EVM User's Guide: TPLD801-DRL-EVM

TPLD801-DRL-EVM Evaluation Module

Description

The TPLD801-DRL-EVM helps users to configure TPLD801DRL devices without requiring the soldering of the devices to the board. Users can utilize InterConnect Studio (ICS) for fast evaluation, development, simulation, and programming. Once programmed, TPLD devices can be removed from the socket and placed in the user's system.

Get Started

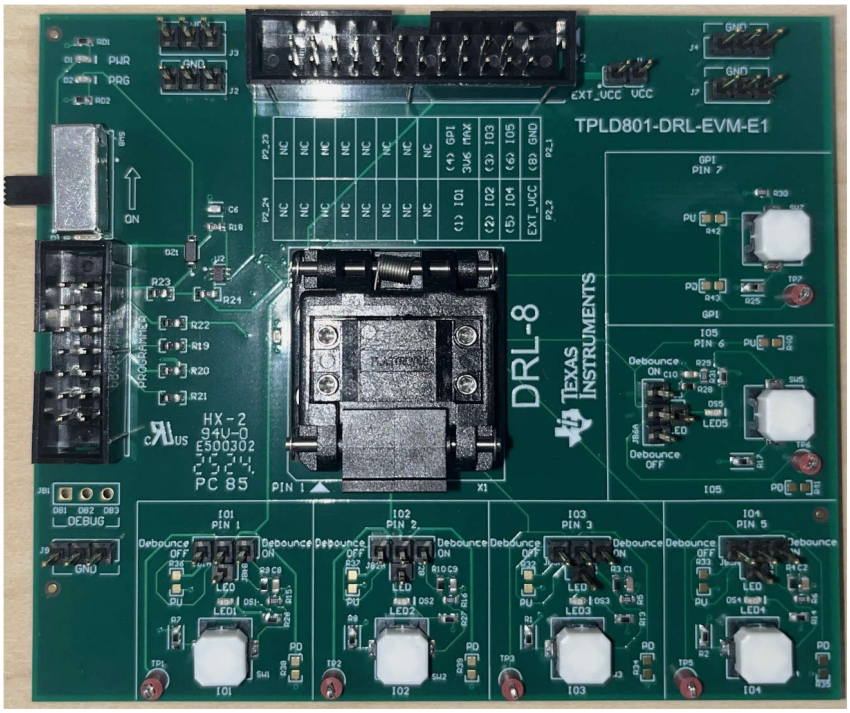
1. Order the TPLD801-DRL-EVM and TPLD-PROGRAM
2. Download the latest version of InterConnect Studio (ICS)
3. Use the cables included the TPLD-PROGRAM kit to connect the system
4. Place an unprogrammed TPLD801DRL into the socket and configure using ICS

Features

- DRL socket for easy programming and evaluation of TPLD801DRL
- Input buttons and output LEDs for quick evaluation
- Header pins and test points for interfacing with custom systems
- Interfaces with TPLD-PROGRAM using a standard keyed 14-pin cable

Applications

- Factory automation and control
- Communications equipment
- Retail automation and payment
- Test and measurement
- Pro audio, video and signage
- Personal electronics



1 Evaluation Module Overview

1.1 Introduction

The TPLD801 is part of the TI Programmable Logic Device (TPLD) family of devices that feature versatile programmable logic ICs with combinational logic and sequential logic functions. TPLD provides an integrated, compact, low power design to implement common system functions, such as timing delays, system resets, power sequencers, I/O expanders, and more.

This user's guide contains support documentation for the TPLD801DRL evaluation module (EVM). Included is a description of how to set up and configure the EVM, how to use the EVM in conjunction with a TPLD-PROGRAM board, and how to use InterConnect Studio to configure TPLD801. Also included are the printed circuit board (PCB) layout, the schematic, and the bill of materials (BOM) of the TPLD801-DRL-EVM.

Note

To program devices, the TPLD-PROGRAM board and InterConnect Studio are required.

TI only supports the use of the cables provided in the TPLD-PROGRAM kit to interface between the EVM and the programmer board.

1.2 Kit Contents

Table 1-1. TPLD801-DRL-EVM Kit Contents

Item	Description	Quantity
TPLD801-DRL-EVM	PCB	1
TPLD801DRL	8-pin TI Programmable Logic Device	6
Quick start guide	Guide to setup system	1

1.3 Specification

PARAMETER	CONDITIONS	MIN	TYP	MAX	UNIT
Vcc	Powered by programmer		3.3		V
Vcc	External Power	1.71		5.5	V
Vi	Per pin input	0		Vcc	V
Vo	Per pin output	0		Vcc	V
GPI	Input	0		Vcc	V

1.4 Device Information

The TPLD801 is a cost-optimized device that offers a rich set of functionality in a small form factor, supports an extended temperature range from -40°C to 125°C, and operates with supply voltages ranging from 1.71V to 5.5V. System designers can create circuits and configure the macrocells, I/O pins, and interconnections by temporarily emulating the non-volatile memory or by permanently programming the one-time programmable (OTP) memory through InterConnect Studio software.

2 Hardware

2.1 Functional Blocks

This section covers the different functional blocks of the TPLD801-DRL-EVM.

2.1.1 Test Points

Each GPIO and GPI pin of a socketed TPLD801DRL part is connected directly to a test point to allow a user to access each pin of the device for probing and testing. The pins are connected to test points as follows:

Pin Number	IO name	Test Point
1	IO1	TP1
2	IO2	TP2
3	IO3	TP3
5	IO4	TP5
6	IO5	TP6
7	GPI	TP7

Each test point is connected directly to the corresponding pin, so any disconnected header pins do not disconnect the test points from the pins.

2.1.2 Programmer Header Block (P1)

The programmer header block accepts the 14-position cable used to connect the TPLD801-DRL-EVM to the TPLD-PROGRAM. TI recommends using this header to connect only to the TPLD-PROGRAM using the cables included in the TPLD-PROGRAM kit. The header is keyed, so the 14-position cable can only be inserted to the case with the key facing the correct direction. To connect the TPLD801-DRL-EVM to a TPLD-PROGRAM, follow the steps in Section 3.2.

SW8 connects the 3V3 line of the programmer header to the VCC line of the EVM. When powering the EVM from the TPLD-PROGRAM, the 3V3 line must be in the ON position.

2.1.3 External Connection Header Block

The P2 header block is intended to be used to interface the TPLD801-DRL-EVM with an external system. Using the guide printed on the EVM silkscreen, the TPLD pins can be interfaced with an external system to allow for prototyping and testing in customer systems. When supplying power to the TPLD using the P2 header block, SW8 needs to be in the OFF position and a shunt placed on J1, connecting the external VCC supply from P2 (VCC_EXT) to the VCC net of the EVM. TI recommends not connecting the board to an external system and to the TPLD-PROGRAM at the same time to avoid the risk of damage to the TPLD-PROGRAM and the external system.

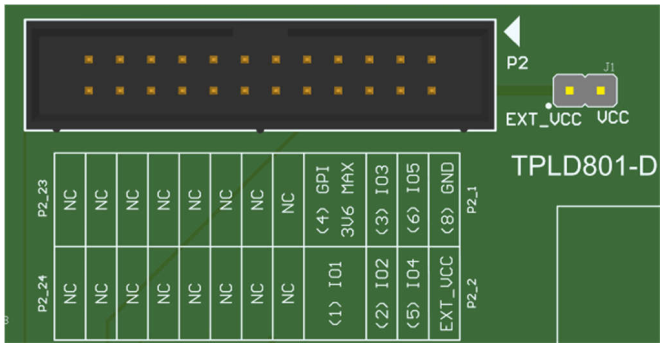


Figure 2-1. P2 and J1 Headers

2.1.4 GPI Protection Block

During the permanent programming process, 8V is applied to the GPI pin of the TPLD. This circuit prevents the voltage at P2 from exceeding 3.3V.

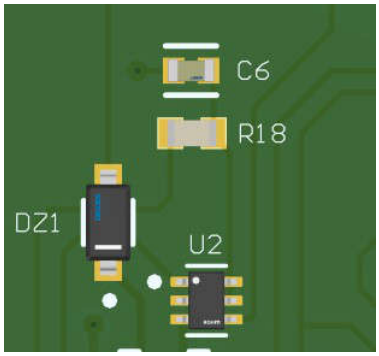


Figure 2-2. GPI Protection Block

2.1.5 DRL Socket

The DRL socket for testing and programming TPLD devices without soldering a device to the EVM.

To place a device in the socket, follow the steps in Section 3.2.

2.1.6 SW or LED Testing Blocks

Each IO pin of the TPLD801DRL except for the GPI pin (pin 7) is connected to a SW/LED testing block. Each SW/LED block consists of a 4-position header that can be connected to a tactile switch with an optional debounce circuit, or to an LED. One side of the 4-position header, labeled OFF, connects directly to the switch output, and the other side of the 4-position header, labeled ON, connects to a debounce circuit leading to the switch output. The pin labeled LED connects to an LED. The middle pin of the header connects to the corresponding TPLD pin. To connect directly to the switch output, place a shunt between the middle pin of the header and the OFF pin. To connect to the debounce circuit, place a shunt between the middle pin of the header and the OFF pin. To connect to the LED, place a shunt between the middle pin of the header and the LED pin. If no shunt is placed between any set of pins, then the TPLD pin is floating.

Each SW/LED Block has soldering spots for optional pull-up and pull-down resistors. These are initially de-populated and are labeled PU and PD, respectively.

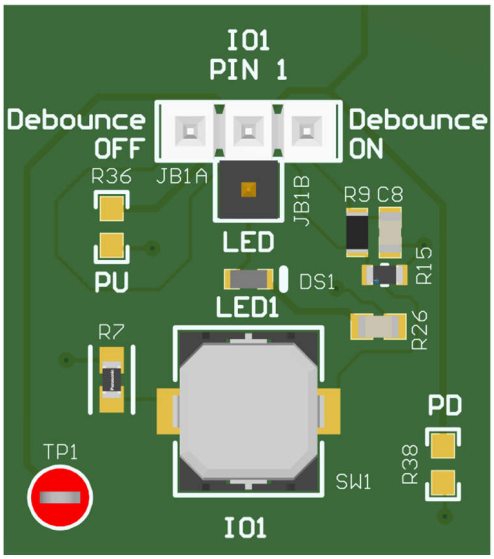


Figure 2-3. Switch/LED Blocks

2.1.7 GPI Switch Testing Block

The GPI line is connected to a tactile switch. This switch has no debounce features. This is to protect the GPI signal during programming. The GPU switch block has soldering spots for optional pull-up and pull-down resistors. These are initially de-populated and are labeled PU and PD, respectively. Do not attempt to permanently program the device with either a pull-up or pull-down resistor installed on the GPI line.

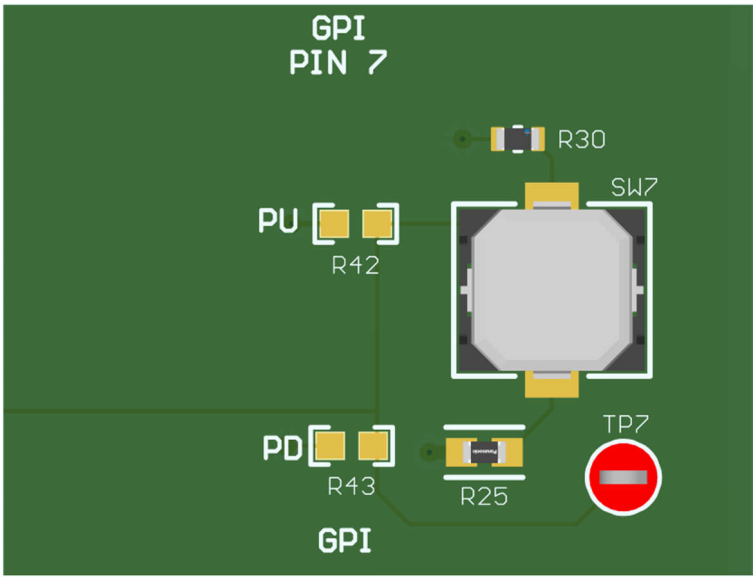


Figure 2-4. GPI Switch Block

3 Software

3.1 Using the TPLD801-DRL-EVM

This section covers using the TPLD801-DRL-EVM to program TPLD801DRL. For more help using InterConnect Studio (ICS) to create your own circuit, see the InterConnect Studio User's Guide.

3.1.1 Equipment Needed for Programming

To program a TPLD device with the TPLD801-DRL-EVM, a TPLD-PROGRAM kit and a computer running InterConnect Studio are needed. The TPLD-PROGRAM kit includes everything required to interface a computer to the TPLD801-DRL-EVM. InterConnect Studio can be downloaded from TI.com by following the instructions in Section 3.1.2.

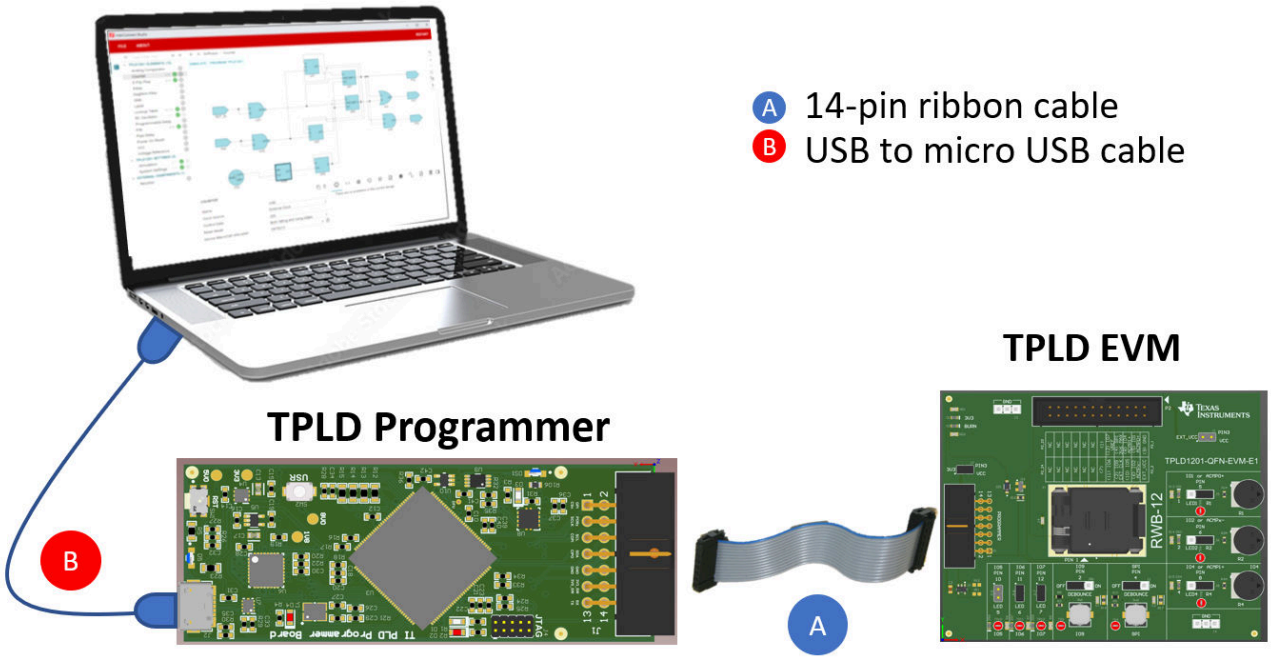


Figure 3-1. Connecting a TPLD EVM and Programmer

3.1.2 Installing Software

InterConnect Studio (ICS) is available free of charge at interconnect_studio.itg.ti.com

For more information on using InterConnect Studio (ICS), reference the InterConnect Studio User's Guide.

3.2 Configuring a TPLD Device

This section covers the steps to use the TPLD801-DRL-EVM and a TPLD-PROGRAM kit to program a TPLD801DRL.

3.2.1 TPLD801-DRL-EVM Setup for Programming

Make sure that the following conditions are met:

1. Set SW8 to the ON position.
2. Make sure that all SW/LED testing blocks are **NOT** set to *Debounce On*.
3. Make sure no pull-up or pull-down resistor is installed on the GPI block.
4. Remove the EXT_VCC (J1) shunt.
5. Disconnect P2 from any external system.

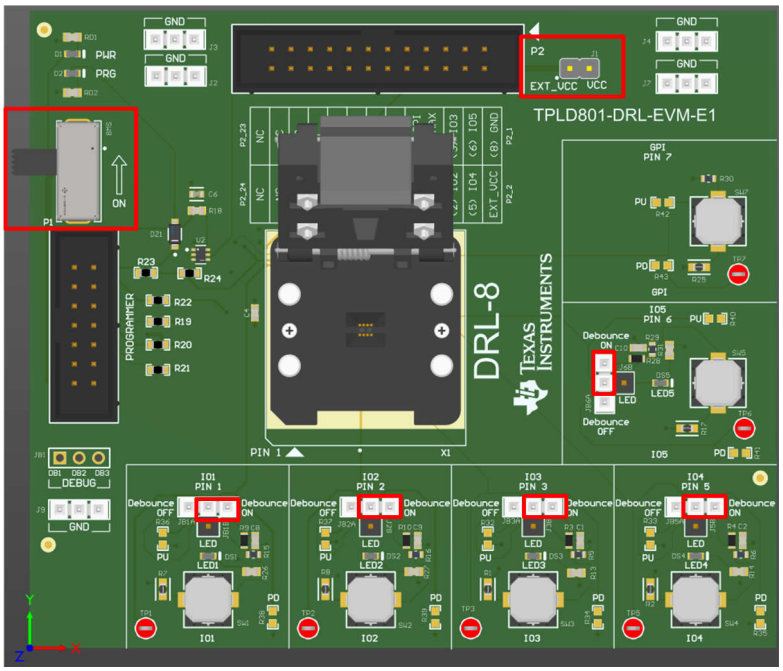


Figure 3-2. Components Considered in Programming Setup

3.2.2 Inserting a TPLD801DRL into the DRL Socket

Do not remove, replace, or add a TPLD device to or from a powered board. Do not place fingers inside the socket or touch the contacts on the bottom of the socket. TI recommends following typical ESD protection procedures while handling the TPLD801DRL.

1. Open the socket by gently pulling the latch until the lid snaps open.
2. Make sure that the socket is clean by blowing off socket contacts and device pads with clean compressed air.
3. Use a vacuum pen or antistatic tweezers to guide the part into the socket, aligning pin 1 of the part to pin 1 of the socket as shown below.
4. Close the socket lid until the latch snaps and holds the lid in place.

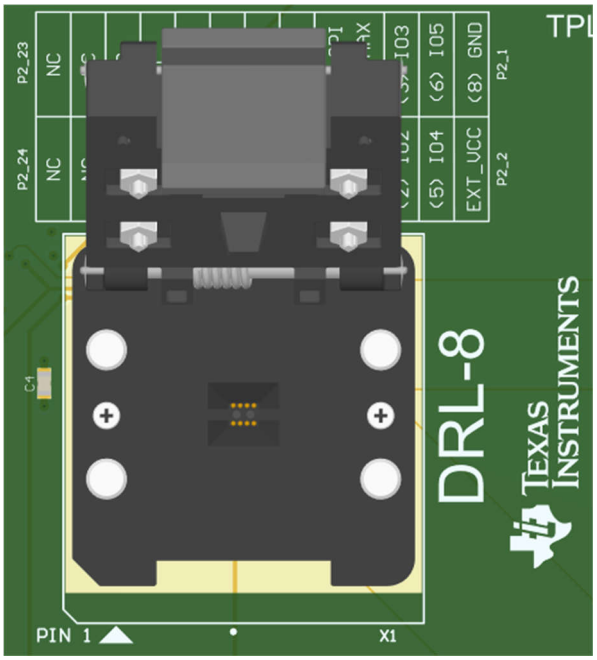


Figure 3-3. DRL Socket

3.2.3 Connecting the TPLD801-DRL-EVM to a TPLD-PROGRAM Board

All cables included are keyed and can only be plugged in when facing the correct direction. If a cable cannot be inserted with the application of a gentle amount of force, try swapping the orientation of the cable and making sure that the header housings are unobstructed before trying again. Forcing the connections can cause damage to the cables and boards.

1. Connect the programmer board to a computer running InterConnect Studio using the provided USB cable. Make sure that a good connection is made between the TPLD-PROGRAM and the computer, indicated by the two blue LEDs on the TPLD-PROGRAM both being on. An example of a fully connected EVM can be seen in Section 3.1.
2. Connect the TPLD-PROGRAM to the TPLD801-DRL-EVM using the provided 14-position ribbon cable. Make sure that a good connection is made between the TPLD801-DRL-EVM and the TPLD-PROGRAM, indicated by the 3V3 LED in the top left of the EVM being on.

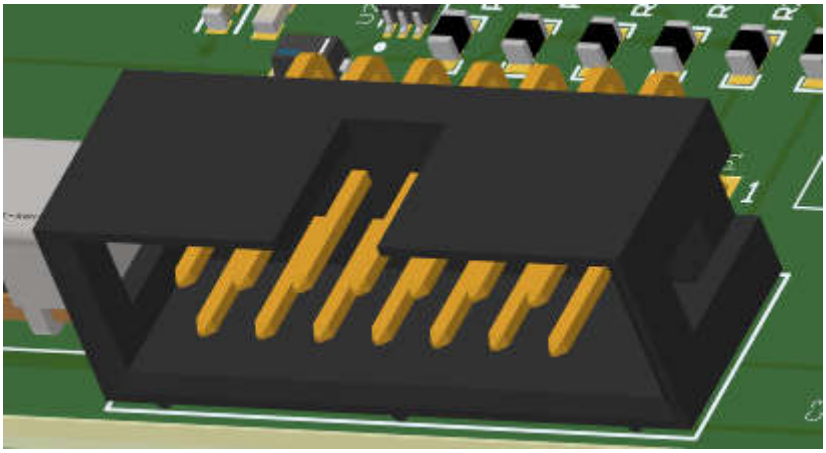


Figure 3-4. Keyed Header Socket

3.2.4 Temporarily Configuring a TPLD Device

This section covers using InterConnect Studio to configure a TPLD801.

When the TPLD is temporarily configured, removing power from the device causes the TPLD to reset and the configured circuit to be erased. The TPLD can be reconfigured multiple times without needing to be reset between configurations.

1. Open InterConnect Studio on the computer to which the TPLD-PROGRAM is connected. Under *Design*, select *TPLD801*. Under *Package:*, select *DRL (SOT-5X3, 8)*.
2. Select *Empty Design* to build a custom circuit, or select one of the premade demo circuits.

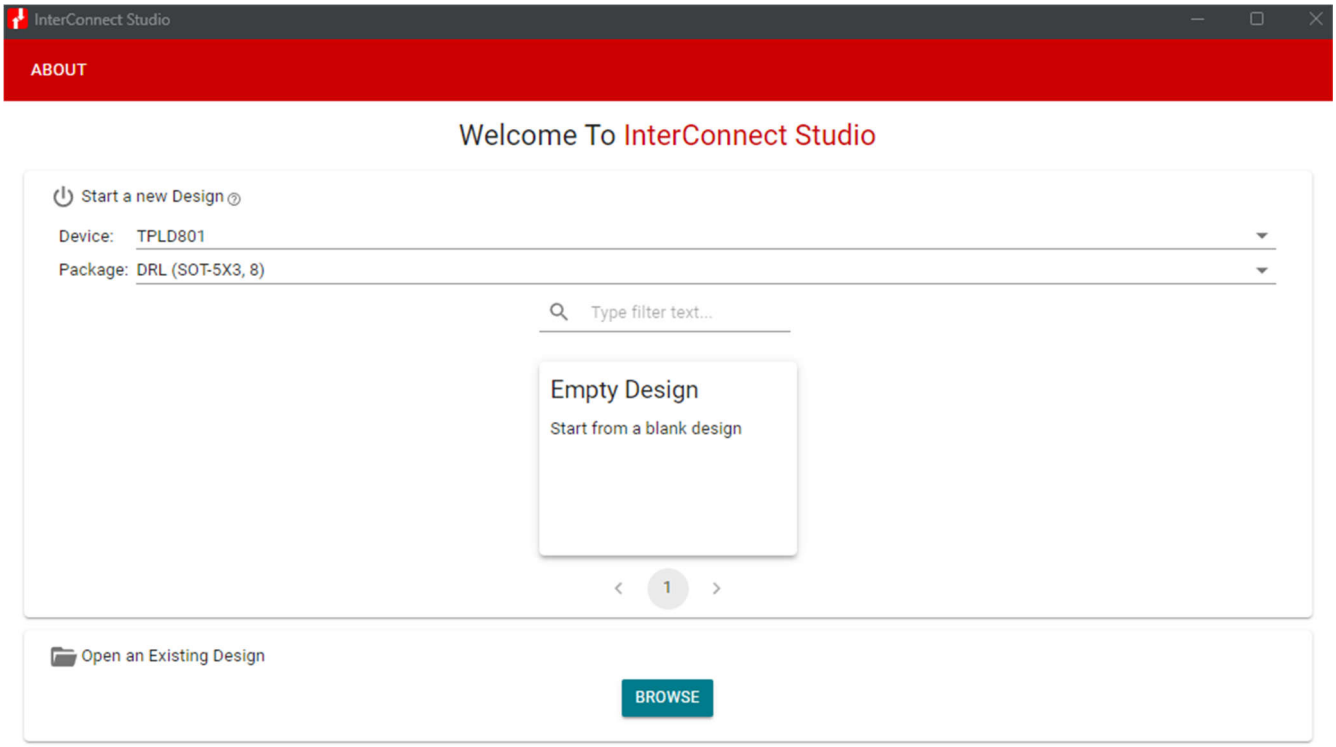


Figure 3-5. Selecting TPLD801DRL in ICS

3. InterConnect Studio opens the chosen circuit.
4. Select the thee dots icon next to *Configure TPLD801* and make sure that the *Permanently Configure Device* is unchecked.
5. Select *CONFIGURE TPLD801* in the top left corner of InterConnect Studio to configure the TPLD in the socket of the EVM with the circuit shown by InterConnect Studio. Select the serial port connected to the TPLD-PROGRAM, then select *OK*.

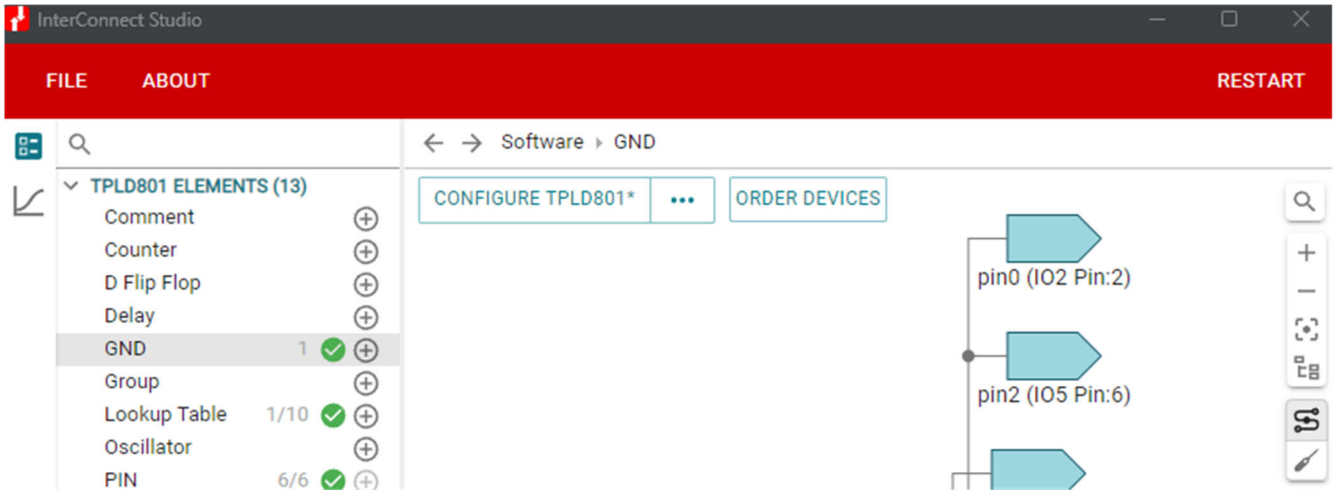


Figure 3-6. Temporarily Configuring in ICS

a. Some LEDs on the TPLD801-DRL-EVM can flash during the programming sequence, which is normal.
b. If the configuration fails, check the connections between the EVM and the computer, make sure SW8 is ON, check the connection between the TPLD device and the socket contacts, confirm that the shunt setup is correct according to Section 3.2.1 and retry.

Once the programming sequence is completed, the TPLD device on the board is temporarily configured with the circuit built in InterConnect Studio. The configured circuit can be tested using the buttons and LEDs provided on the EVM.

3.2.5 Permanently Programming a TPLD Device

This section covers using InterConnect Studio to permanently program a TPLD801. Permanently programmed devices retain the configuration the devices are programmed with after power is reset.

Permanently programmed devices must not be permanently programmed again to avoid damaging the device.

1. Open the desired configuration to be permanently programmed in the TPLD801 in InterConnect Studio.
2. Open the Configure Settings by selecting the three dots icon beside the *CONFIGURE TPLD801* button.
3. Select *Permanently Configure Device*. If using a TPLD-PROGRAM to power the EVM, then leave the Power Source as *Programmer*. Select *OK*.

Figure 3-7. Permanent Programming in ICS

4. Select the serial port connected to the TPLD-PROGRAM, then select *OK* again.
   a. Some LEDs on the TPLD801-DRL-EVM can flash during the programming sequence, which is normal.
   b. If the programming fails, check the connections between the EVM and the computer, make sure SW8 is ON, check the connection between the TPLD device and the socket contacts, confirm that the shunt setup is correct according to Section 3.2.1 and retry.
5. Remove power from the EVM before removing the permanently programmed TPLD801.

4 Hardware Design Files

4.1 Schematics

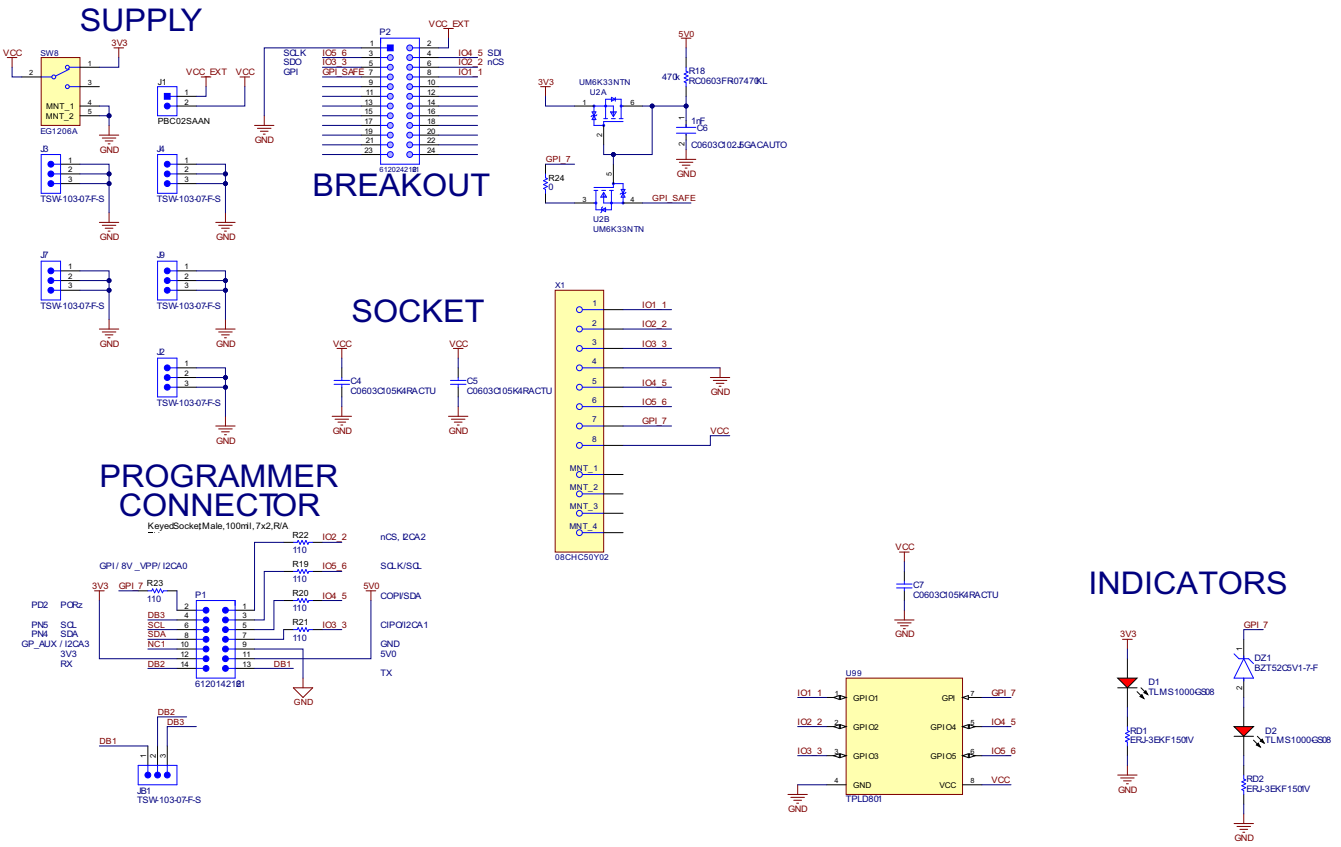


Figure 4-1. TPLD801-DRL-EVM Schematic 1

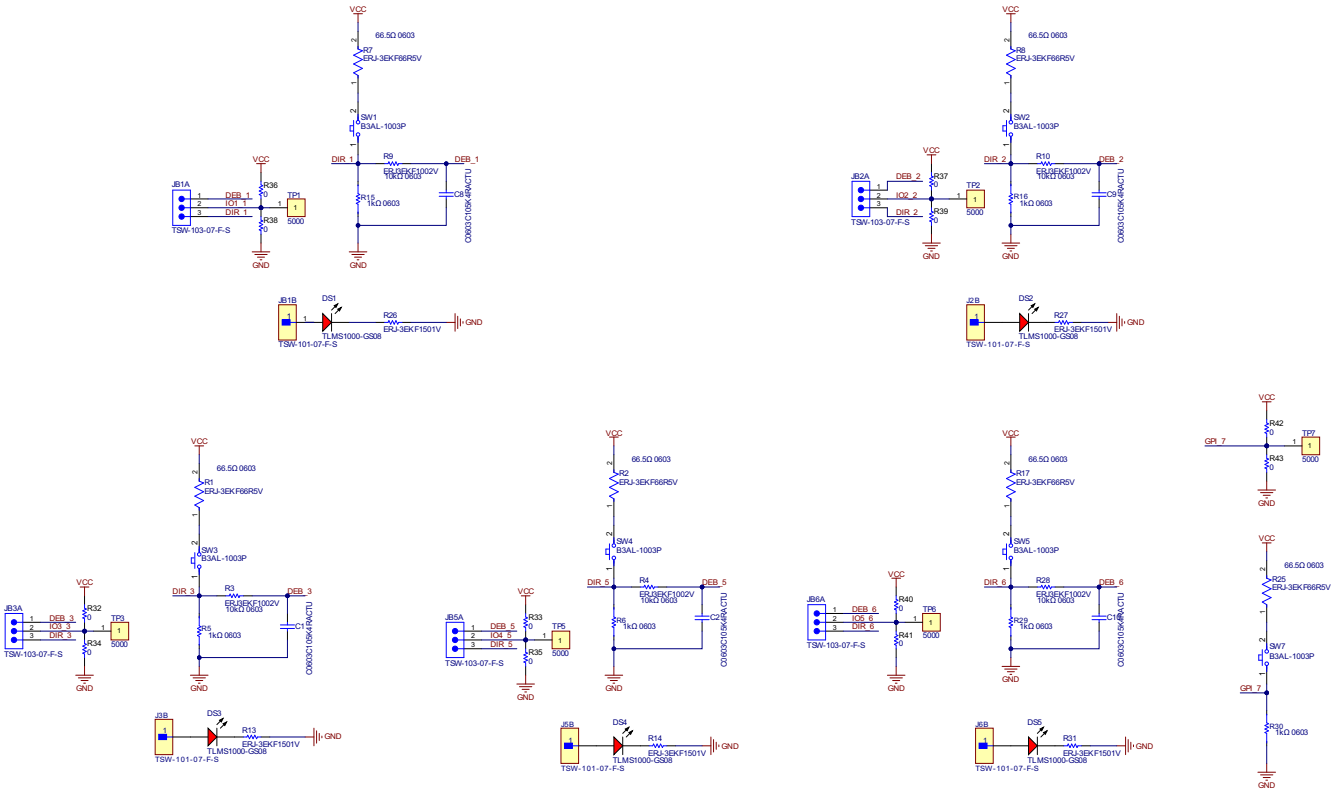


Figure 4-2. TPLD801-DRL-EVM Schematic 2

4.2 PCB Layout

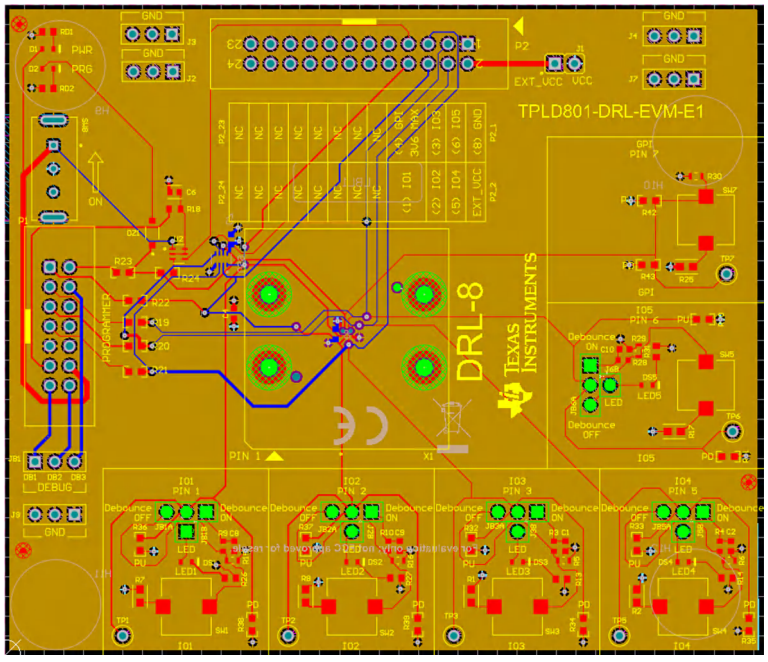


Figure 4-3. TPLD801-DRL-EVM Layout

4.2.1 PCB Overview

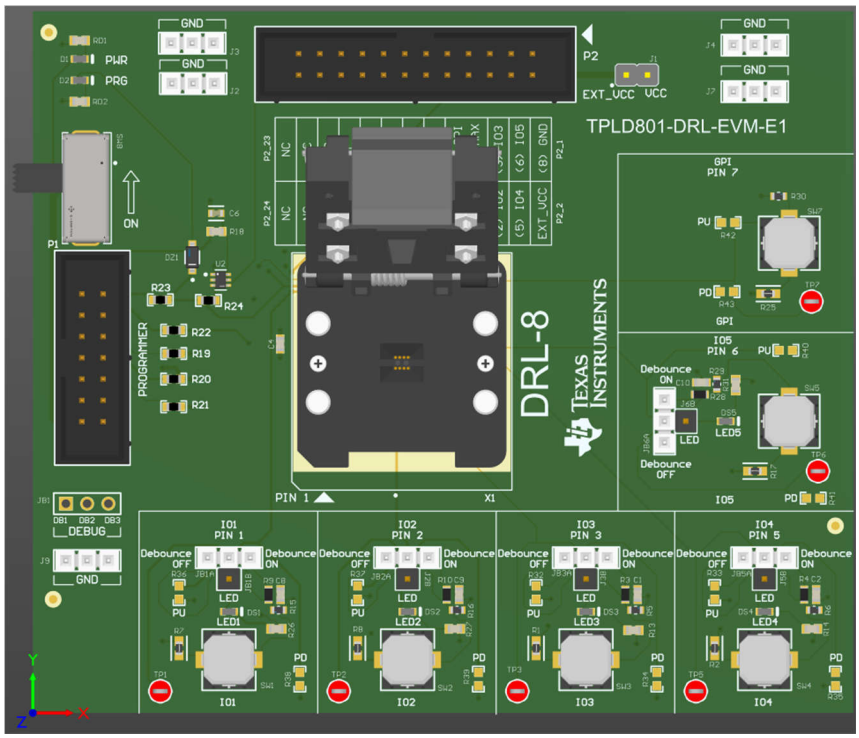


Figure 4-4. TPLD801-DRL-EVM Board (Top View)

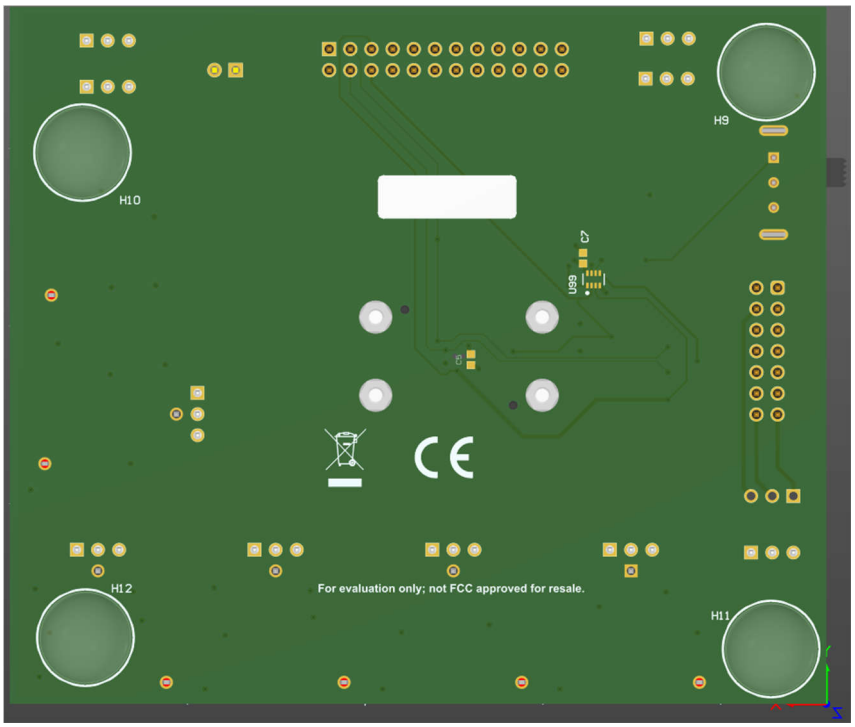


Figure 4-5. TPLD801-DRL-EVM Board (Bottom View)

4.3 Bill of Materials

This section provides information on the components that can be used with the TPLD801-DRL-EVM. Other components can be used as long as the components are able to fit the provided plated holes and pads.

Table 4-1. Bill of Materials

Designator	Item	Value	Manufacturer	Part Number
X1	Socket	DRL	Plastronics	08CHC50Y02
TP1, TP2, TP3, TP5, TP6, TP7	Test Point	Red	Keystone Electronics	5000
P1	Header	7x2	Wurth Electronics	61201421621
P2	Header	12x2	Wurth Electronics	61202421621
SW1, SW2, SW3, SW5, SW4, SW7	Switch	Tactile	Omron	B3AL-1003P
DZ1	Diode	5.1	Diodes	BZT52C5V1-7-F
C6	Capacitor	1000pF	KEMET	C0603C102J5GACAUTO
C1, C2, C4, C8, C9, C10	Capacitor	1 uF	KEMET	C0603C105K4RACTU
R5, R6, R15, R16, R29, R30	Resistor	1 kOhm	Vishay	CRCW06031K00FKEAC
R19, R20, R21, R22, R23	Resistor	110 Ohm	Vishay / Dale	CRCW0603110RJNEA
SW8	Switch	Slide	E-Switch	EG1206A
R3, R4, R9, R10, R28	Resistor	10 kOhm	Vishay Dale	ERJ3EKF1002V
R1, R2, R7, R8, R17, R25	Resistor	66.5 Ohm	Panasonic	ERJ-3EKF66R5V
R13, R14, R26, R27, R31, RD1, RD2	Resistor	1.5 kOhm	Panasonic	ERJ-3EKF1501V
J1	Header	2x1		PBC02SAAN
R18	Resistor	470 kOhm	Yageo	RC0603FR-07470KL
R24	Resistor	0 Ohm	Stackpole Electronics Inc	RMCF0603ZT0R00
H9, H10, H11, H12	Bumpon	Clear	3M	SJ-5303 (CLEAR)
SH-J1, SH-J2, SH-J3, SH-J4, SH-J5, SH-J6, SH-J7, SH-J8	Shunt		Sullins Connector Solutions	SPC02SYAN
D1, D2, DS1, DS2, DS3, DS4, DS5	LED	1.8V	Vishay	TLMS1000-GS08
J1B, J2B, J3B, J6B, JB5B	Header	1x1	Samtec	TSW-101-07-F-S
J2, J3, J4, J7, J9, JB1A, JB2A, JB3A, JB4A, JB5A	Header	3x1	Samtec	TSW-103-07-F-S
U2	Transistor	Dual	Rohm	UM6K33NTN

5 Additional Information

5.1 Trademarks

All trademarks are the property of their respective owners.

6 Revision History

NOTE: Page numbers for previous revisions may differ from page numbers in the current version.

Changes from Revision A (October 2024) to Revision B (October 2024)	Page
• Updated TPLD801-DRL-EVM schematic images	11

Changes from Revision * (August 2024) to Revision A (October 2024)	Page
• Updated marketing status to initial release	1
• Updated hardware image	1

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