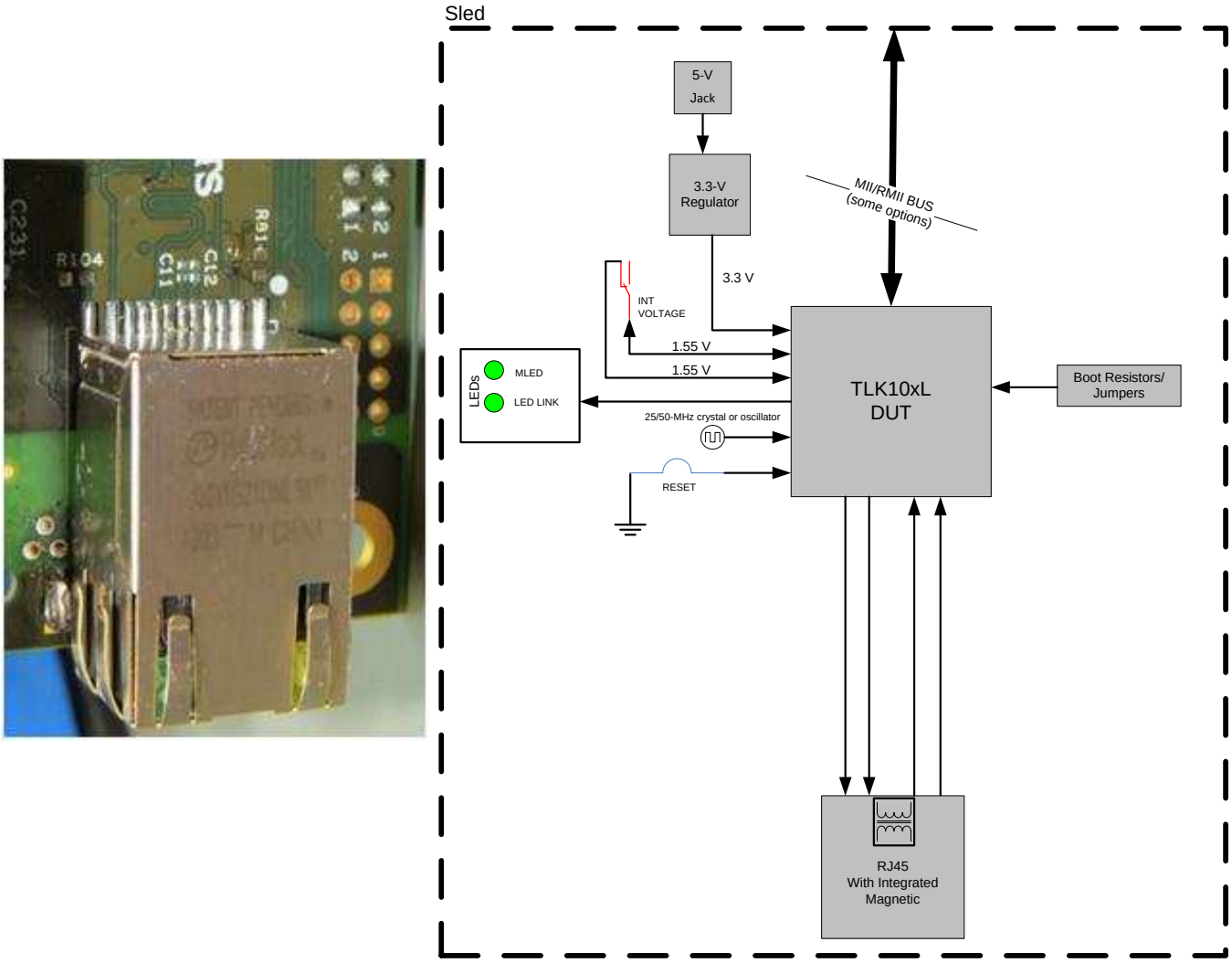


Figure 7. Integrated Magnetic with RJ45 Block Diagram

9.3.1 Transformer-Less Operation

The TLK10xLEVM can support Transformer-Less operation, with no magnetic on the MDI path, but capacitors instead. For more details on the Transformer-Less operation, please refer to the relevant application note on the TLK10xL web-site (SLLA327).

In order to work in Transformer-Less mode, the following modifications are required to the TLK10xLEVM:

- Connect 0R to the following resistors:
  - R107, R108, R109, R110
- Disconnect the following resistors:
  - R112, R113, R114, R115
  - R101, R103, R34, R69
- Connect 33 nF to the following capacitors:
  - C20, C21, C22, C27

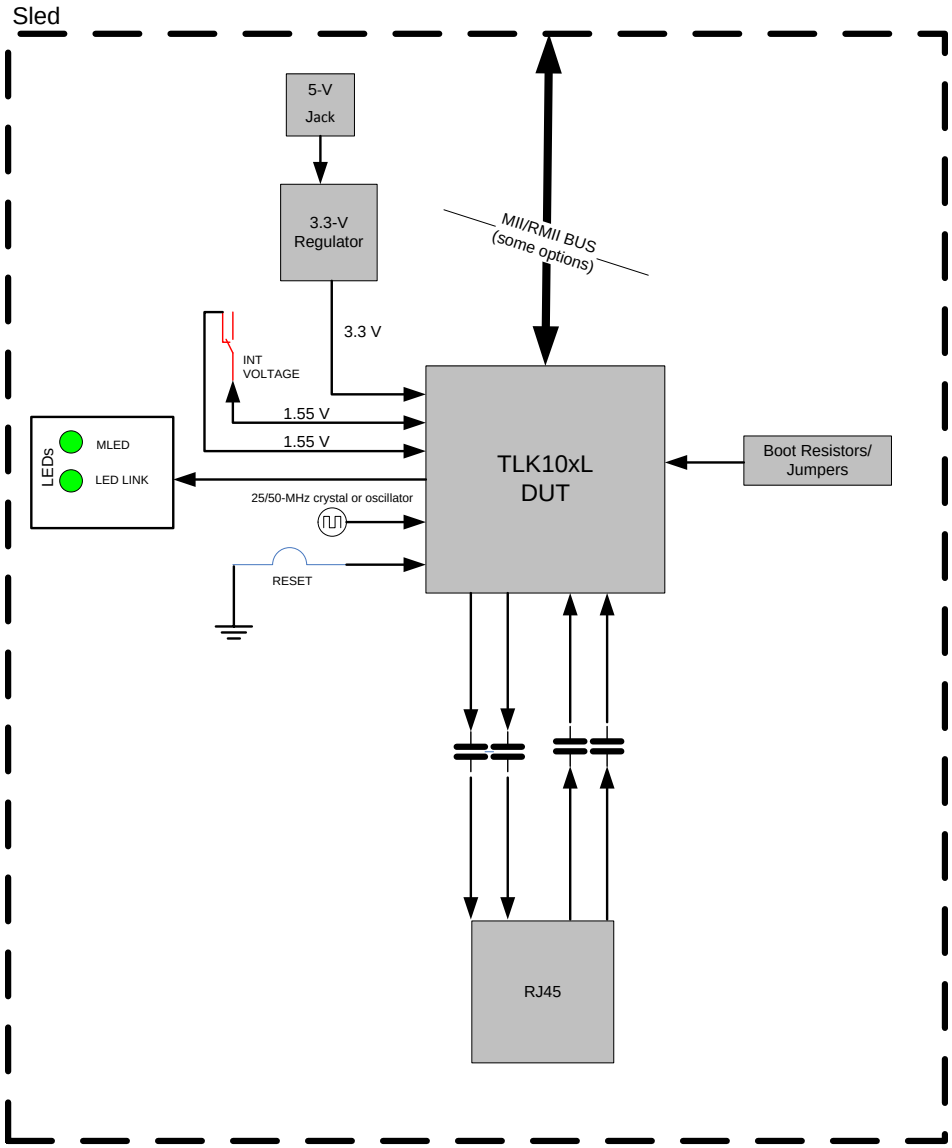


Figure 8. Transformer-Less Operation Block Diagram

10 Clock Options

10.1 Default Configuration

The TLK10xLEVM supports several clock options, with default configuration of 25 MHz from crystal. In this mode an external crystal resonator connected across pins XI and XO.

The crystal must be 25-MHz ±50 ppm-tolerance crystal reference.

10.2 25M OSC Configuration

The TLK10xL can also operate with 25M external CMOS-level oscillator source connected to pin XI only. Please refer to the datasheet for OSC requirement specifications.

In order to operate with 25M OSC, the following modifications are required:

- U5 OSC should be mounted – Epson, SG-211SCE (d) 25MHZ (footprint SMT 2 X 2.5)
- 0R should be mounted to R1 resistor location
- Disconnect the following resistors: R71, R72

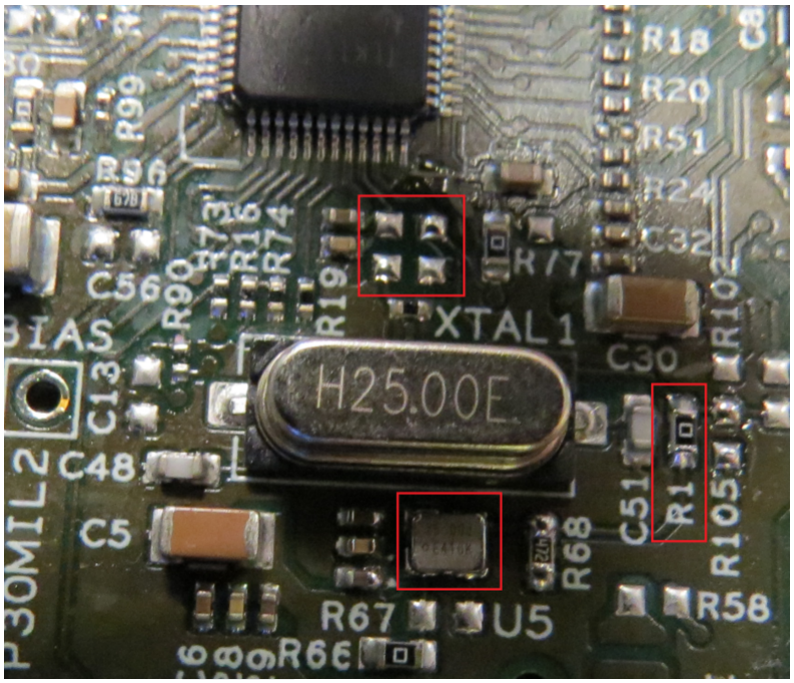


Figure 9. 25M OSC Modifications

10.3 External Clock Supplied to TLK10xL

External clock can be supplied to the TLK10xL by using the 40-pin header (J12). The external clock must meet the TLK10xL datasheet requirements and to be within 25 MHz ±50ppm-tolerance.

The following changes are required to route the external clock to the TLK10xL:

- Connect 0R to R78
- Disconnect the following resistors: R71, R72
- External clock (25M/50M) should be connected to *Ext 25/50M* pin (pin 37) of the 40-pin header (J12)

11 Schematic

Figure 10 through Figure 14 illustrate the TLK10xL schematics.

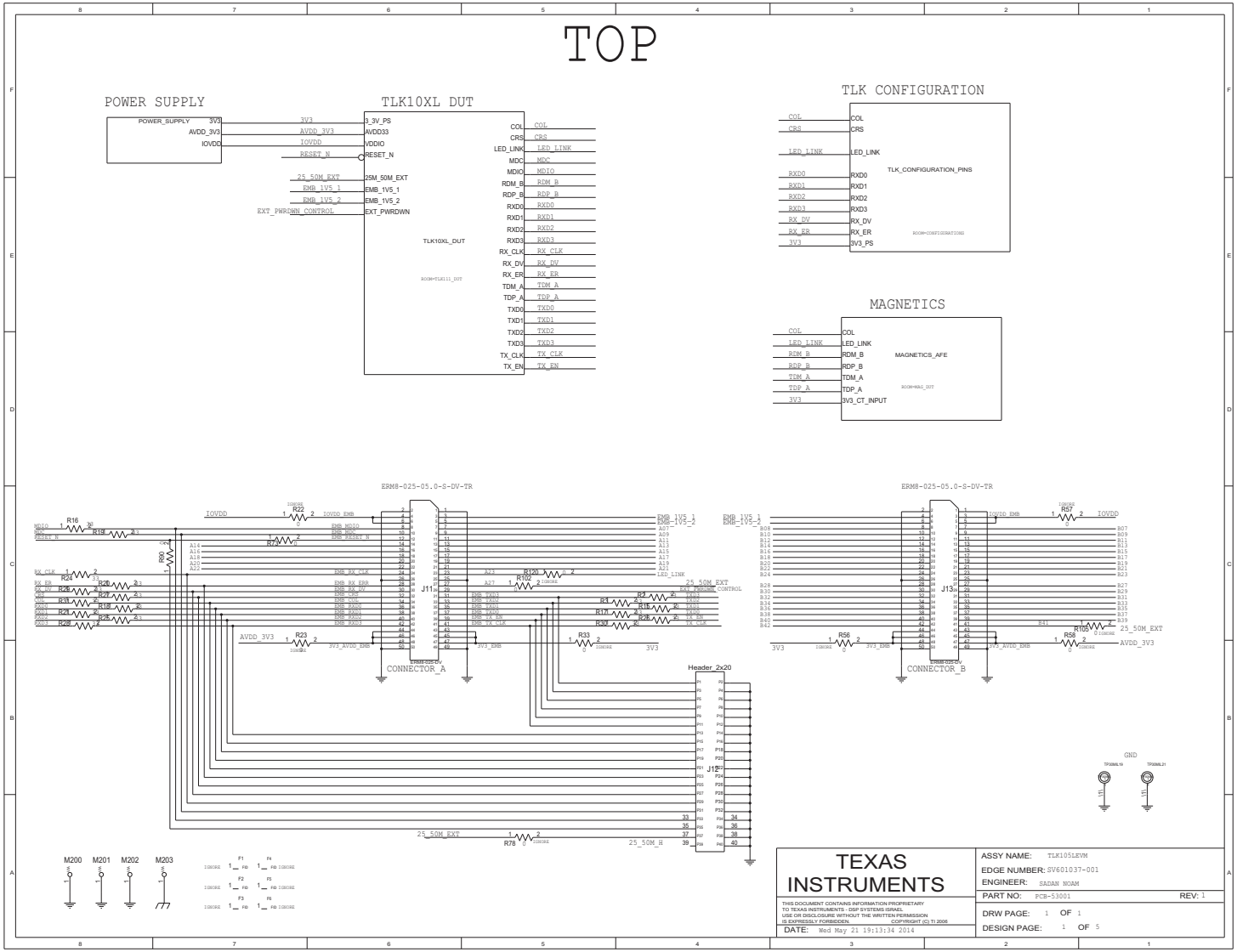


Figure 10. TLK10xL EVM Schematics (1 of 5)

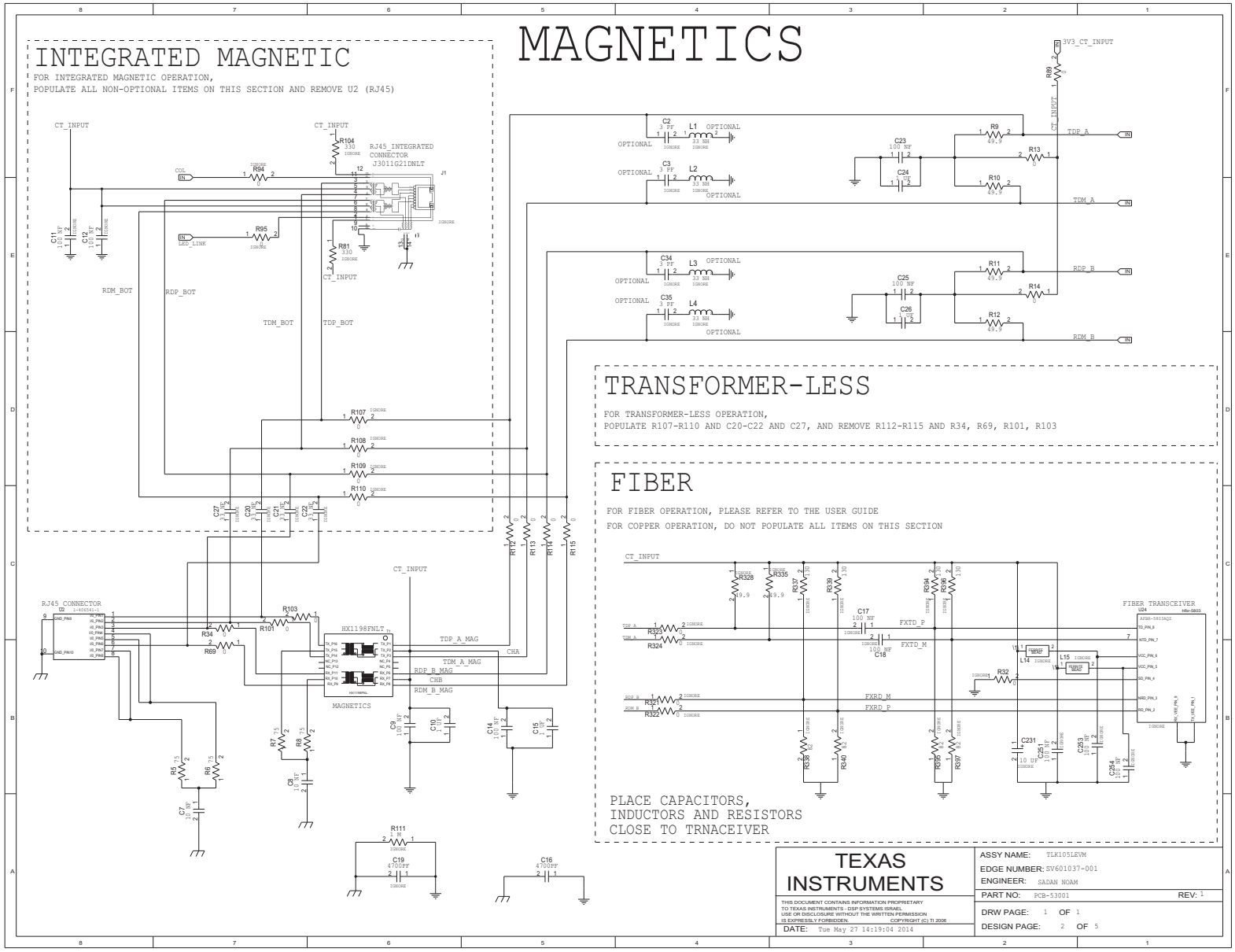


Figure 11. TLK10xL EVM Schematics (2 of 5)

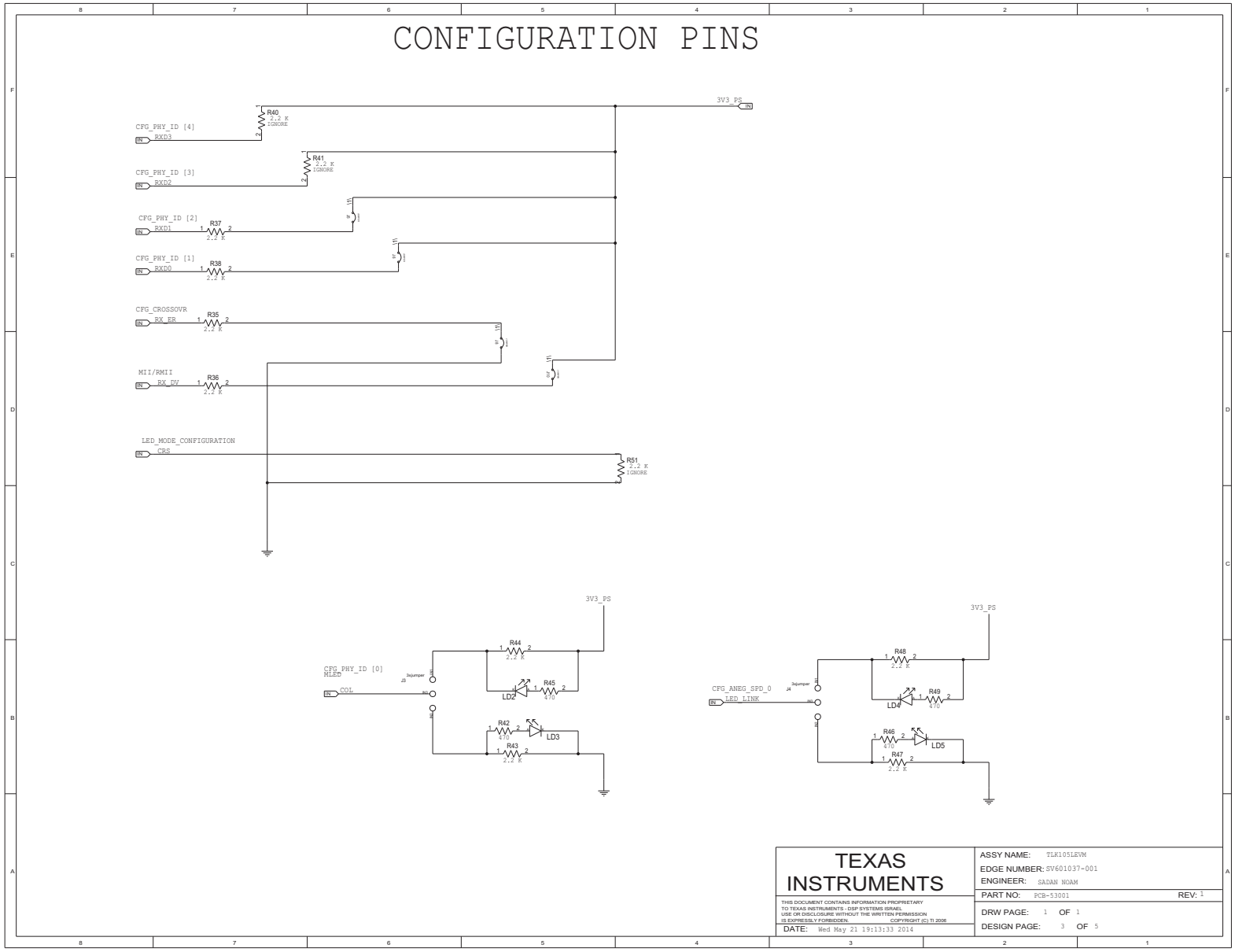


Figure 12. TLK10xL EVM Schematics (3 of 5)

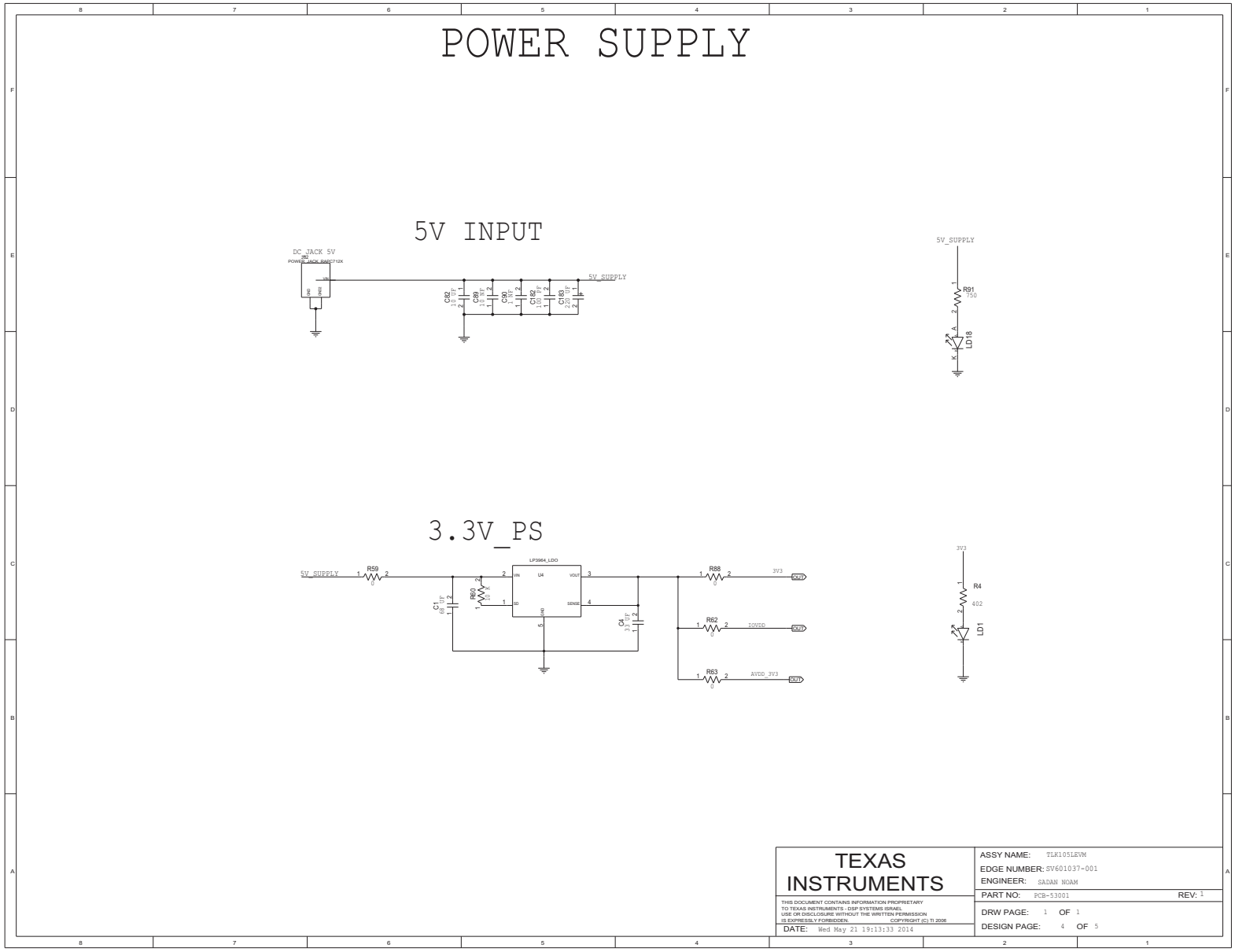


Figure 13. TLK10xL EVM Schematics (4 of 5)

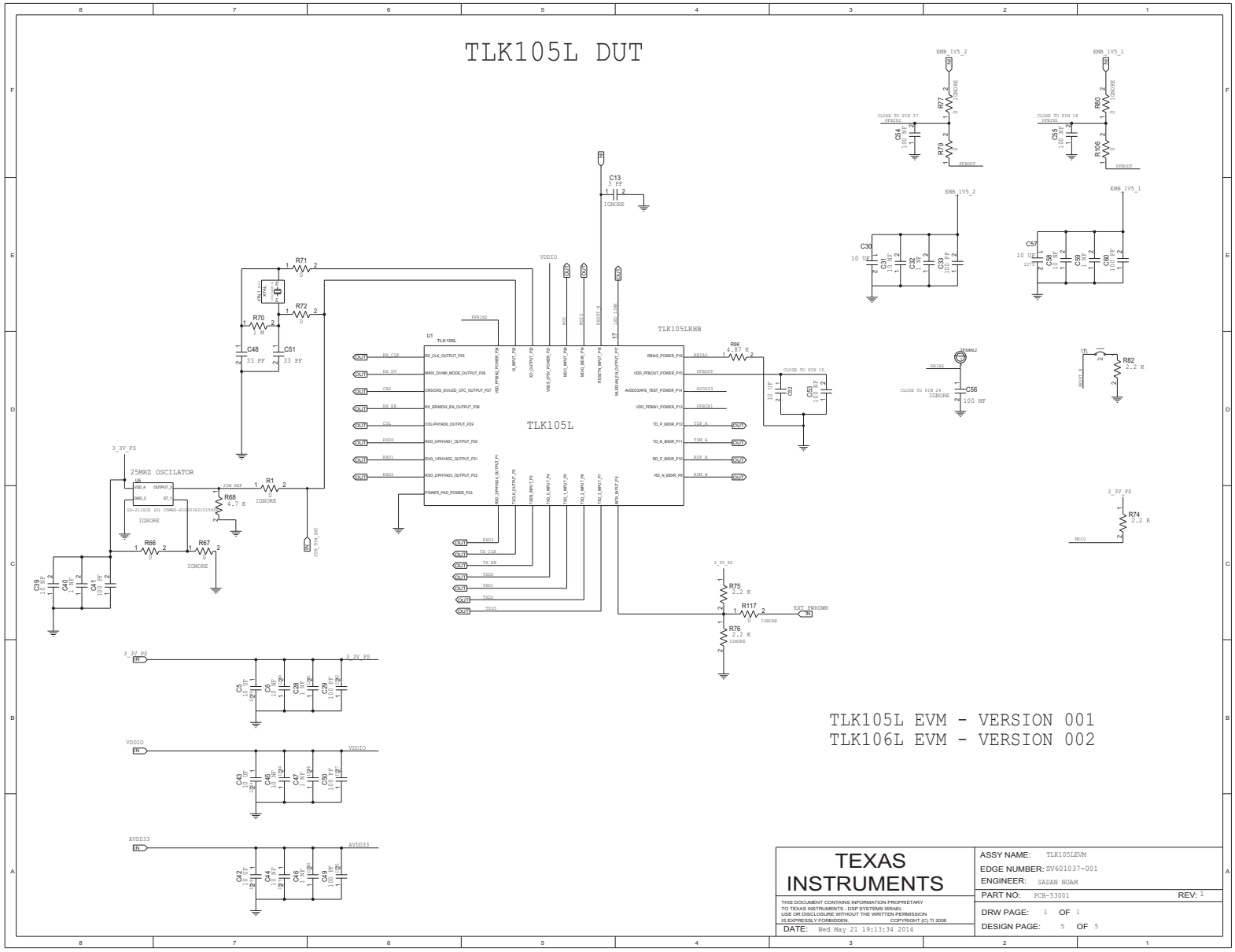


Figure 14. TLK10xL EVM Schematics (5 of 5)

12 Layout

Figure 15 through Figure 18 show the PCB layout drawings.

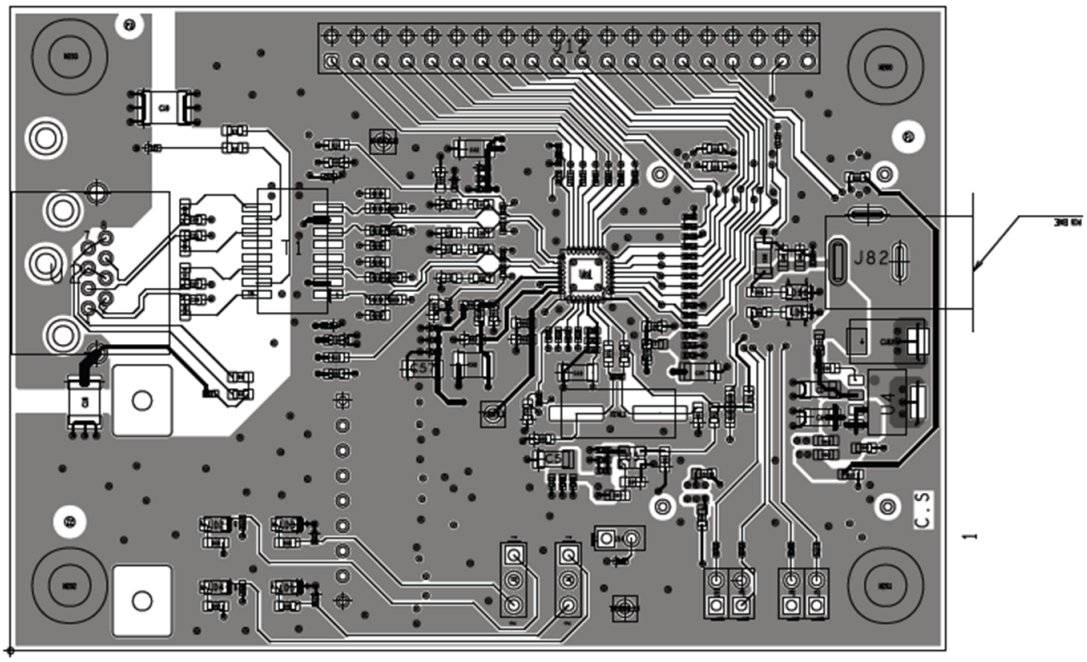


Figure 15. Layer 1 - Signal

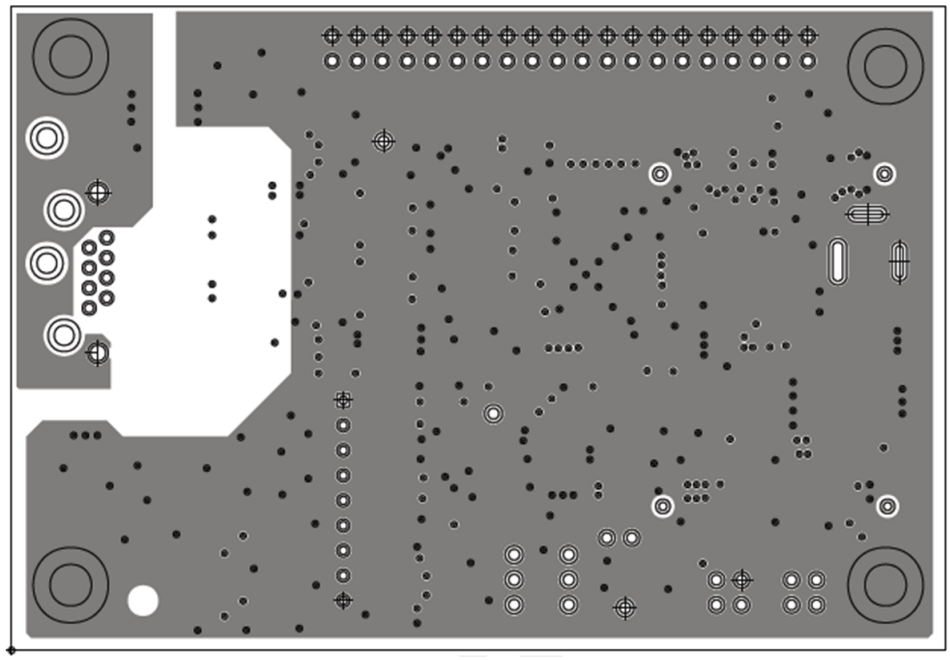


Figure 16. Layer 2 - GND

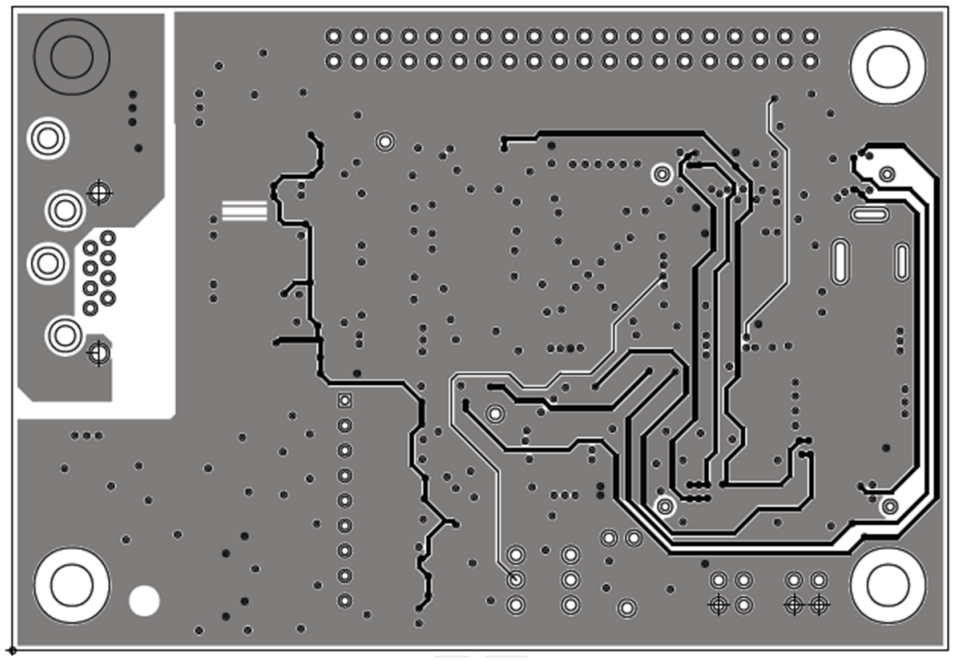


Figure 17. Layer 3 - Power

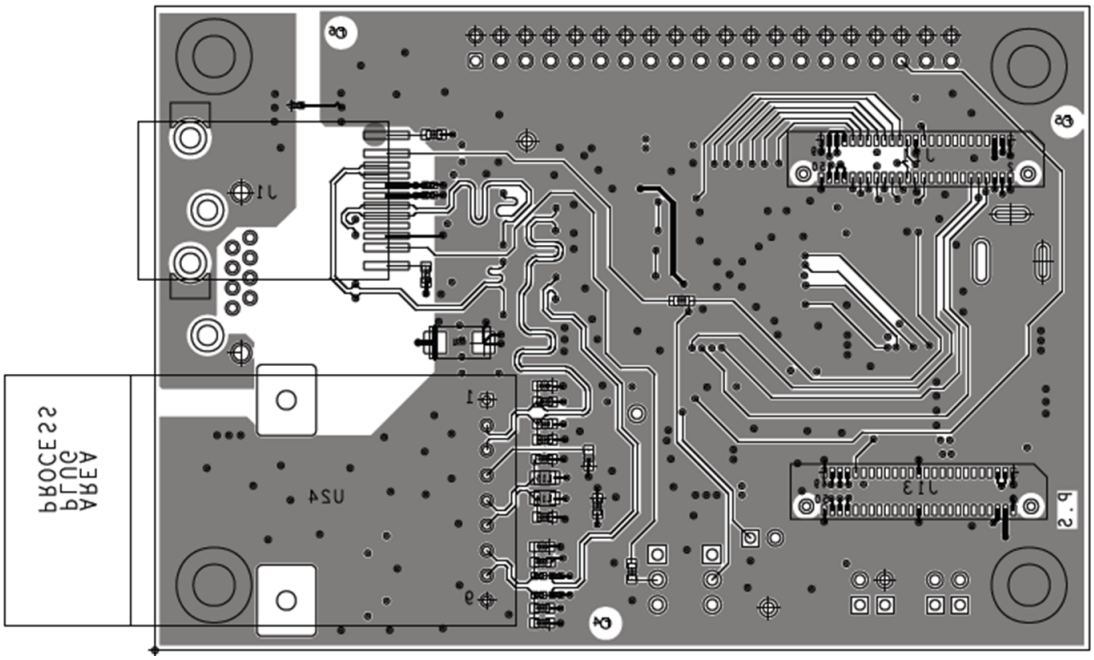


Figure 18. Layer 4 - Signal

13 Board Assembly

Figure 19 and Figure 20 show the board assembly drawings for this EVM.

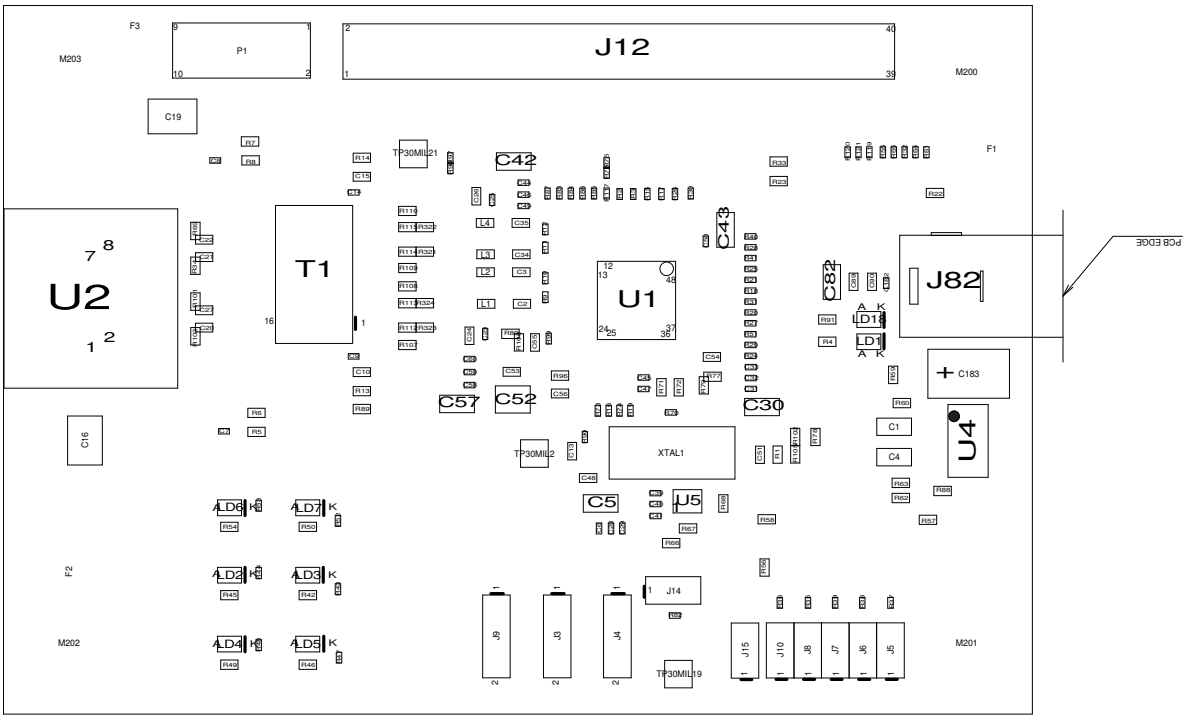


Figure 19. Layer 1 – Components Side Assembly

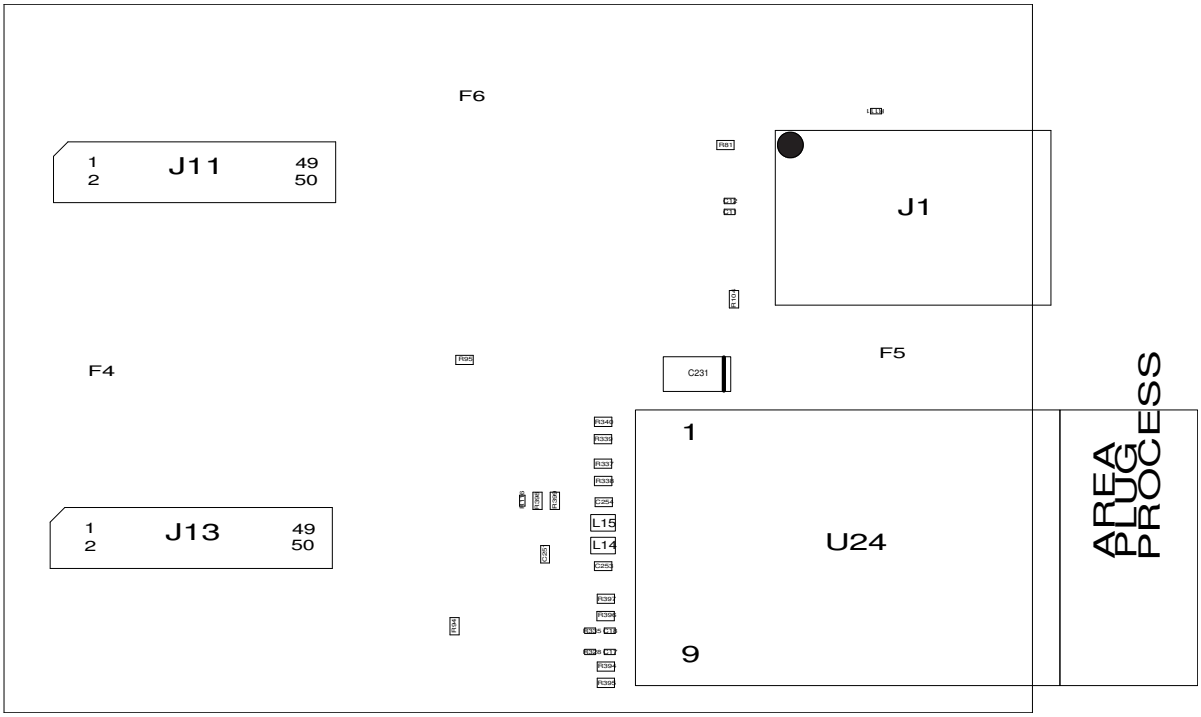


Figure 20. Layer 4 – Print Side Assembly

14 Board Marking (Silk)

Figure 21 and Figure 22 show the board markings (silk) for this EVM.

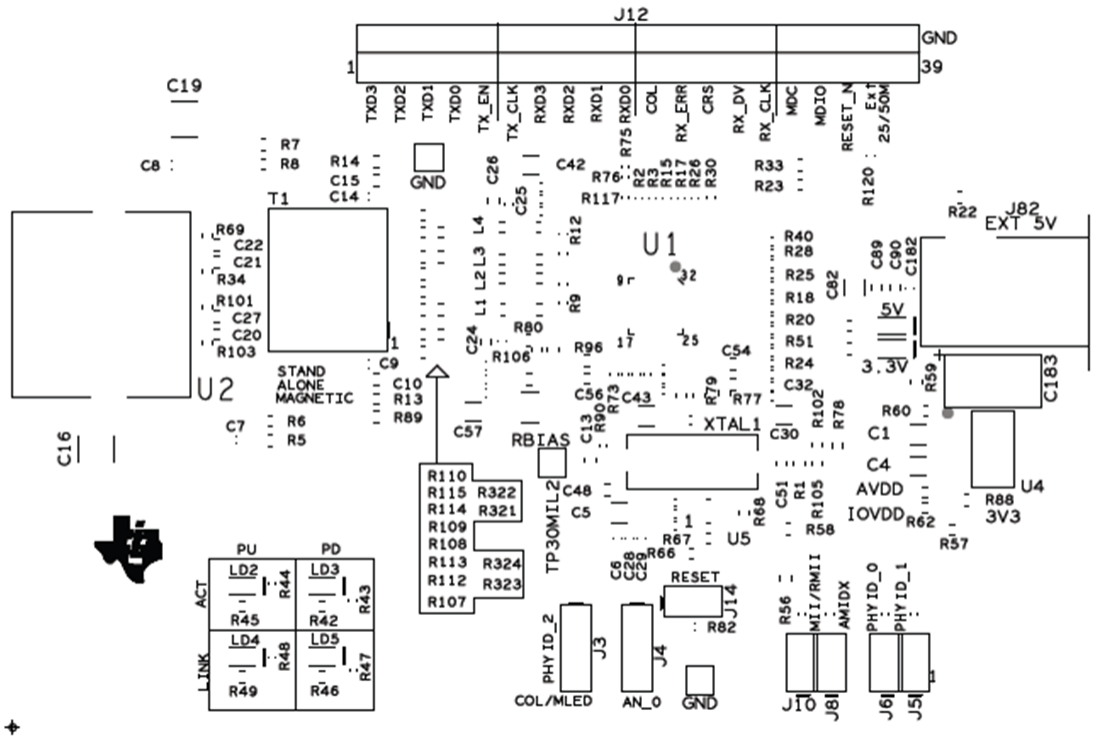


Figure 21. Layer 1 – Components Side Silk

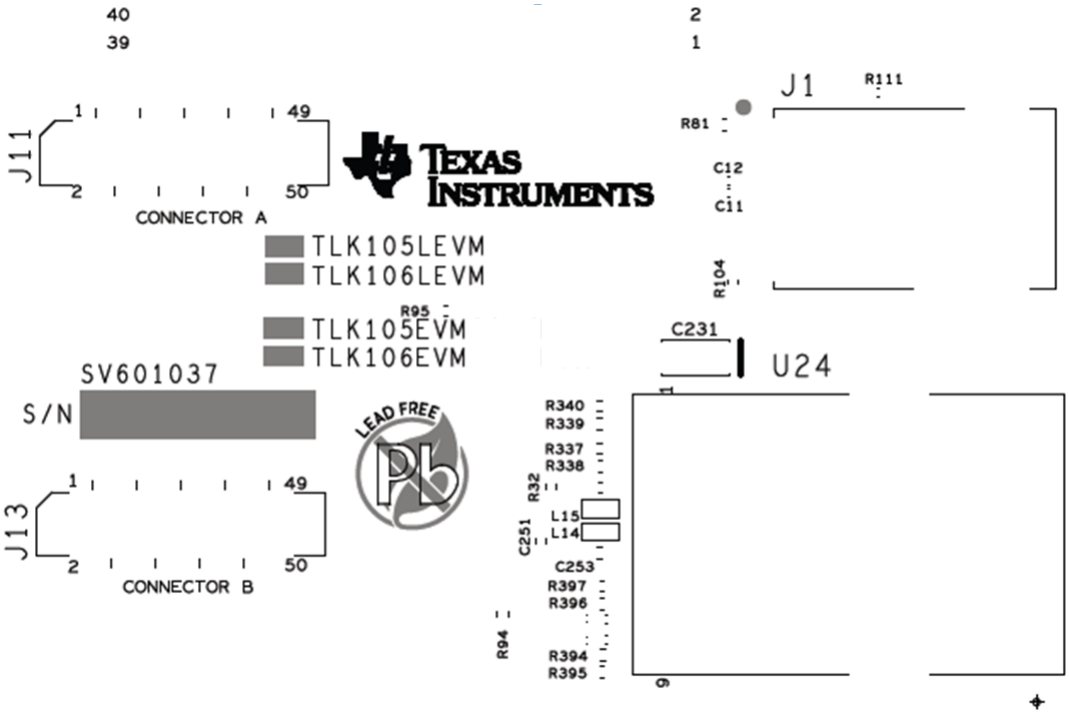


Figure 22. Layer 4 – Print Side Silk

15 Bill of Materials

Table 2 lists the BOM for this EVM.

Table 2. Bill of Materials

S. #	Ref Des	Qty	JEDEC Type	Vendor	Vendor Part Number	Value	BOM Ignore	DESCRIPTION	Digi-key Number
1	!PCB	1			SV601037-001			TLK10xLEVM	
2	U5	1	SMT2X2_5	EPSON	SG-211SCE (d) 25MHZ-X1G0036210159xx	?	IGNORE	3.3V CMOS SMD OSCILLATOR WITH STANDBY, 25MHz, 20ppm -40-+85	
3	J3,J4	2	JUMPERX3	Samtec	TSW-103-07-G-S	?		CONN HEADER 3POS .100" T/H GOLD	SAM1029-03-ND
4	C52	1	C1210	Samsung	CL32A106KPINNNE	10 UF		CAP CER 10UF 10V 10% X5R 1210	1276-3311-2-ND
5	C2,C3,C13,C34,C35	5	C0603	Samsung	CL10C030BB8NNNC	3 PF	IGNORE	CAP CER 3PF 50V NPO 0603	1276-2125-2-ND
6	C20-C22,C27	4	C0603	KEMET	C0603C333J3RACTU	33 NF	IGNORE	CAP CER 33NF 25V 5% X7R 0603	399-9068-2-ND
7	C4	1	C1206	Nichicon	F930G336KAA	33 UF		CAP TANT 33UF 4V 10% 1206	489-8141-2-ND
8	C251,C253,C254	3	C0603	SAMSUNG	CL10B104KO8NNNC	100 NF	IGNORE	CAP CER 100NF 16V 10% X7R 0603	1276-1005-2-ND
9	C53-C55	3	C0603	SAMSUNG	CL10B104KO8NNNC	100 NF		CAP CER 100NF 16V 10% X7R 0603	1276-1005-2-ND
10	C5,C30,C42,C43,C57,C82	6	C1206	TDK	C3216X7R1V106M160AC	10 UF		CAP CER 10UF 35V 20% X7R 1206	4458034-2-ND
11	C90	1	C0603	SAMSUNG	CL10C102JB8NNNC	1 NF		CAP CER 1NF 50V 5% NPO 0603	1276-1091-2-ND
12	C89	1	C0603	SAMSUNG	CL10B103KB8NCNC	10 NF		CAP CER 10NF 50V 10% X7R 0603	1276-1921-2-ND
13	C1	1	C1206	Nichicon	F930J686KAA	68 UF		CAP TANT 68UF 6.3V 10% 1206	493-6546-2-ND
14	C16	1	C1812	AVX	1812GC472KAT1A	4700PF		CAP CER 4700PF 2KV 10% X7R 1812	478-3003-2-ND
15	C19	1	C1812	AVX	1812GC472KAT1A	4700PF	IGNORE	CAP CER 4700PF 2KV 10% X7R 1812	478-3003-2-ND
16	C48,C51	2	C0603	SAMSUNG	CL10C330FB8NNNC	33 PF		CAP CER 33PF 50V 1% NPO 0603	1276-2262-2-ND
17	C29,C33,C41,C49,C50,C60,C182	7	C0402	Yageo	CC0402JRNPO9BN101	100 PF		CAP CER 100PF 50V 5% NPO 0402	311-1024-2-ND
18	C10,C15,C24,C26	4	C0603	Samsung	CL10B105KQ8NNNC	1 UF		CAP CER 1UF 6V3 10% X7R 0603	1276-1024-2-ND
19	C11,C12,C17,C18	4	C0402	SAMSUNG	CL05B104KP5NNNC	100 NF	IGNORE	CAP CER 0.1UF 10V 0.1% X7R 0402	1276-1002-2-ND
20	C9,C14,C23,C25	4	C0402	SAMSUNG	CL05B104KP5NNNC	100 NF		CAP CER 0.1UF 10V 0.1% X7R 0402	1276-1002-2-ND
21	C28,C32,C40,C46,C47,C59	6	C0402	Kemet	C0402C102J3RACTU	1 NF		CAP CER 1NF 25V 5% X7R 0402	399-7752-2-ND
22	C6-C8,C31,C39,C44,C45,C58	8	C0402	Kemet	C0402C103J5RACTU	10 NF		CAP CER 10NF 50V 5% X7R 0402	399-7758-2-ND
23	J1	1	CON_RJ45_J3011	Pulse	J3011G21DNL	?	IGNORE	RJ45 CAT5 8 POS RA Female with integrated magnetic	553-1763-2-ND
24	L14,L15	2	L0805	Samsung	CIM21J121NE	120 OHM	IGNORE	FERRITE CHIP 120OHM 800MA 0805	1276-6333-2-ND
25	XTAL1	1	HC49SM_I	CTS	ATS250BSM-1E	?		CRYSTAL 25.0MHZ 18PF SMD	CTX1213CT-ND
26	J12	1	CON_SAMTEC_XXC020DFDN-RC	?	TSW-120-07-G-D	?		20PINS DOUBLE ROW .100	SAM1028-20-ND
27	U24	1	CON_AGILENT_HFBR-5803-SC	Avago	HFBR-5803AQZ	?	IGNORE	Fast Ethernet Optical Transceiver	516-2346-ND
28	T1	1	SM16	PULSE	HX1198FNLT	?		10/100 BASE-T MAGNETICS	553-2209-2-ND
29	L1-L4	4	L0603	Bourns Inc.	CI160808-33NJ	33 NH	IGNORE	INDUCTOR MULTI LAYER CHIP 33NH	CI160808-33NJTR-ND
30	J5,J6,J8,J10,J14	5	JMP02	SAMTEC	TSW-102-07-G-S	?		CONN HEADER 2POS 0.100" SGL GOLD	SAM1029-02-ND
31	LD1-LD5,LD18	6	LED0805	Everlight	QTLP630C4TR	?		LED GREEN WATER CLR 08050 SMD T/R	1080-1411-2-ND
32	U4	1	SOT-223-5	TI	LP3964EMP-3.3/NOPBTR-ND	?		IC REG LDO 3.3 0.8A SOT223-5	LP3964EMP-3.3/NOPBTR-ND

Table 2. Bill of Materials (continued)

S. #	Ref Des	Qty	JEDEC Type	Vendor	Vendor Part Number	Value	BOM Ignore	DESCRIPTION	Digi-key Number
33	C231	1	C6032	VISHAY SPRAGUE	293D106X9025C2TE3	10 UF	IGNORE	CAP TANT 10UF 25V 10% 2312	718-1050-2-ND
34	C183	1	7343	Kemet	T491D227K006AT	220 UF		CAP TANT 220UF 6V3 10% 2917	399-8378-2-ND
35	J82	1	CON3	SWITCHCRAFT	RAPC712X	?		CONN POWERJACK MINI R/A PCMT	SC237-ND
36	R60	1	R0603	Samsung Electro-Mechanics America, Inc	RC1608J103CS	10 K		RES 10K OHM 1/10W 5% 0603	1276-5086-2-ND
37	R117	1	R0402	YAGEO	RC0402JR-070R	0	IGNORE	RES 0.0 OHM 1/16W JUMP 0402 SMD	311-0.0JRTR-ND
38	R73,R90,R120	3	R0402	YAGEO	RC0402JR-070R	0		RES 0.0 OHM 1/16W JUMP 0402 SMD	311-0.0JRTR-ND
39	R1,R22,R23,R32,R33,R56-R58,R67,R77,R78,R80,R94,R95,R102,R105,R107-R110,R321-R324	24	R0603	Yageo	RC0603JR-070RL	0	IGNORE	RES 0.0 OHM 1/10W JUMP 0603 SMD	311-0.0GRTR-ND
40	R13,R14,R34,R59,R62,R63,R66,R69,R71,R72,R79,R88,R89,R101,R103,R106,R112-R115	20	R0603	Yageo	RC0603JR-070RL	0		RES 0.0 OHM 1/10W JUMP 0603 SMD	311-0.0GRTR-ND
41	R2,R3,R15-R21,R24-R31	17	R0402	YAGEO	RC0402FR-0733RL	33		RES 33.0 OHM 1/16W 1% 0402 SMD	311-33.0LRTR-ND
42	R5-R8	4	R0603	YAGEO	RC0603FR-0775RL	75		RES 75.0 OHM 1/10W 1% 0603 SMD	311-75.0HRTR-ND
43	R338,R340,R395,R397	4	R0603	YAGEO	RC0603FR-0782RL	82	IGNORE	RES 82.0 OHM 1/10W 1% 0603 SMD	311-82.0HRTR-ND
44	R337,R339,R394,R396	4	R0603	YAGEO	RC0603FR-07130RL	130	IGNORE	RES 130 OHM 1/10W 1% 0603 SMD	311-7130HRTR-ND
45	R4	1	R0603	YAGEO	RC0603FR-07402RL	402		RES 402 OHM 1/10W 1% 0603 SMD	311-402HRTR-ND
46	R42,R45,R46,R49	4	R0603	YAGEO	RC0603FR-07470RL	470		RES 470 OHM 1/10W 1% 0603 SMD	311-470HRTR-ND
47	R91	1	R0603	YAGEO	RC0603FR-07750RL	750		RES 750 OHM 1/10W 1% 0603 SMD	311-750HRTR-ND
48	R9-R12	4	R0402	YAGEO	RC0402FR-0749R9L	49.9		RES 49.9 OHM 1/16W 1% 0402 SMD	311-49.9LRTR-ND
49	R328,R335	2	R0402	YAGEO	RC0402FR-0749R9L	49.9	IGNORE	RES 49.9 OHM 1/16W 1% 0402 SMD	311-49.9LRTR-ND
50	R81,R104	2	R0603	Samsung Electro-Mechanics America, Inc.	RC1608J331CS	330	IGNORE	RES 330 OHM 1/10W 5% 0603	1276-5050-2-ND
51	R35-R38,R43,R44,R47,R48,R74,R75,R82	11	R0402	YAGEO	RC0402FR-072K2L	2.2 K		RES 2.20K OHM 1/16W 1% 0402 SMD	311-2.20KLRTR-ND
52	R40,R41,R51,R76	4	R0402	YAGEO	RC0402FR-072K2L	2.2 K	IGNORE	RES 2.20K OHM 1/16W 1% 0402 SMD	311-2.20KLRTR-ND
53	R96	1	R0603	Yageo	RC0603FR-074K87L	4.87 K		RES 4.87K OHM 1/10W 1% 0603 SMD	311-4.87KHRTR-ND
54	R68	1	R0603	BOURNS	CR0603-JW-472GLF	4.7 K		RES 4.7K OHM 1/10W 5% 0603 SMD	CR0603-JW-472GLFTR-ND
55	R111	1	R0402	YAGEO	RC0402FR-071ML	1 M	IGNORE	RES 1.00M OHM 1/16W 1% 0402 SMD	311-1.0MLRTR-ND
56	R70	1	R0402	YAGEO	RC0402FR-071ML	1 M		RES 1.00M OHM 1/16W 1% 0402 SMD	311-1.0MLRTR-ND
57	U2	1	CON_RJ45_TE_1-406541-1	TE Connectivity	1-406541-1	?		CONN MOD JACK R/A 8P8C SHIELDED	A97716-ND
58	J11,J13	2	CON_SAMTEC_ERM8-05-S-DV-TR	Samtec	ERM8-025-05.0-S-DV-TR	?		Connector, 2x50 way Plug 0.8mm board to board socket strip, Male	
59	U1	1	QFN50P500X500X100-33	TI	TLK105LRHB	?		IC TXRX IND ETHERNET PHY 32QFN	
60	TP30MIL19,TP30MIL21	2	TH	SAMTEC	HMTSW-101-07-TM-S-240	?		TESTPOINT_TH_0.9mm_pad_1.7MM	HMTSW-101-07-TM-S-240-ND
61	TP30MIL2	1	TH	SAMTEC	HMTSW-101-07-TM-S-240	?	IGNORE	TESTPOINT_TH_0.9mm_pad_1.7MM	HMTSW-101-07-TM-S-240-ND

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10. User has sole responsibility to ensure the safety of any activities to be conducted by it and its employees, affiliates, contractors or designees, with respect to handling and using EVMs. Further, user is responsible to ensure that any interfaces (electronic and/or mechanical) between EVMs 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.
11. User shall employ reasonable safeguards to ensure that user's use of EVMs will not result in any property damage, injury or death, even if EVMs should fail to perform as described or expected.
12. User shall be solely responsible for proper disposal and recycling of EVMs consistent with all applicable federal, state, and local requirements.

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Agreement to Defend, Indemnify and Hold Harmless. User agrees to defend, indemnify, and hold TI, its directors, officers, employees, agents, representatives, affiliates, 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 and/or use of EVMs. User's indemnity shall apply whether Claims arise under law of tort or contract or any other legal theory, and even if EVMs fail to perform as described or expected.

Safety-Critical or Life-Critical Applications. If user intends to use EVMs in evaluations of safety critical applications (such as life support), and a failure of a TI product considered for purchase by user for use in user's product would reasonably be expected to cause severe personal injury or death such as devices which are classified as FDA Class III or similar classification, then user must specifically notify TI of such intent and enter into a separate Assurance and Indemnity Agreement.

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For EVMs not including a radio and not subject to the U.S. Federal Communications Commission (FCC) or Industry Canada (IC) regulations, TI intends EVMs to be used only for engineering development, demonstration, or evaluation purposes. EVMs are not finished products typically fit for general consumer use. EVMs may nonetheless generate, use, or radiate radio frequency energy, but have not been tested for compliance with the limits of computing devices pursuant to part 15 of FCC or the ICES-003 rules. Operation of such EVMs 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.

General Statement for EVMs including a radio

User Power/Frequency Use Obligations: For EVMs including a radio, the radio included in such EVMs is intended for development and/or professional use only in legally allocated frequency and power limits. Any use of radio frequencies and/or power availability in such EVMs and their development application(s) must comply with local laws governing radio spectrum allocation and power limits for such EVMs. 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 TI unless user has obtained appropriate experimental and/or development licenses from local regulatory authorities, which is the sole responsibility of the user, including its acceptable authorization.

U.S. Federal Communications Commission Compliance

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 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 its 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.

Industry Canada Compliance (English)

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.

Canada Industry Canada Compliance (French)

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.

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.

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.

Mailing Address: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265

Important Notice for Users of EVMs Considered "Radio Frequency Products" in Japan

EVMs entering Japan are NOT certified by TI as conforming to Technical Regulations of Radio Law of Japan.

If user uses EVMs in Japan, user is required by Radio Law of Japan to follow the instructions below with respect to EVMs:

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.

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