

# EBL4600CI-EVALZ: QLx4600-S30 Evaluation Board User Guide

## Introduction

The [QLx4600-S30](#) lane extender evaluation board is a versatile stand-alone card developed to evaluate the performance of Intersil QLx4600-S30 series quad equalizer.

Items provided along with the board:

- This application note
- Power cable

## References

- [QLx4600-S30](#) Datasheet

## Ordering Information

| PART NUMBER     | DESCRIPTION  |
|-----------------|--|
| EBL4600CI-EVALZ | QLx4600-S30 evaluation board with power supply cable |

## Key Features

- QLx4600-S30 series IC
- Single 5V external power supply
- On-board regulators provide all voltages required for MCU and IC operation
- On-board DC/DC converter that provides the 1.2V supply to the IC
- Optional on-board boost selection for each channel via two sets of headers
- Adjustable detection threshold for quiescent modes
- 8 sets of SMA connectors for high speed signals input and output

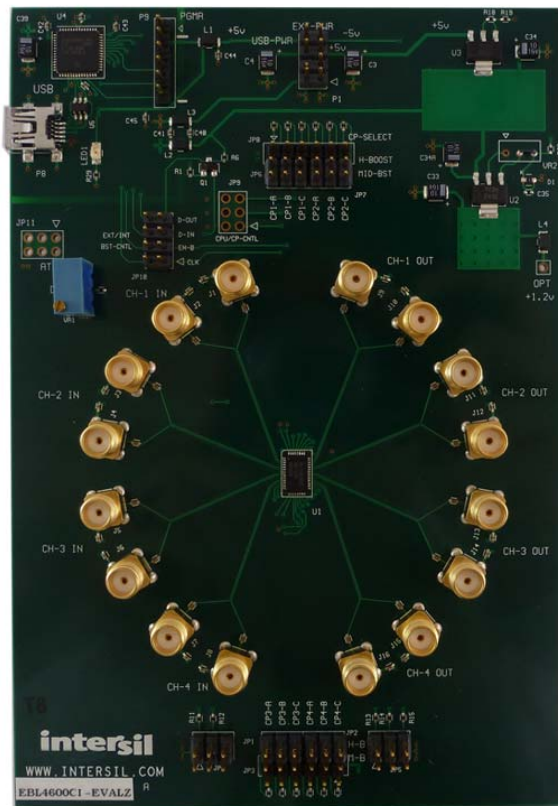


FIGURE 1. TOP OF BOARD

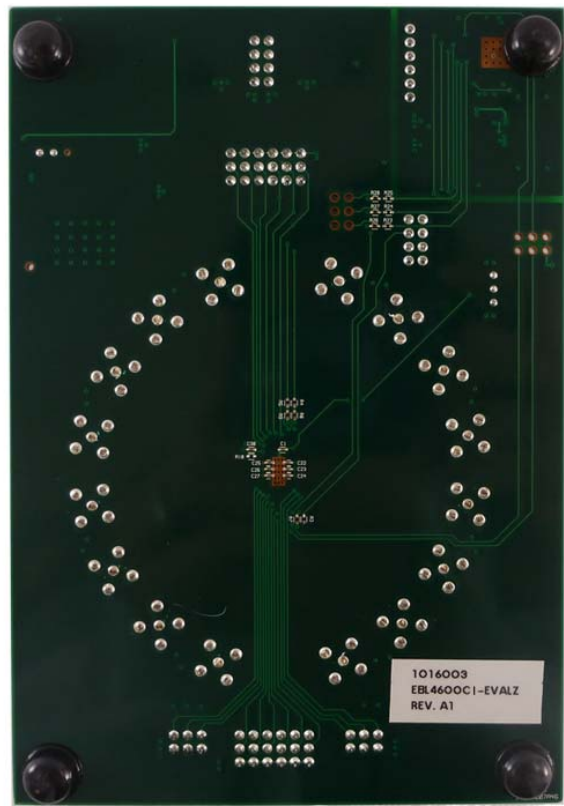


FIGURE 2. BOTTOM OF BOARD

## Operation of Evaluation Board

After a brief description of the board design and layout, the different features and options to operate the board are highlighted.

- Providing power to the board through an external supply
- The eight high speed differential I/O
- The impedance select function
- The variable detection threshold
- Controlling the equalizer boost via control pins

### QLx4600-S30 Evaluation Board

The QLx4600-S30 evaluation board is a 4-layer, 4”(w)x5.6”(h)x0.059”(t) in dimension, and fabricated with (Allied-Signal) FR-408 dielectric material. 100Ω differential signal traces are laid out with 0.0062” width and 0.0058” spacing. 50Ω single-ended traces are 0.009” wide. [Figure 3](#) shows the top view of the board.

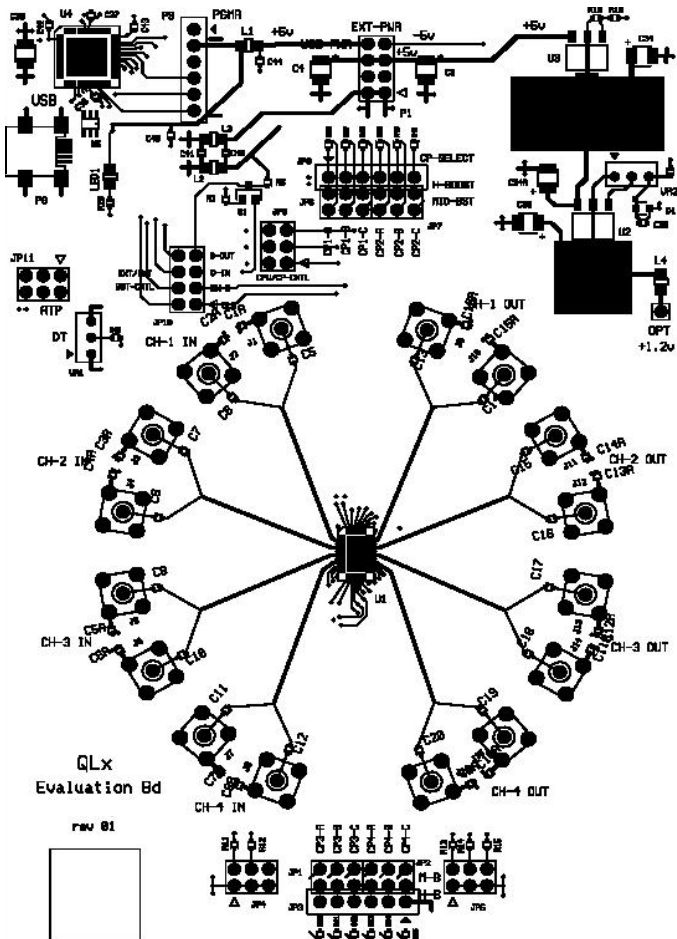


FIGURE 3. QLX4600-S30 EVALUATION BOARD PCB OUTLINE

### Power Supply

Power can be supplied to the board by using an external power supply. On-board voltage regulators supply the appropriate 1.2V to the QLx4600-S30 IC.

### PROVIDING POWER FROM EXTERNAL 5V POWER SUPPLY

The evaluation board can also be powered by an independent external 5.0V power supply via header P1 as highlighted on [Figure 4](#). The maximum current consumption for the board including the voltage regulators, microcontroller circuits and the IC together is approximately 245mA with all channels active.

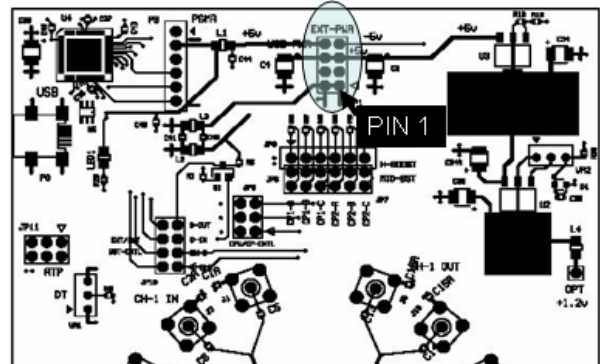


FIGURE 4. QLX4600-S30 EVALUATION BOARD EXTERNAL POWER SUPPLY POWER CONNECTOR

[Table 1](#) provides description of the connector P1. A power cable is provided with the evaluation board.

TABLE 1. P1 CONNECTOR DESCRIPTION

|          |          |
|----------|----------|
| 8 - NC   | 7 - NC   |
| 6 - 5.0V | 5 - 5.0V |
| 4 - NC   | 3 - NC   |
| 2 - GND  | 1 - GND  |

### High Speed Data\_I/O Interface Connectors

There are sixteen SMA connectors on the board, eight for the CML differential inputs and eight for the CML differential outputs. All the connections from the SMA connectors to the QLx4600-S30 series chip are AC-coupled with a 220nF broadband capacitor. [Figure 5 on page 3](#) shows each channel by their name, direction and their polarities.

### Detection Threshold (DT)

The DT is another very important feature of the QLx4600-S30 series IC. On the evaluation board, the DT can be changed by adjusting the potentiometer VR1 ([Figure 6 on page 3](#)).

In normal operation, the potentiometer should be set so that the voltage across the adjacent 10k resistor is 0V.

For applications that need to adjust this level, it can be simply done by changing the potentiometer and reading the voltage across the 10k resistor in order to infer the current coming from the DT pin.

For example, measuring a voltage of -200mV across the 10k resistor indicates a 20μA current from the DT pin.

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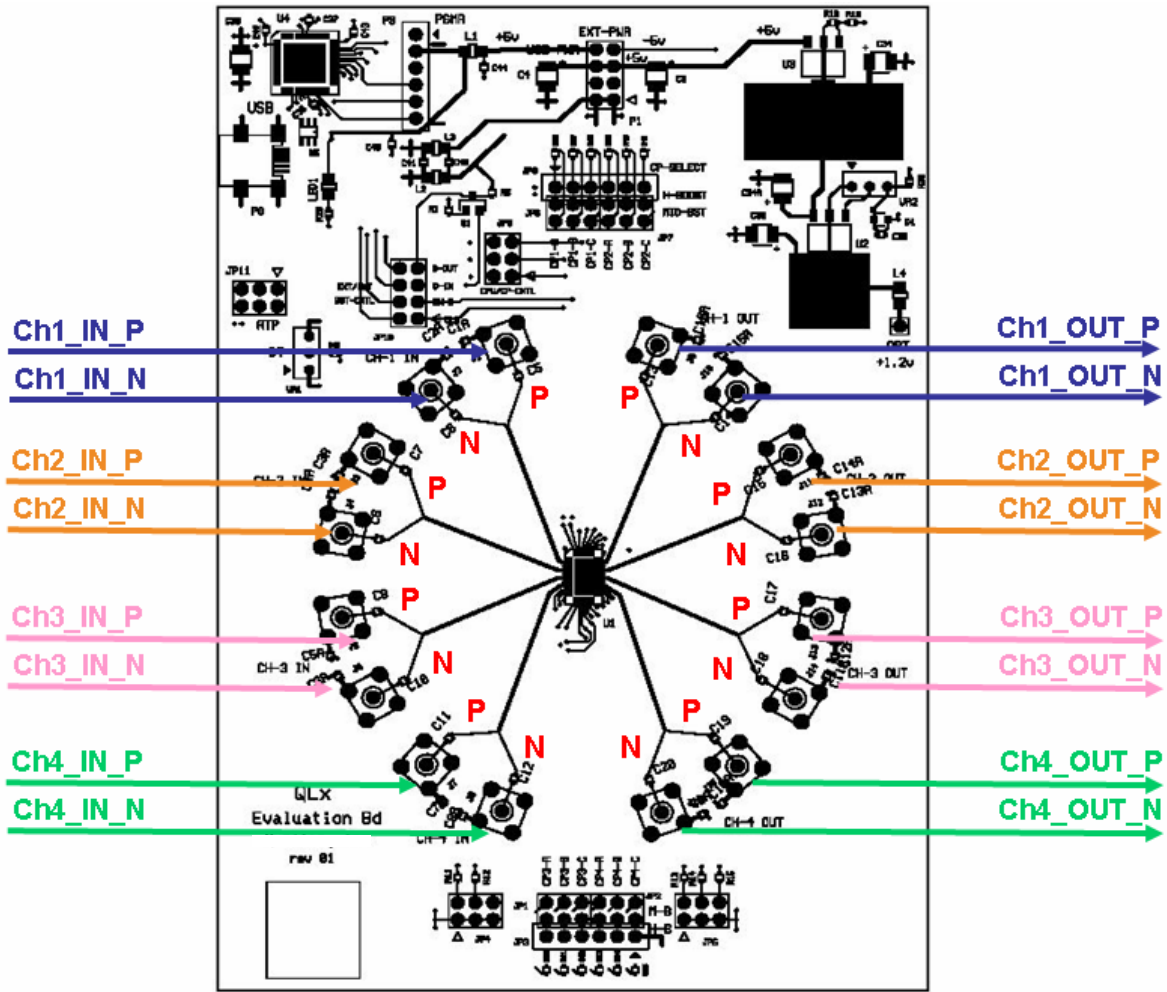


FIGURE 5. QLX4600-S30 EVALUATION BOARD RF-I/O INTERFACE

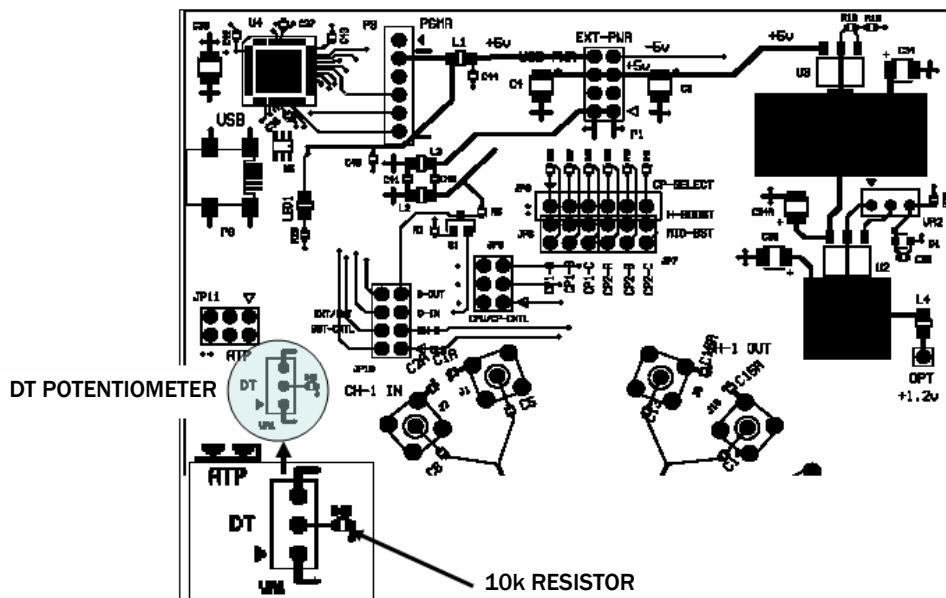


FIGURE 6. QLX4600-S30 EVALUATION BOARD DT POTENTIOMETER

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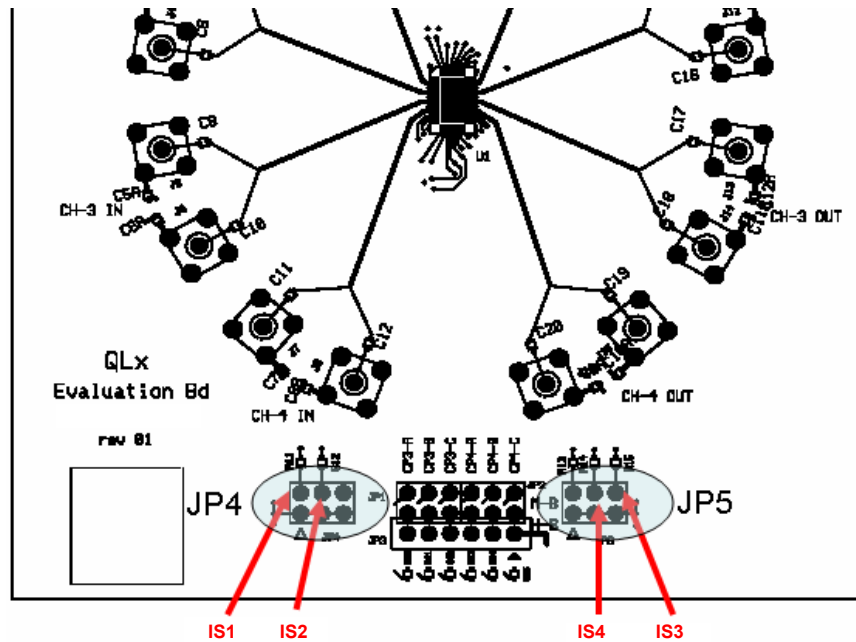


FIGURE 7. QLX4600-S30 EVALUATION BOARD IMPEDANCE SELECT

## Impedance Select

Two 3x2 headers, JP4 and JP5, provide interfaces to the “impedance select” pins of the QLx4600-S30 series ICs. With this function, the user can put any equalizer channel into a standby or reset state by placing a jumper across the header for the selected channel. When in the reset state, the single-ended input impedance of the equalizer channel goes in excess of 200kΩ (from its nominal value of 50Ω) to indicate to a transmitter that the receiver channel is down and not passing data. Additionally, power consumption for a channel is reduced when in the standby state.

TABLE 2. DESCRIBES JP4 AND JP5 CONNECTIVITY

| JP4     |         |         | JP5      |         |         |
|---------|---------|---------|----------|---------|---------|
| 2 - IS1 | 4 - IS2 | 6 - GND | 2 - Mode | 4 - IS4 | 6 - IS3 |
| 1 - GND | 3 - GND | 5 - GND | 1 - GND  | 3 - GND | 5 - GND |

## Boost Setting Control Pins

In order to enable boost setting control via the control pins, JP5-Pin 2 must be jumpered to ground.

The boost setting configuration (compensation setting) for each individual equalizer channel is done through a 3x3 header. There are four sets of headers, one for each equalizer channel. [Figure 8](#) illustrates the location of the headers.

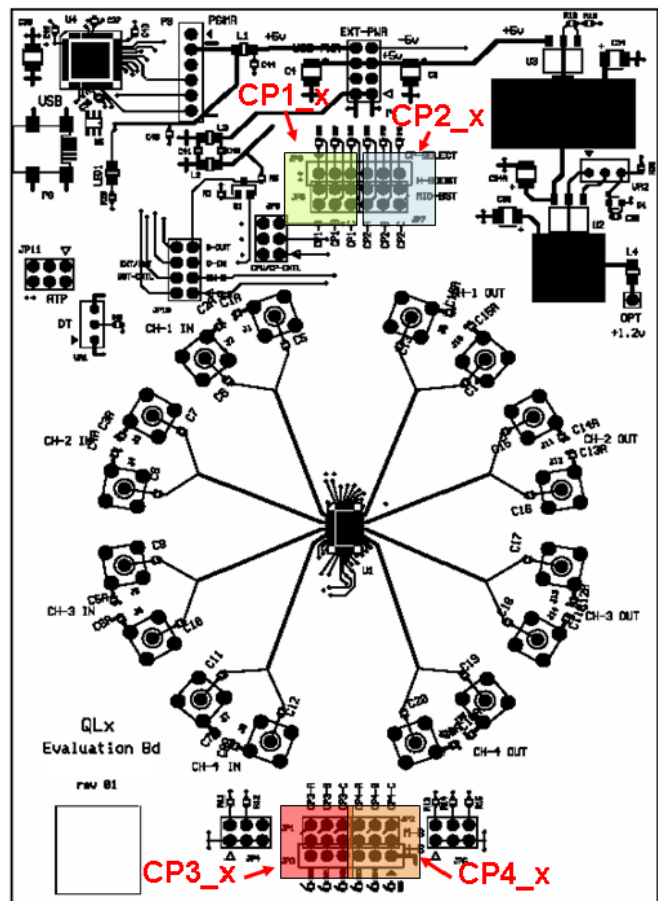


FIGURE 8. EQUALIZER BOOST CONTROL HEADERS

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The notation CP[1-4]\_[A - C] refers to the QLx4600-S30 quad equalizer CPs. They are associated with the 4 channels 3-digit number where 'A' is the MSB and 'C' is the LSB. Table 3 describes the relationship between the CPs and the equalizer boost setting. Bit A can only take one of two values, either Low (L) or High (H), while bit B and C can take one of three values, Low (L), Middle (M) and High (H). Hence, eighteen of the thirty-two different boost levels are accessible through the CPs for each equalizer channel.

TABLE 3. CP AND EQUALIZER BOOST SETTING RELATIONSHIP

| CP[1-4]_A | CP[1-4]_B | CP[1-4]_C | BOOST |
|-----------|-----------|-----------|-------|
| L         | L         | L         | 0     |
| L         | L         | M         | 2     |
| L         | L         | H         | 4     |
| L         | M         | L         | 6     |
| L         | M         | M         | 8     |
| L         | M         | H         | 10    |
| L         | H         | L         | 12    |
| L         | H         | M         | 14    |
| L         | H         | H         | 15    |
| H         | L         | L         | 16    |
| H         | L         | M         | 17    |
| H         | L         | H         | 19    |
| H         | M         | L         | 21    |
| H         | M         | M         | 23    |
| H         | M         | H         | 24    |
| H         | H         | L         | 26    |
| H         | H         | M         | 28    |
| H         | H         | H         | 31    |

For Channels 1 and 2, the headers JP6-8 are used to set the CPs. High state is achieved by placing a jumper between the top two pins of the header and the middle state is achieved by placing a jumper between the bottom two pins. Low state is simply achieved by using no jumper at all. Figure 9 illustrates how one could set the CPs for a QLx4600-S30 Series IC boost value of 21 (H, M, L) on Channel 1 and a boost of 16 (H, L, L) on Channel 2.

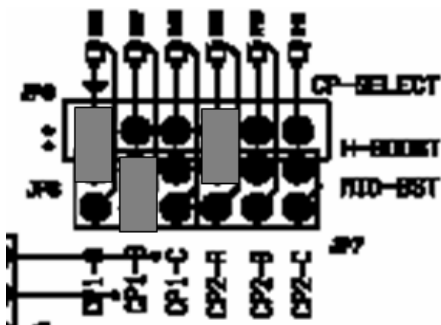


FIGURE 9. ILLUSTRATION OF SETTINGS FOR CP1 = (H, M, L) AND CP2 = (H, L, L)

For Channels 3 and 4, we use headers JP1-3 in a similar fashion except High is achieved using the bottom two pins and middle is achieved by using the top two pins. Figure 10 illustrates how one could set the CPs for a boost value of 18 (H, L, M) on Channel 3 and a value of 14 (L, H, M) on Channel 4.

On Figure 10 please also note how pin 2 on JP5 is jumpered to ground in order to enable the CP control feature.

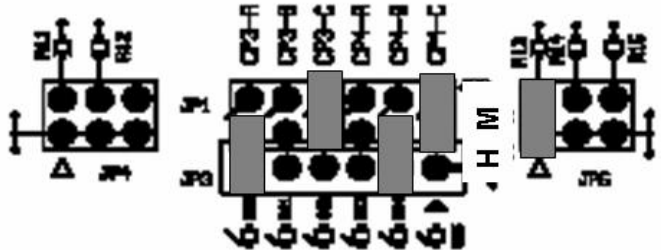


FIGURE 10. ILLUSTRATION OF SETTINGS FOR CP3 = (H, L, M) AND CP4 = (L, H, M)

# Evaluation Board Schematic

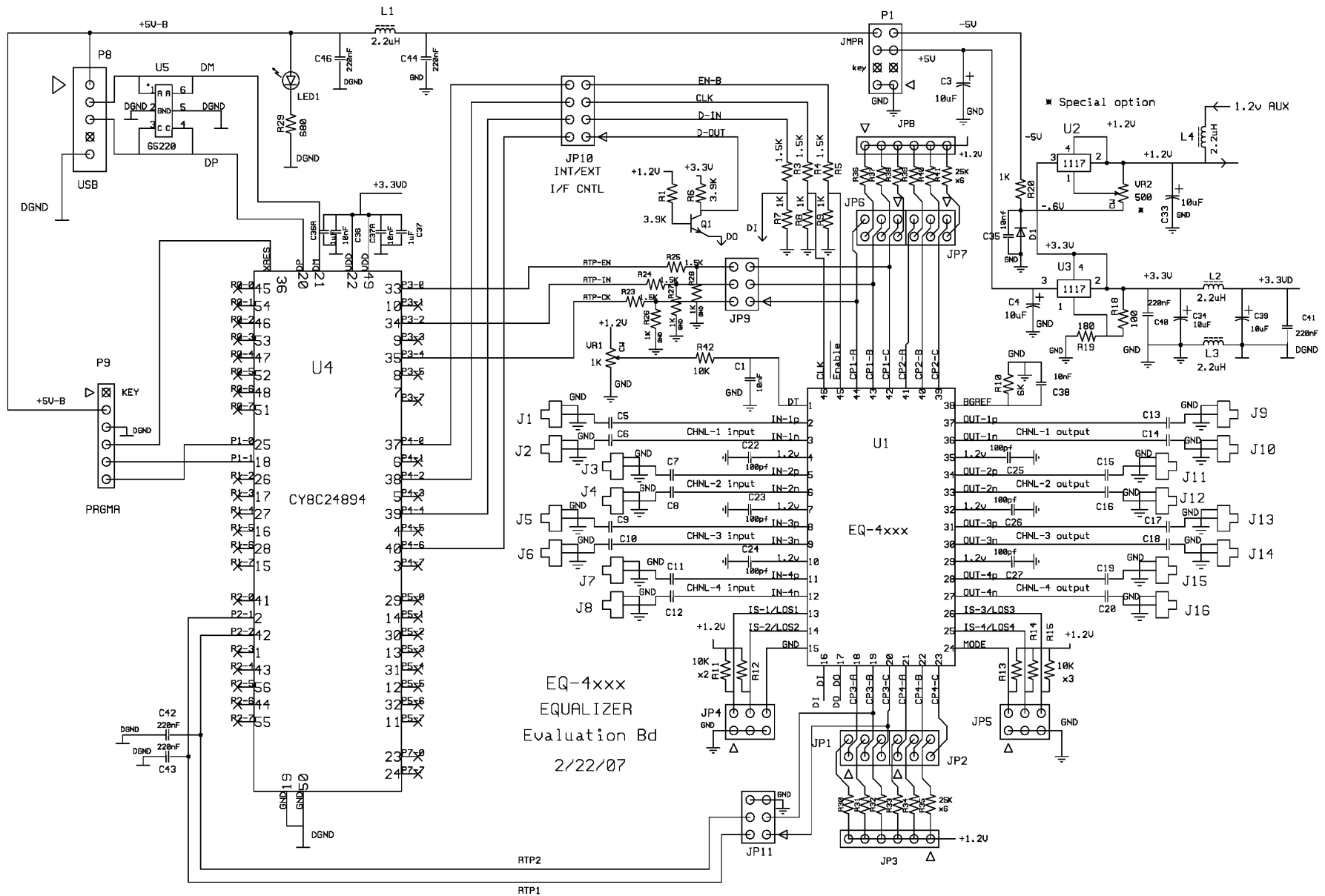


FIGURE 11. SCHEMATIC OF THE QLX4600-S30 EVALUATION BOARD

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### QLX4600-S30 Bill of Materials

| MANUFACTURER PART               | QTY | UNITS | REFERENCE DESIGNATOR                                | DESCRIPTION  | MANUFACTURER           |
|---------------------------------|-----|-------|---|--|------------------------|
| EBL4XXEVALZREVAPCB              | 1   | ea    | SEE LABEL-RENAME BOARD                              | PWB-PCB, EBL4XXEVALZ, REVA, ROHS                           | IMAGINEERING INC       |
| MBB0502Y224MGP5N8 - (GLOBAL PN) | 16  | ea    | C5-C20  | CAP-BURIED, SMD, 0502, 220nF/82pF, 16V, +22-82%, Y5V, ROHS | PRESIDO COMPONENTS     |
| GRM1555C1H101JZ01D              | 6   | ea    | C22, C23, C24, C25, C26, C27                        | CAP, SMD, 0402, 100pF, 50V, 5%, COG, ROHS                  | MURATA                 |
| C1005X7R1C103K                  | 18  | ea    | C1, C38, C1A-C16A                                   | CAP, SMD, 0402, 0.01μF, 16V, 10%, X7R, ROHS                | TDK                    |
| ECJ-0EFOJ105Z                   | 2   | ea    | C36, C37  | CAP, SMD, 0402, 1μF, 6.3V, +80-20%, Y5V, ROHS              | PANASONIC              |
| LMK105F224ZV-F                  | 6   | ea    | C40, C41, C42, C43, C44, C45                        | CAP, SMD, 0402, 0.22μF, 10V, +80-20%, Y5V, ROHS            | TAIYO YUDEN            |
| TAO16TCR106KBR                  | 6   | ea    | C3, C4, C33, C34, C34A, C39                         | CAP, TANT, SMD, B, 10μF, 16V, 10%, ROHS                    | VENKEL                 |
| LQH31CN2R2M03L                  | 4   | ea    | L1, L2, L3, L4                                      | COIL-INDUCTOR, CHOKE, SMD, 1206, 2.2μH, 20%, 430mA, ROHS   | MURATA                 |
| 10-89-7062                      | 6   | ea    | JP1, JP2, JP4, JP5, JP6, JP7 -SEE LABEL-GENERIC.    | CONN-HEADER, 2x3, BRKAWY, 2.54mm, 0.330x.107, ROHS         | MOLEX                  |
| 10-89-7082                      | 2   | ea    | JP10, P1 NOTE: Cut keying pin on P1 per DWG.#1.     | CONN-HEADER, 2x4, BRKAWY, 2.54mm, 0.330x.107, ROHS         | MOLEX                  |
| 22-28-4063                      | 3   | ea    | JP3, JP8, P9 NOTE: Cut keying pin on P9 per DWG.#1. | CONN-HEADER, 1x6, BRKAWY, 2.54mm, 0.240x.125, ROHS         | MOLEX                  |
| 221789-1                        | 16  | ea    | J1-J16 *(SEE ASSEMBLY-NOTE)                         | CONN-RF, SMA JACK, PCB MNT, 50Ω, GOLD, ROHS                | AMP/TYCO               |
| SPC02SYAN                       | 12  | ea    | BAG and SHIP W/BOARD                                | CONN-JUMPER, SHORTING, 2PIN, BLACK, GOLD, ROHS             | SULLINS                |
| UX60-MB-5ST                     | 1   | ea    | P8  | CONN-RECEPTACLE, SMD, MINI USB 2.0, 5POS, ROHS             | HIROSE ELECTRIC        |
| 597-3311-407F                   | 1   | ea    | LED1  | LED, SMD, 1206, GREEN, 75mW, 3mcd, PbFREE                  | DIALIGHT               |
| CY8C24894-24LFXI                | 1   | ea    | U4  | IC-PSoC MICROCONTROLLER, 8-BIT, 24MHZ, 56P, QFN, ROHS      | CYPRESS SEMICONDUCTOR  |
| LM1117MP-ADJ/NOPB               | 2   | ea    | U2, U3  | IC- ADJ. LDO REGULATOR, 3P, SOT-223, 800mA, ROHS           | NATIONAL SEMICONDUCTOR |
| QLX4600SIQSR                    | 1   | ea    | U1  | IC-QLX4600-SI30, QUAD LANE EXTENDER, 46P, QFN, ROHS        | INTERSIL               |
| SN65220DBVR                     | 1   | ea    | U5  | IC-SINGLE USB PORT TVS, SMD, 6P, SOT-23-6, ROHS            | TEXAS INSTRUMENTS      |
| 2SC248000L                      | 1   | ea    | Q1  | TRANSISTOR, NPN, SMD, SC-59, 3P, 30V, 50mA, 150mW, ROHS    | PANASONIC              |
| CT94EW102                       | 1   | ea    | VR1   | POT-TRIM, TH, 3P, 1k, 1/2W, 10%, 18TURN, TOP ADJ., ROHS    | COPAL ELECTRONICS      |
| CR0402-16W-1001FT               | 6   | ea    | R7, R8, R9, R26, R27, R28                           | RES, SMD, 0402, 1k, 1/16W, 1%, TF, ROHS                    | VENKEL                 |
| ERJ-2RKF1002X                   | 6   | ea    | R11, R12, R13, R14, R15, R42                        | RES, SMD, 0402, 10k, 1/16W, 1%, TF, ROHS                   | PANASONIC              |
| ERJ-2RKF1100X                   | 1   | ea    | R18   | RES, SMD, 0402, 110Ω, 1/16W, 1%, TF, ROHS                  | PANASONIC              |
| CR0402-16W-1501FT               | 3   | ea    | R3, R4, R5  | RES, SMD, 0402, 1.5k, 1/16W, 1%, TF, ROHS                  | VENKEL                 |
| CR0402-16W-1800FT               | 1   | ea    | R19   | RES, SMD, 0402, 180Ω, 1/16W, 1%, TF, ROHS                  | VENKEL                 |
| CR0402-16W-2552FT               | 12  | ea    | R30-R41   | RES, SMD, 0402, 25.5k, 1/16W, 1%, TF, ROHS                 | VENKEL                 |
| CR0402-16W-3901FT               | 2   | ea    | R1, R6  | RES, SMD, 0402, 3.9k, 1/16W, 1%, TF, ROHS                  | VENKEL                 |

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### QLx4600-S30 Bill of Materials (Continued)

| MANUFACTURER PART        | QTY  | UNITS | REFERENCE DESIGNATOR   | DESCRIPTION   | MANUFACTURER |
|--------------------------|------|-------|--|---|--------------|
| CR0402-16W-6041FT        | 1    | ea    | R10  | RES, SMD, 0402, 6.04k, 1/16W, 1%, TF, ROHS                  | VENKEL       |
| CR0402-16W-6800FT        | 1    | ea    | R29  | RES, SMD, 0402, 680Ω, 1/16W, 1%, TF, ROHS                   | VENKEL       |
| CR0603-10W-000T          | 1    | ea    | D1   | RES, SMD, 0603, 0Ω, 1/10W, TF, ROHS                         | VENKEL       |
| 2841/1-100-BLK (TEFLON)  | 0.25 | in    | VR2 - Wire jumper from pin 2 to pin 3.   | WIRE, 30AWG, SOLID T.C., INSULATED, BLACK, ROHS             | ALPHA WIRE   |
| WIREDPOWERCABLE1ZFG      | 1    | ea    | BAG and SHIP W/BOARD   | CABLE-FG, WIREDPOWERCABLE1Z, ROHS                           | INTERSIL     |
| SJ-5003SPBL              | 4    | ea    | Bottom four corners.   | BUMPS, 0.44inW x 0.20inH, DOMETOP, BLACK                    | 3M           |
| 212403-013               | 1    | ea    | Place assy in bag.   | BAG, STATIC, 5x8, ZIPLOC, ROHS                              | INTERSIL     |
|                          | 1    | ea    | J1-J16 - Ignore silkscreen on component side of PCB. Mount SMA's on solder side (bottom) of PCB. Cut SMA post ends flush with the PCB.   | ASSEMBLY NOTE   |              |
|                          | 0    | ea    | C35  | DO NOT POPULATE OR PURCHASE                                 |              |
|                          | 0    | ea    | JP11   | DO NOT POPULATE OR PURCHASE                                 |              |
|                          | 0    | ea    | JP9  | DO NOT POPULATE OR PURCHASE                                 |              |
|                          | 0    | ea    | R20, R23, R24, R25   | DO NOT POPULATE OR PURCHASE                                 |              |
| DWG#1_EBL4XXX_KEYPIN_CUT | 1    | ea    | P1, P9   | See attached drawing for visual and/or manual instruction.  | INTERSIL     |
|                          | 1    | ea    | Place a LABEL marked H_M, in a vertical position between JP2 and JP5 so the "H" is located at the bottom and the "M" is at the top when looking at the label after installation. | LABEL, GENERIC  |              |
| LABEL-RENAME BOARD       | 1    | ea    | RENAME PCB TO: EBL4600CI-EVALZ.  | LABEL, TO RENAME BOARD                                      | INTERSIL     |
| LABEL-SERIAL NUMBER      | 1    | ea    |  | LABEL-SERIAL #, LINE 1 = YRWK/REV#/SN;<br>LINE 2 = BOM NAME | INTERSIL     |

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Intersil has long realized that to enable the complex server clusters of next generation datacenters, it is critical to manage the signal integrity issues of electrical interconnects. To address this, Intersil has developed its groundbreaking Q:ACTIVE™ product line. By integrating its analog ICs inside cabling interconnects, Intersil is able to achieve unsurpassed improvements in reach, power consumption, latency and cable gauge size as well as increased airflow in tomorrow's datacenters. This technology transforms passive cabling into intelligent "roadways" that yield lower operating expenses and capital expenditures for the expanding data center.

Intersil lane extenders allow greater reach over existing cabling while reducing the need for thicker cables. This significantly reduces cable weight and clutter, increases airflow and improves power consumption.

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