

# TLK105/6L Customer EVM

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This User Guide describes the design and operation of the evaluation module (EVM) for the TLK105L and TLK106L.

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## 1 TLK105/6L EVM Purpose and Content

The Industrial Ethernet TLK105/6LCUSEVM enables Texas Instruments customers to quickly design and market systems using the TLK105L and TLK106L devices. Customers are encouraged to use a design similar to the EVM circuit to expedite their product development.

The TLK105/6LCUSEVM requires only a single-voltage power supply (5V from the MII). All other voltages are internally regulated.

The EVM kit contains:

- TLK105/6LCUSEVM Unit
- Printed copy of this User's Guide
- TLK105/6LCUSEVM schematic

### 1.1 TLK105/6L EVM Use

The TLK10xL devices support an IEEE 802.3u 100BASE-FX Fiber Interface. This ability was not implemented in this customer EVM. For fiber performance evaluation, a new customer EVM is being developed.

The TLK10xL devices support the use of 2 LEDs. The second LED support was not implemented in this customer EVM. For two-LED evaluation, a new customer EVM is being developed.

## 2 Information and Specifications

This section provides the specifications of TLK105/6LCUSEVM card and a description of the card's interfaces, connectors, jumpers and LEDs.

### 2.1 Usage Setup and Configuration

The TLK105/6L is powered via the MII connector.

- If 5V is supplied, the on-board voltage regulator, U1, converts 5V to 3.3V for the device.
- If 3.3V is supplied from the MII connector, populate R59 and remove R56.
- Make sure to install jumper J2 in order to supply 3.3V to CT\_INPUT.
- Make sure that jumper J1 exists and is configured for MII or RMII.

### 2.2 Address Settings

The following jumpers set the PMD address of the TLK105/6LCUSEVM Physical Layer device:

J7: PHY ID [0]  
J6: PHY ID [1]  
J5: PHY ID [2]

- **Default board setting for the PHY Address is 01h**
- The board may be set to any PHY Address 00h-07h by populating jumpers J5-J7.

## 2.3 TLK105/6L Connections

Table 1 describes the connections of the TLK105/6LCUSEVM. Table 2 shows AN\_0 mode selection.

**Table 1. TLK105/6LCUSEVM Connections**

| Ref. Des. | Name                         | Function                                      |
|-----------|------------------------------|---|
| P1        | MII Male Connector           | MII interface                                 |
| J1        | MII or RMII selector         | Select between MII mode to RMII mode          |
| J14       | RESET N                      | Reset the device                              |
| J2        | Central Tap voltage selector | Enable 3.3V supply to the central tap.        |
| U2        | RJ45                         | RJ45 Ethernet connector                       |
| J5-J7     | PHY ID[0:2]                  | Configure PHY ID address (default = addr 01h) |
| J10       | RMII Enable                  | Enable RMII. (default = MII)                  |
| J8        | CFG CROSSOVER                | Disable AMDIX (default = AMDIX ON)            |
| J4        | CFG ANEG SPD 0               | See description below                         |

**Table 2. TLK105/6LCUSEVM ANEG Modes Connections**

| AN_0 | Forced Mode |
|------|-------------|
| 0    | Half Duplex |
| 1    | Full Duplex |

## 3 TLK105/6LCUSEVM Specifications

### 3.1 Overview

Texas Instruments provides the TLK105/6LCUSEVM platform for customer evaluation of TLK105/6L devices, demonstrating the advanced performance described in the TLK10xL data sheet, SLLSEE3. The EVM supports 10/100 Base-T and is compliant with IEEE 802.3 standard. The TLK105/6LCUSEVM operates from a single power supply (5V or 3.3V) from the MII. All other voltages required for the TLK105/6L are internally generated in the device. The TLK105/6LCUSEVM operates over the industrial temperature range.

### 3.2 Required Resources

Use any equipment that provides a standard IEEE 802.3, Clause 22 MII DTE interface; for example, a SmartBits® Netcom box.

### 3.3 Features

The TLK105/6LCUSEVM features:

- Industrial temperature rating:  $-40^{\circ}\text{C} \pm 105^{\circ}\text{C}$  (the TLK105L maximum temperature is  $85^{\circ}\text{C}$ )
- Industrial-temperature external magnetics
- Control and status:
  - Configurable PHY Addresses – any address between 00h-07h (01h default) using jumpers as described in [Table 1](#)
  - 4 LEDs – 2 power and 2 status LEDs (Link)
- Strap options:
  - MII or RMII jumper (MII disable)
  - Resistor strapping options:
    - Configurable PHY Addresses 08h-31h
  - RESET\_N ( $\overline{\text{RESET}}$ ) jumper
- Connections for the following interfaces:
  - MII connector
  - RJ-45 connector
- Single-sided component placement
- On-board clock – Crystal or Oscillator Dual Footprint
- On-board power supplied by MII the connector only, resistors to configure 5V or 3.3V operation

### 3.4 RMII Configuration

To use the TLK105/6L with the RMII interface, change the following:

- Change J1 to PD (RMII)
- Connect J10 (RMII PU)
- Disconnect R71 and R72
- Populate R73 ( $0\Omega$ )
- Remove XTAL1
- Populate a 50MHz oscillator at U5, such as VALPEY\_FISHER, part number VF3AH1-50MHZ

**Note:** In RMII mode, the PHY shares a 50MHz clock with the MAC. Install a 50MHz OSC on the TLK105/6LCUSEVM at U5, and remove the crystal. The MAC receives the shared CLK on the TX\_CLK pin on the MII Connector (this pin is not used when working in RMII).

### 3.5 TLK105/6LCUSEVM Block Diagram

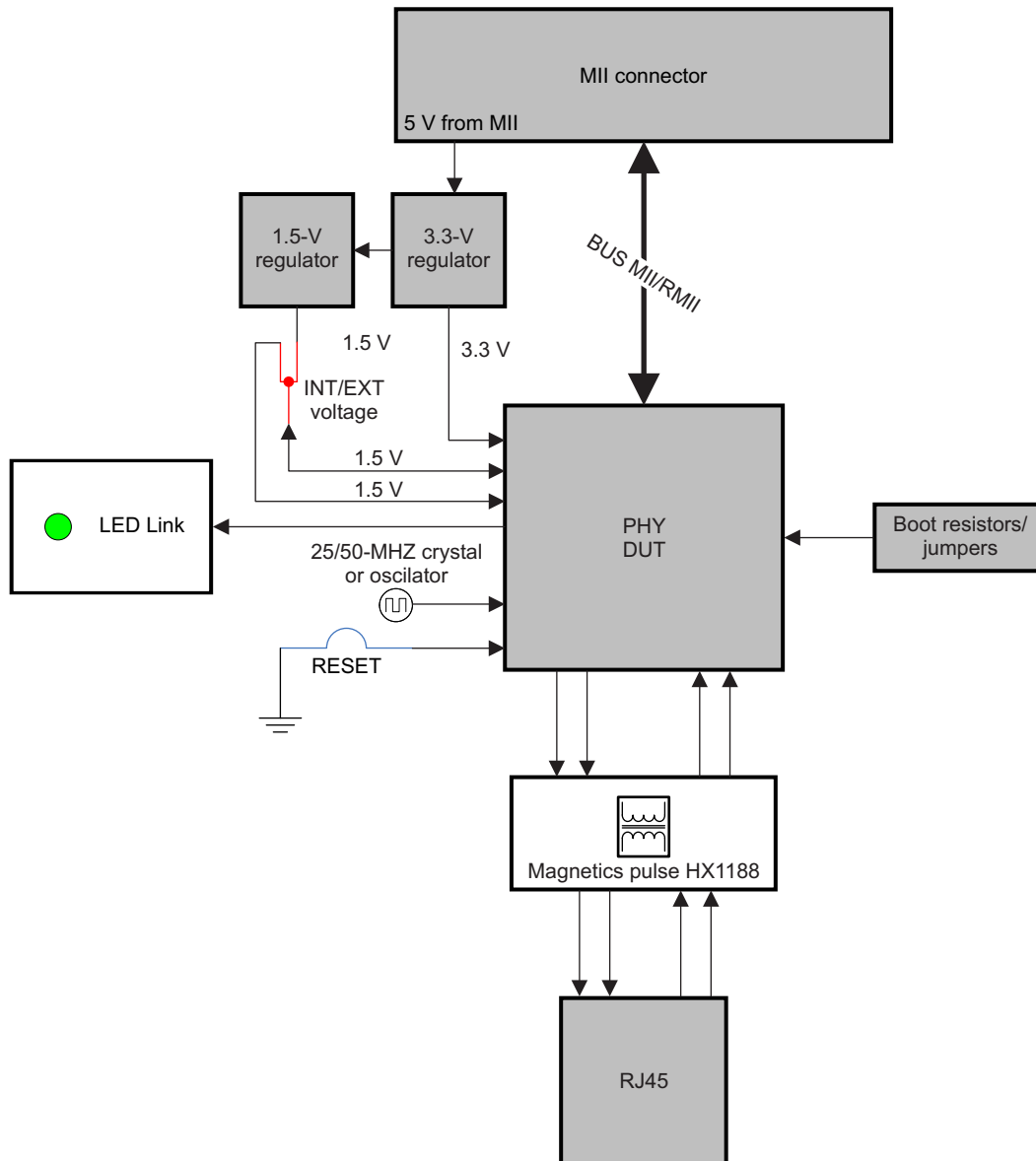


Figure 1. EVM Block Diagram

### 3.6 PCB Physical Layout

- FR4 material
- Trace impedance—Differential impedance 100 ohms,  $\pm 5\%$
- Uniform supply and ground planes
- 4-layer board
- Combination of through-hole and surface-mount technology

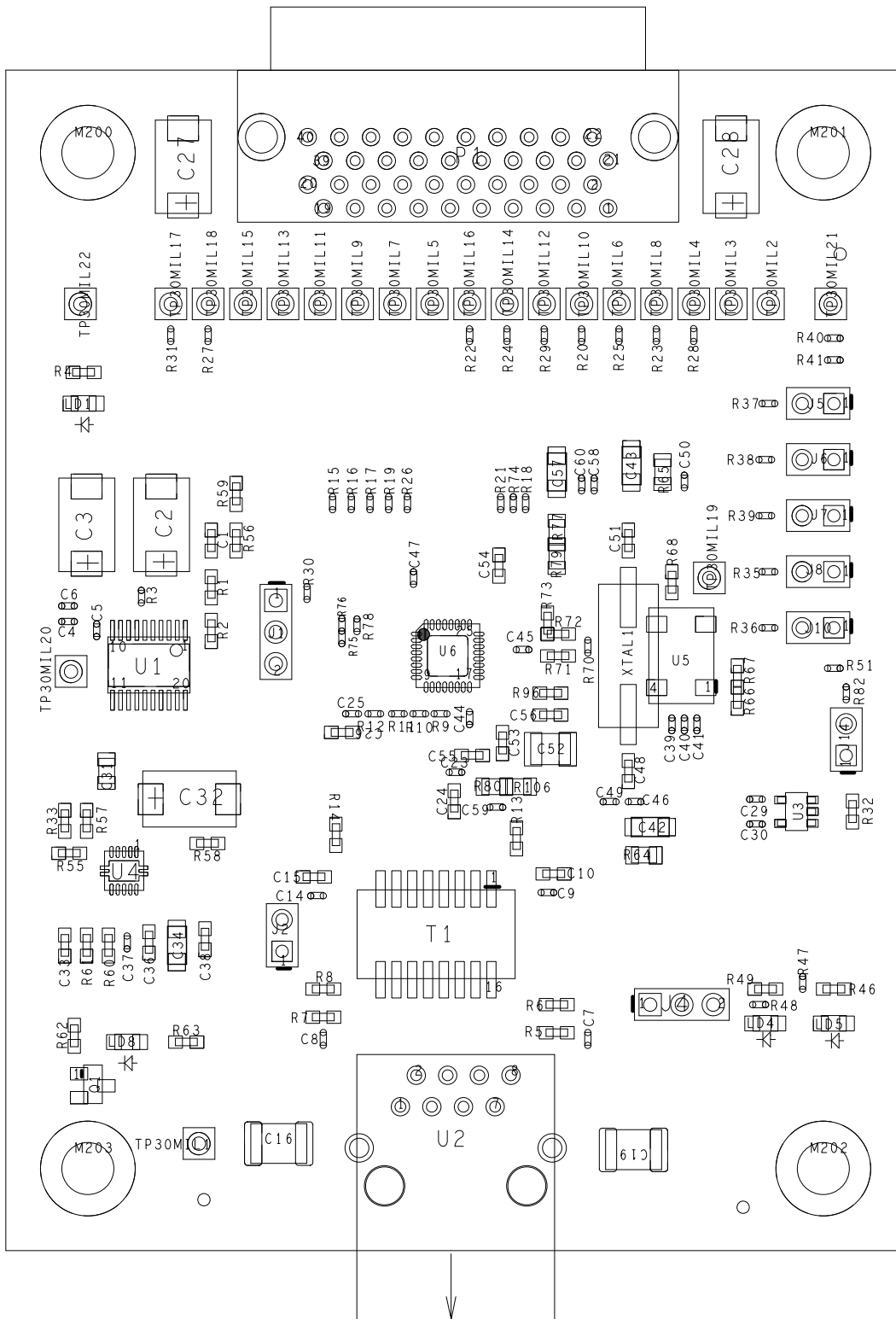


Figure 2. EVM Layout

### 3.7 EVM Schematics

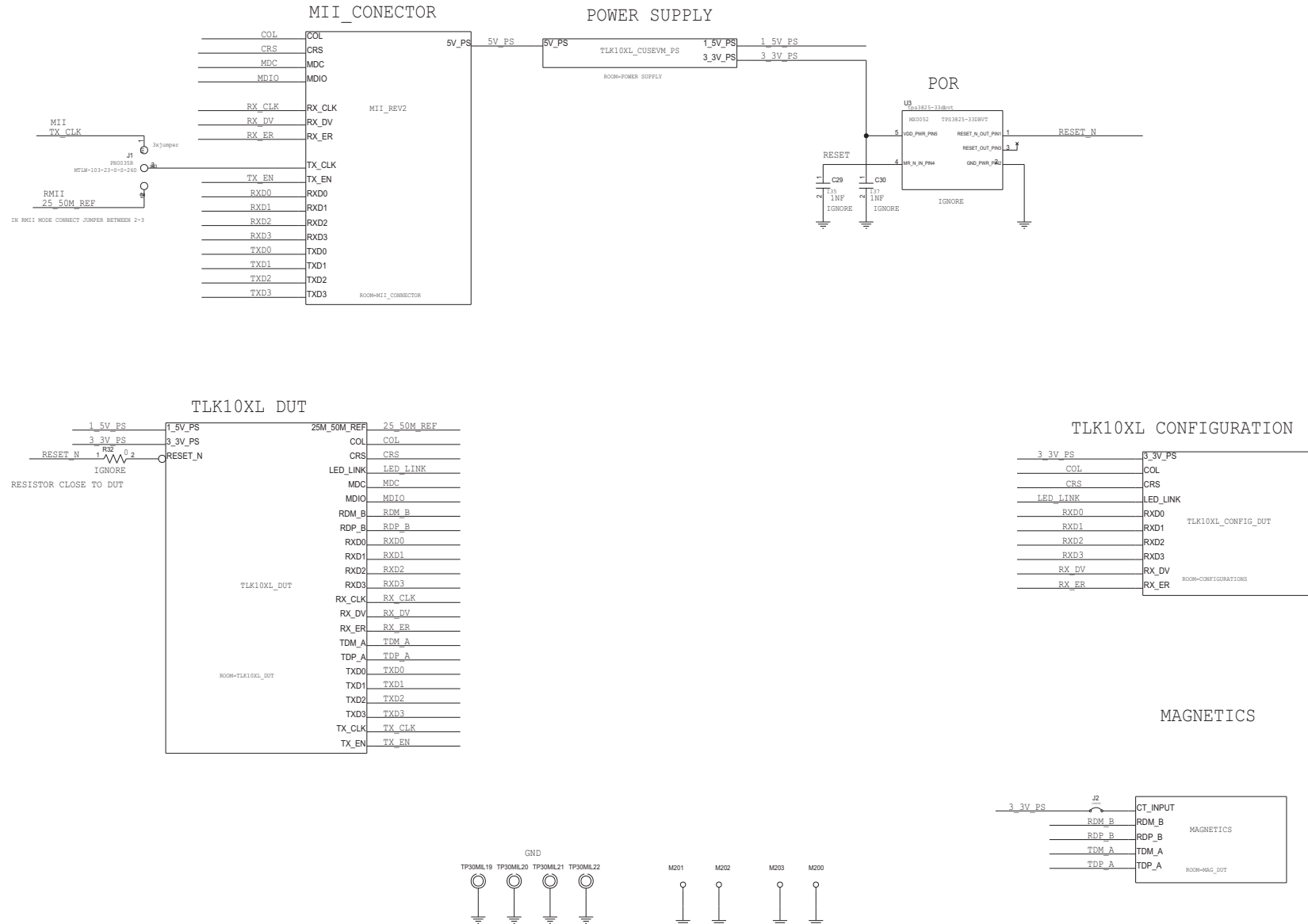


Figure 3. TLK105/6LCUSEVM – Top Level Schematics

TLK10XT DUT

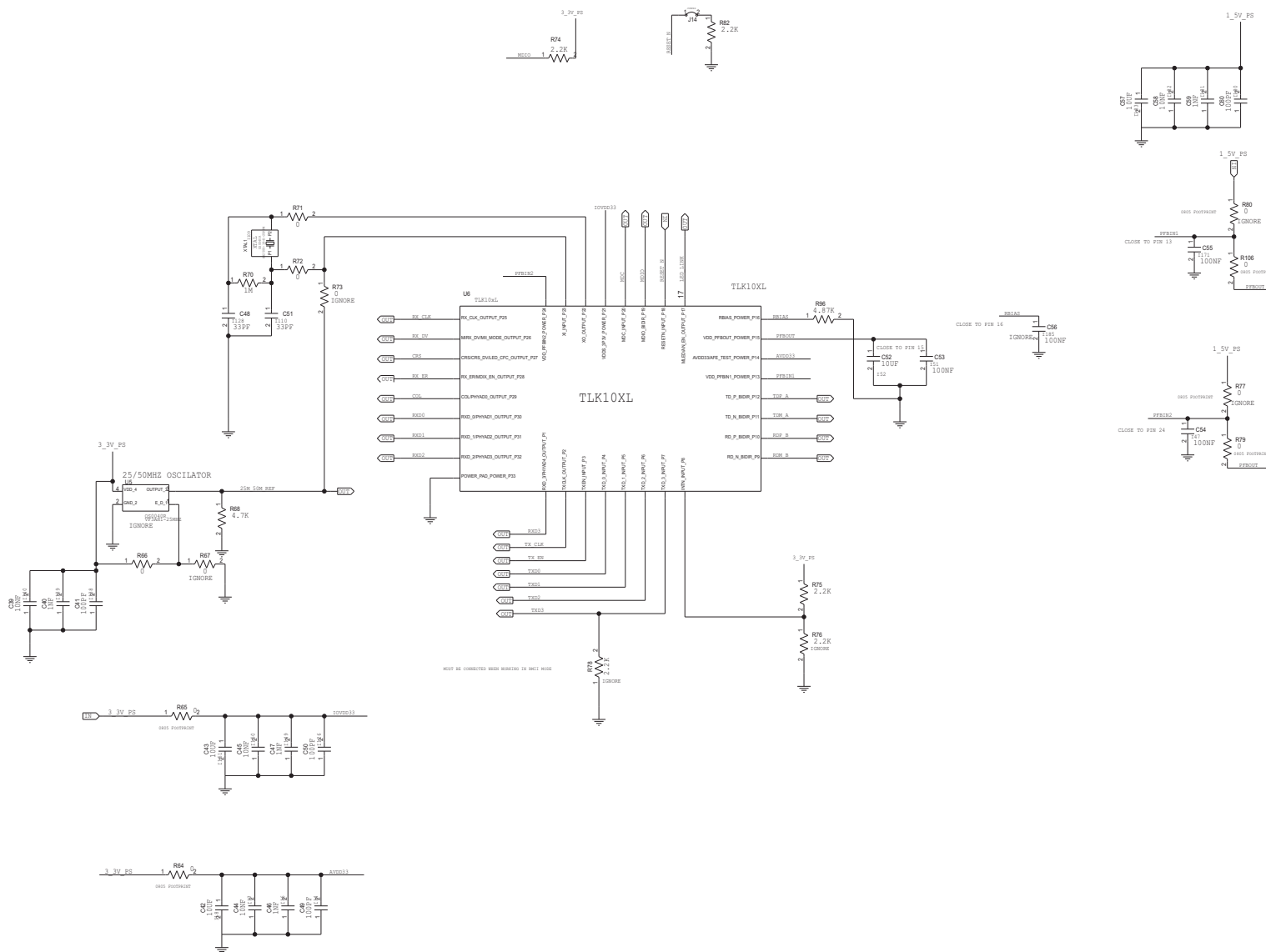


Figure 4. TLK105/6LCUSEVM – PHY Schematics



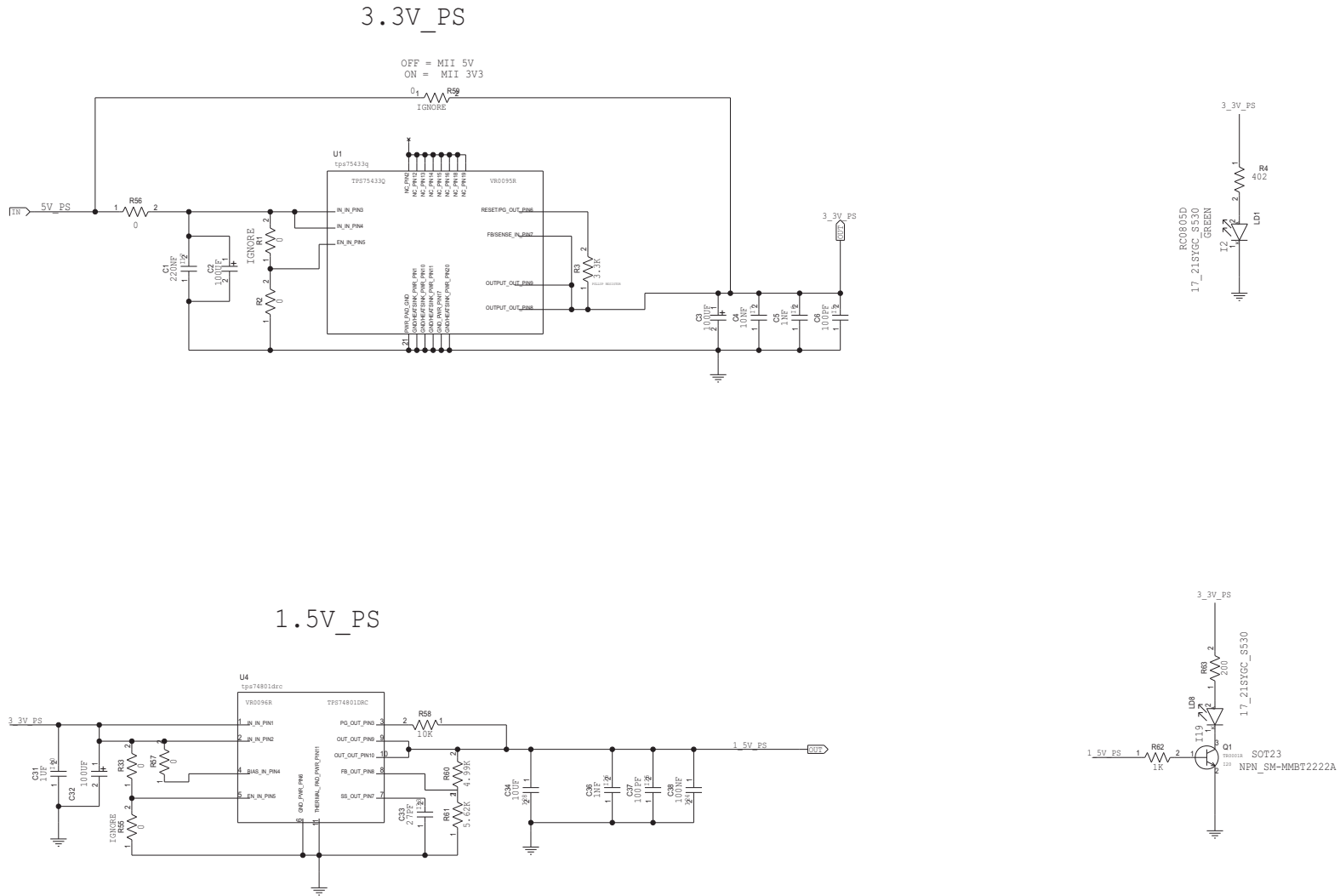


Figure 5. TLK105/6LCUSEVM – 3.3V/1.5V LDO Schematics

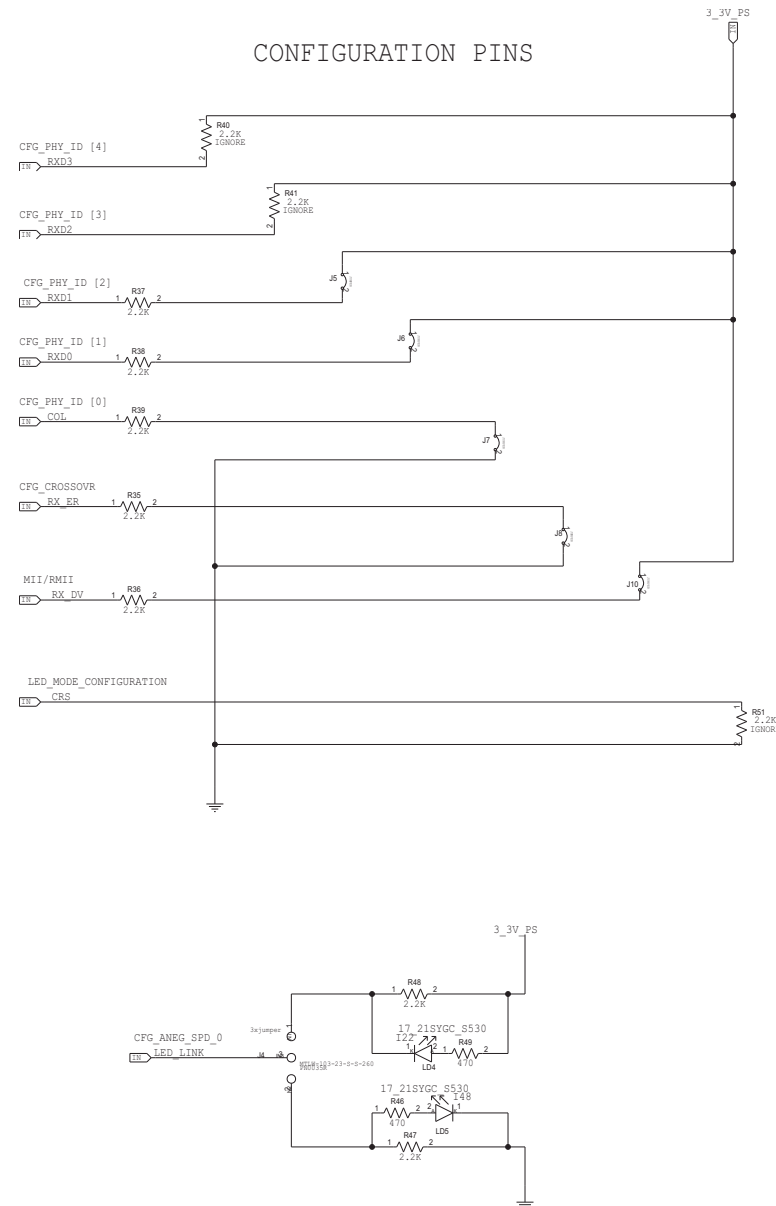
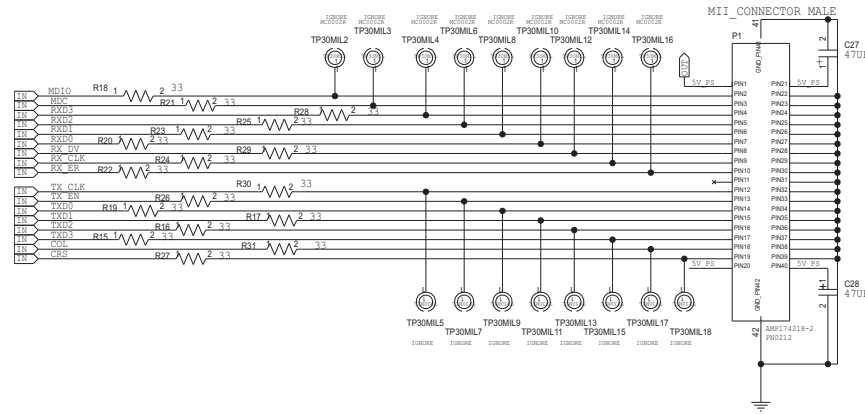


Figure 6. TLK105/6LCUSEVM – SOR Schematics



**Figure 7. TLK105/6LCUSEVM – MII Connector Schematics**

# MAGNETICS

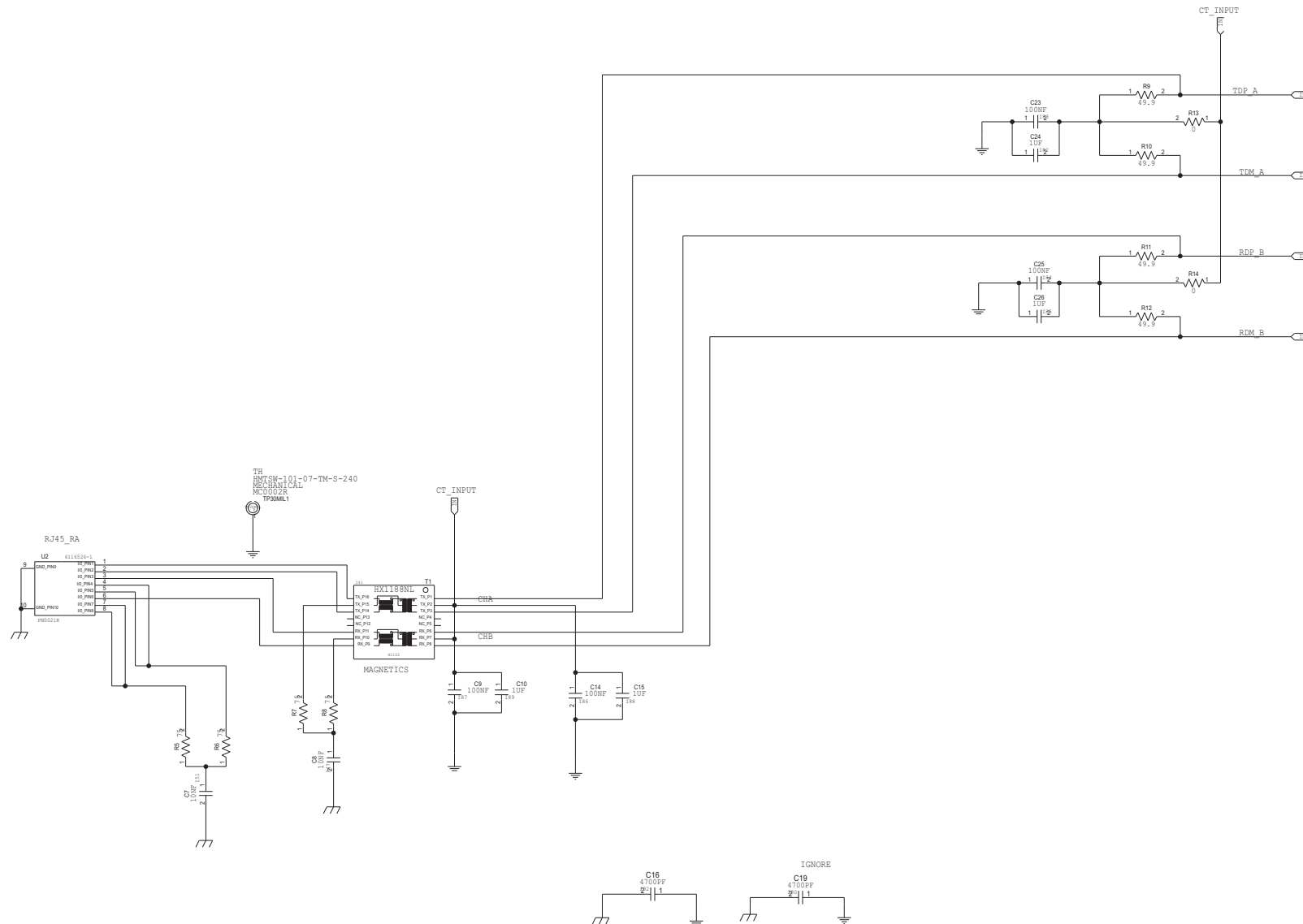


Figure 8. TLK105/6LCUSEVM – Magnetics Schematics

## 4 Bill of Materials

### 4.1 Bill of Materials

**Table 3. Bill of Materials**

| Part Name   | Ref Des                        | Qty | JEDEC Type | Part No. | Vendor        | Vendor Part No.     | Value  | BOM Ignore | Description   | New Part No. |
|---|--------------------------------|-----|------------|----------|---------------|---------------------|--------|------------|---|--------------|
| 3XJUMPER_MECHANICAL-  | J1, J4                         | 2   | JUMPERX3   | PN0035R  | SAMTEC        | MTLW-103-23-S-S-260 |        |            | JUMPERX3 MALE   | CON-103260R  |
| 8_POS_TH_MEC-PN0021R, 8POS, 6116526-1                                   | U2                             | 1   | 8POS       | PN0021R  | AMP-TYCO      | 6116526-1           |        |            | RJ45 CAT5 8 POS RA Female   | CON-111333R  |
| CAPACITOR_SINGLE-CP0042, 100NF, 10V, 10%, 10%, RC0402, GMC04X7R104K10NT | C9, C14, C23, C25              | 4   | RC0402     | CP0042   | CALCHIP       | GMC04X7R104K10NT    | 100NF  |            | 100NF_X7R_10V_10%_0402  | CAT-400134R  |
| CAPACITOR_SINGLE-CP0046, 1NF, 50V, 5%, 5%, RC0603, CL10B102JBNC         | C36                            | 1   | RC0603     | CP0046   | SAMSUNG       | CL10B102JBNC        | 1NF    |            | 1NF_X7R_50V_5%_0603   | CAP-600106R  |
| CAPACITOR_SINGLE-CP0067, 10UF, 35V, 20%, 20%, 1206, CE_GMK325_F106ZHT   | C34, C42, C43, C57             | 4   | 1206       | CP0067   | TAIYO_YUDEN   | CE_GMK325_F106ZHT   | 10UF   |            | 10UF_Y5V_35V_20%_1206   | CAP-401010R  |
| CAPACITOR_SINGLE-CP0105, 100NF, 16V, 10%, 10%, 0603, CL10B104KONC       | C38, C53-C55                   | 4   | 603        | CP0105   | SAMSUNG       | CL10B104KONC        | 100NF  |            | 100NF_X7R_16V_10%_0603  | CAP-400136R  |
| CAPACITOR_SINGLE-CP0105, 100NF, 16V, 10%, 10%, 0603, CL10B104KONC       | C56                            | 1   | 603        | CP0105   | SAMSUNG       | CL10B104KONC        | 100NF  | IGNORE     | 100NF_X7R_16V_10%_0603  | CAP-400136R  |
| CAPACITOR_SINGLE-CP0120, 1UF, 16V, 80%, 20%, 0805, ECJ2VF1C105Z         | C31                            | 1   | 805        | CP0120   | PANASONIC     | ECJ2VF1C105Z        | 1UF    |            | 1UF_Y5V_16V_+80%_-20%_0805  | CAP-300108R  |
| CAPACITOR_SINGLE-CP0135, 1NF, 25V, 5%, 5%, 0402, VJ0402Y102JXXA         | C29, C30                       | 2   | 402        | CP0135   | VITRAMON      | VJ0402Y102JXXA      | 1NF    | IGNORE     | 1NF_X7R_25V_5%_0402   | CAS-600104R  |
| CAPACITOR_SINGLE-CP0135, 1NF, 25V, 5%, 5%, 0402, VJ0402Y102JXXA         | C5, C40, C46, C47, C59         | 5   | 402        | CP0135   | VITRAMON      | VJ0402Y102JXXA      | 1NF    |            | 1NF_X7R_25V_5%_0402   | CAS-600104R  |
| CAPACITOR_SINGLE-CP0136, 27PF, 50V, 1%, 1%, 0603, 0603N270F500NT        | C33                            | 1   | 603        | CP0136   | HITANO        | 0603N270F500NT      | 27PF   |            | 27PF_NPO_50V_1%_0603  | CAP-902716R  |
| CAPACITOR_SINGLE-CP0146, 10NF, 50V, 5%, 5%, 0402, CL05B103JBNC          | C4, C7, C8, C39, C44, C45, C58 | 7   | 402        | CP0146   | SAMSUNG       | CL05B103JBNC        | 10NF   |            | 10NF_X7R_50V_5%_0402  | CAS-601034R  |
| CAPACITOR_SINGLE-CP0147R, 100PF, 50V, 5%, 5%, RC0402, VJ0402A101JXAT    | C6, C37, C41, C49, C50, C60    | 6   | RC0402     | CP0147R  | VITRAMON      | VJ0402A101JXAT      | 100PF  |            | 100PF_NPO_50V_5%_0402   | CAP-910004R  |
| CAPACITOR_SINGLE-CP0221, 1UF, 6.3V, 15%, 15%, 0603, ECJ1VB0J105K        | C10, C15, C24, C26             | 4   | 603        | CP0221   | PANASONIC     | ECJ1VB0J105K        | 1UF    |            | 1UF_X7R_6V3_15%_0603  | CAS-300106R  |
| CAPACITOR_SINGLE-CP0255, 220NF, 16V, 5%, 5%, 0603, 0603B224J160NT       | C1                             | 1   | 603        | CP0255   | HITANO        | 0603B224J160NT      | 220NF  |            | 220NF_16V_5%_0603   | CAS-402236R  |
| CAPACITOR_SINGLE-CP0259, 33PF, 50V, 1%, 1%, 0603, CL10C330FB8NNNC       | C48, C51                       | 2   | 603        | CP0259   | SAMSUNG       | CL10C330FB8NNNC     | 33PF   |            | 33PF_NPO_50V_1%_0603  | CAP-903316R  |
| CAPACITOR_SINGLE-XXXX, 10UF, 10V, 10%, 10%, 1210, GRM32AR61C106KAB7L    | C52                            | 1   | 1210       | XXXX     | MURATA        | GRM32AR61C106KAB7L  | 10UF   |            | 10UF_X5R_10V_10%_1210 LOW ESR   | CAM-301005R  |
| CAPACITOR_SINGLE-XXXX, 4700PF, 2000V, 10%, 10%, C1812, 1812GC472KATA1A  | C16, C19                       | 2   | C1812      | XXXX     | SAMSUNG       | 1812GC472KATA1A     | 4700PF |            | 4700PF_NPO_2000V_10%_1812   | CAP-704735R  |
| F4107R_SMT5X7-OS0040R, SMT5X7, VF3AH1-25MHZ                             | U5                             | 1   | SMT5X7     | OS0040R  | VALPEY_FISHER | VF3AH1-25MHZ        |        | IGNORE     | 3.3V TIGHT STABILITY HCMOS SMD OSCILLATOR WITH STANDBY, 25MHz, 25ppm -40-+85 (INDUSTRIAL) | OSC-507025R  |
| HC49SM_I-25M-INDUSTRIAL_OX0040R   | XTAL1                          | 1   | HC49SM_I   | OX0040R  | HEC           | HH2500-18-E-25PPM   |        |            | XTAL HC49SM 25MHZ 100PPM 18PF INDUSTRIAL  | CRS-250018R  |

**Table 3. Bill of Materials (continued)**

| Part Name  | Ref Des                                    | Qty | JEDEC Type | Part No. | Vendor    | Vendor Part No.   | Value | BOM Ignore | Description                           | New Part No. |
|--|--|-----|------------|----------|-----------|-------------------|-------|------------|---------------------------------------|--------------|
| HX1188NL_SM16-TF0116R, SM16,                                   | T1   | 1   | SM16       | TF0122R  | PULSE     | HX1188NL          |       |            | 10/100 BASE-T MAGNETICS               | CON-118800R  |
| JUMPER_TH-PN0019, JMP02, 90120-0762                            | J2, J5-J8, J10, J14                        | 7   | JMP02      | PN0019   | MOLEX     | 90120-0762        |       |            | MOLEX JUMPER 0.1 INCH                 | CON-901202R  |
| LED_SM-LD0021, 50V, RC0805D, 17_21SYGC_S530, GREEN             | LD1, LD4, LD5, LD8                         | 4   | RC0805D    | LD0021   | EVERLIGHT | 17_21SYGC_S530    |       |            | GREEN_LED_SMD_0805                    | LED-215301R  |
| MII-PN0212, , AMP174218-2                                      | P1   | 1   | MII-MALE   | PN0212   | AMP       | AMP174218-2       |       |            | MII_40PIN_SHILDED_THRA_MALE           | CON-174218R  |
| NPN_IC-MMBT222AA-TR0001R                                       | Q1   | 1   | SOT23      | TR0001R  | XXXX      | NPN-SM-MMBT222AA  |       |            | NPN SOT23 TRANSISTOR                  | TRS-104023R  |
| PCAP_SINGLE-CT0024, 100UF, 10V, 20%, 20%, 7343, EEJL1AD107R    | C2, C3, C32                                | 3   | 7343       | CT0024   | PANASONIC | EEJL1AD107R       | 100UF |            | 100UF_10V_20%_Tantalum_Low_ESR_D_Size | CAP-100343R  |
| PCAP_SINGLE-CT0026R, 47UF, 20V, 10%, 10%, 7343, TCSVS1D476KDAR | C27, C28                                   | 2   | 7343       | CT0026R  | SAMSUNG   | TCSVS1D476KDAR    | 47UF  |            | 47UF_TANT_20V_10%_7343                | CAP-047343R  |
| RESISTOR_2PIN-RE0004, 0, 0.06W, 5%, RC0603JW_000E              | R1, R32, R55, R59, R67, R73                | 6   | 603        | RE0004   | BOURNS    | RC0603JW_000E     | 0     | IGNORE     | 0_0W06_5%_0603                        | RES-100006R  |
| RESISTOR_2PIN-RE0004, 0, 0.06W, 5%, RC0603JW_000E              | R2, R13, R14, R33, R56, R57, R66, R71, R72 | 9   | 603        | RE0004   | BOURNS    | RC0603JW_000E     | 0     |            | 0_0W06_5%_0603                        | RES-100006R  |
| RESISTOR_2PIN-RE0005, 0, 0.1W, 5%, RC0805JW_000E               | R64, R65, R79, R106                        | 4   | 805        | RE0005   | BOURNS    | RC0805JW_000E     | 0     |            | 0R_0W1_5%_0805                        | RES-100008R  |
| RESISTOR_2PIN-RE0005, 0, 0.1W, 5%, RC0805JW_000E               | R77, R80                                   | 2   | 805        | RE0005   | BOURNS    | RC0805JW_000E     | 0     | IGNORE     | 0R_0W1_5%_0805                        | RES-100008R  |
| RESISTOR_2PIN-RE0044, 4.7K, 0.06W, 5%, CR0603JW-472E           | R68  | 1   | 603        | RE0044   | BOURNS    | CR0603JW-472E     | 4.7K  |            | 4K7_0W06_5%_0603                      | RES-404706R  |
| RESISTOR_2PIN-RE0085, 49.9, 0.06W, 1%, RC0402FR-0749R9         | R9-R12                                     | 4   | 402        | RE0085   | YAGEO     | RC0402FR-0749R9   | 49.9  |            | 49R9_0W06_1%_0402                     | RES-249914R  |
| RESISTOR_2PIN-RE0125, 1K, 0.06W, 1%, CR0603FX_1001E            | R62  | 1   | 603        | RE0125   | YAGEO     | CR0603FX_1001E    | 1K    |            | 1K_0W06_1%_0603                       | RES-300106R  |
| RESISTOR_2PIN-RE0152, 470, 0.1W, 1%, CR0603FX-470R             | R46, R49                                   | 2   | 603        | RE0152   | YAGEO     | CR0603FX-470R     | 470   |            | 470_0W1_1%_0603                       | RES-147006R  |
| Part Name  | Ref Des                                    | Qty | JEDEC TYPE | PART No. | VENDOR    | VENDOR PART No.   | VALUE | BOM IGNORE | DESCRIPTION                           | NEW PART No. |
| RESISTOR_2PIN-RE0182, 10K, 0.06W, 1%, RC0603FR_0710K           | R58  | 1   | 603        | RE0182   | YAGEO     | RC0603FR_0710K    | 10K   |            | 10K_0W06_1%_0603                      | RES-301006R  |
| RESISTOR_2PIN-RE0218, 200, 0.06W, 1%, RC0603FR-07200R          | R63  | 1   | 603        | RE0218   | AVX       | RC0603FR-07200R   | 200   |            | 200R_0W06_1%_0603                     | RES-320006R  |
| RESISTOR_2PIN-RE0294, 75, 0.06W, 1%, CR0603FX_75R              | R5-R8                                      | 4   | 603        | RE0294   | YAGEO     | CR0605FX_75R      | 75    |            | 75R_0W06_1%_0603                      | RES-107506R  |
| RESISTOR_2PIN-RE0343, 3.3K, 0.06W, 1%, CR0402FX-3301G          | R3   | 1   | 402        | RE0343   | YAGEO     | CR0402FX-3301G    | 3.3K  |            | 3K3_0W06_1%_0402                      | RES-403304R  |
| RESISTOR_2PIN-RE0475, 5.62K, 0.06W, 1%, RC0603FR-075K62        | R61  | 1   | 603        | RE0475   | YAGEO     | RC0603FR-075K62   | 5.62K |            | 5K62_0W06_1%_0603                     | RES-856216R  |
| RESISTOR_2PIN-RE0518R, 402, 0.06W, 1%, CR0603-FX-402RELF       | R4   | 1   | 603        | RE0518R  | BOURNS    | CR0603-FX-402RELF | 402   |            | RESISTOR_402OHM_1%_0603               | RES-140206R  |
| RESISTOR_2PIN-RE0536R, 1M, 0.06W, 1%, RC0402FR-071M            | R70  | 1   | RC0402     | RE0536R  | YAGEO     | RC0402FR-071M     | 1M    |            | RESISTOR_1M_1%_0402                   | RES-600104R  |

Table 3. Bill of Materials (continued)

| Part Name   | Ref Des                          | Qty | JEDEC Type            | Part No. | Vendor | Vendor Part No.       | Value | BOM Ignore | Description                                    | New Part No. |
|---|----------------------------------|-----|-----------------------|----------|--------|-----------------------|-------|------------|--|--------------|
| RESISTOR_2PIN-RE0661R, 2.2K, 0.06W, 1%, CR0402FR-072K2L | R35-R39, R47, R48, R74, R75, R82 | 10  | 402                   | RE0661R  | YAGEO  | CR0402FR-072K2L       | 2.2K  |            | 2.2K_0W06_1%_0402                              | RES-402204R  |
| RESISTOR_2PIN-RE0661R, 2.2K, 0.06W, 1%, CR0402FR-072K2L | R40, R41, R51, R76, R78          | 5   | 402                   | RE0661R  | YAGEO  | CR0402FR-072K2L       | 2.2K  | IGNORE     | 2.2K_0W06_1%_0402                              | RES-402204R  |
| RESISTOR_2PIN-RE0662R, 33, 0.06W, 1%, CR0402FR-0733R    | R15-R31                          | 17  | 402                   | RE0662R  | YAGEO  | CR0402FR-0733R        | 33    |            | 33_0W06_1%_0402                                | RES-103304R  |
| RESISTOR_2PIN-XXXX, 4.87K, 0.06W, 1%, CR0603-FX-4871ELF | R96                              | 1   | RC0603                | XXXX     | BOURNS | CR0603-FX-4871ELF     | 4.87K |            | RESISTOR_4.87K_1%_0603                         | RES-404876R  |
| RESISTOR_2PIN-XXXX, 4.99K, 0.06W, 1%, CR0603-FX-4991ELF | R60                              | 1   | RC0603                | XXXX     | BOURNS | CR0603-FX-4991ELF     | 4.99K |            | RESISTOR_4.99K_1%_0603                         | RES-304996R  |
| TLK10XL_IC  | U6                               | 1   | QFN50P500X500 X100-33 | XXXX     | TI     | TLK10xL               |       |            | 10_100_PHY_32P_QFN                             | TLK10xL      |
| TP30MIL_MECHANICAL-MC0002R                              | TP30MIL1, TP30MIL19-TP30MIL22    | 5   | TH                    | MC0002R  | SAMTEC | HMTSW-101-07-TM-S-240 |       |            | TESTPOINT_TH_0.9mm_pad_1.7MM                   | CON-101240R  |
| TP30MIL_MECHANICAL-MC0002R                              | TP30MIL2-TP30MIL18               | 17  | TH                    | MC0002R  | SAMTEC | HMTSW-101-07-TM-S-240 |       | IGNORE     | TESTPOINT_TH_0.9mm_pad_1.7MM                   | CON-101240R  |
| TPS3825-33DBVT_IC-MX0052, DBV, TPS3825-33DBVT           | U3                               | 1   | DBV                   | MX0052   | TI     | TPS3825-33DBVT        |       | IGNORE     | PROCESSOR SUPERVISORY CIRCUITS WITH MR_N INPUT | REG-382533R  |
| TPS74801DRC_IC-VR0096R, SON10, TPS74801DRC              | U4                               | 1   | SON10                 | VR0096R  | TI     | TPS74801DRC           |       |            | LDO 1.5A ADJ                                   | REG-748010R  |
| TPS75433Q_IC-VR0095R, TSSOP-20, TPS75433Q               | U1                               | 1   | TSSOP-20              | VR0095R  | TI     | TPS75433Q             |       |            | LDO 3.3V 2A                                    | REG-754330R  |

## 5 Software

The EVM requires no specific software, and can be controlled from networking equipment that supports the MII interface. However, for SmartBits users, TI can provide a proprietary GUI that simplifies the controllability of the TLK105/6LCUSEVM through SmartBits and enables advanced features such as the cable diagnostic tool.



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## EVM Warnings and Restrictions

It is important to operate this EVM within the input voltage range of and the output voltage range of .

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 . The EVM is designed to operate properly with certain components above 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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