

## Power GreenPAK™ Development Motherboard

Development Board for Power GreenPAK™ Family Products

The Power GreenPAK™ Development Motherboard provides programming, emulation, and testing functions for the Power GreenPAK™ family of integrated circuits. This Development Motherboard is intended to work alongside the Go Configure™ Software Hub.

### Specifications

- USB 2.0 interface
- Windows 7/8.1/10/11, macOS (v10.15 or higher) Ubuntu 18.04/20.04/22.04, Debian 11/Testing

### Board Contents

- Power GreenPAK™ Development Motherboard
- USB 2.0 cable
- 12 V power supply

### Features

- Emulation and programming
- Seven individual programmable power sources
- External power connectors
- Real-time GPIO state control
- Onboard LED GPIO state indication
- Voltage monitor for power channels
- Eight probe connectors

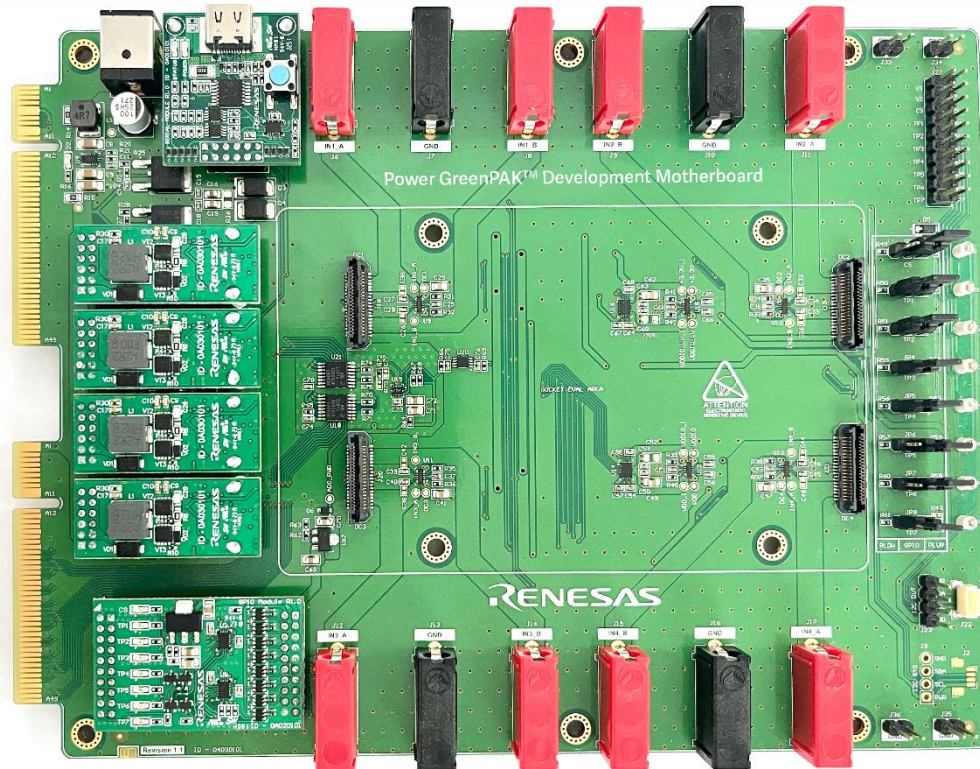


Figure 1. Power GreenPAK™ Development Motherboard

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# 1. Functional Description

The Power GreenPAK™ Development Motherboard R1.0 is made available to provide debugging capabilities for the Power GreenPAK™ family of integrated circuits. It contains all the necessary modules and peripherals to power the IC, program it, emulate the design, measure voltages, and change the input states of the available GPIOs. All interactions between the Power GreenPAK™ Development Motherboard and the Power GreenPAK™ integrated circuit are provided by a set of test points (TP) and power supplies that are configured by the software, depending on the manufacturer part number of the actual IC. There are two main options available for test points – the programming interface and the real-time control interface.

The programming interface works only for programming and emulation sequences. When programming or emulation entry is done, the programming test points transfer their functionality to real-time control, depending on the Power GreenPAK™ IC part number. It is possible to change the GPIO control states by using the Go Configure™ Software. Manual control is also available, where the input states can be set using onboard jumpers.

The board has both internal and external power options. It is possible to use an external power supply connected to the External Power Connectors to power the integrated circuit with a certain voltage level that should not exceed target device specifications. Alternatively, power for the device power inputs can be sourced from internal DC-DC modules.

More detailed information about the Go Configure™ Software can be found in [Go Configure™ Software Hub User Guide](#).

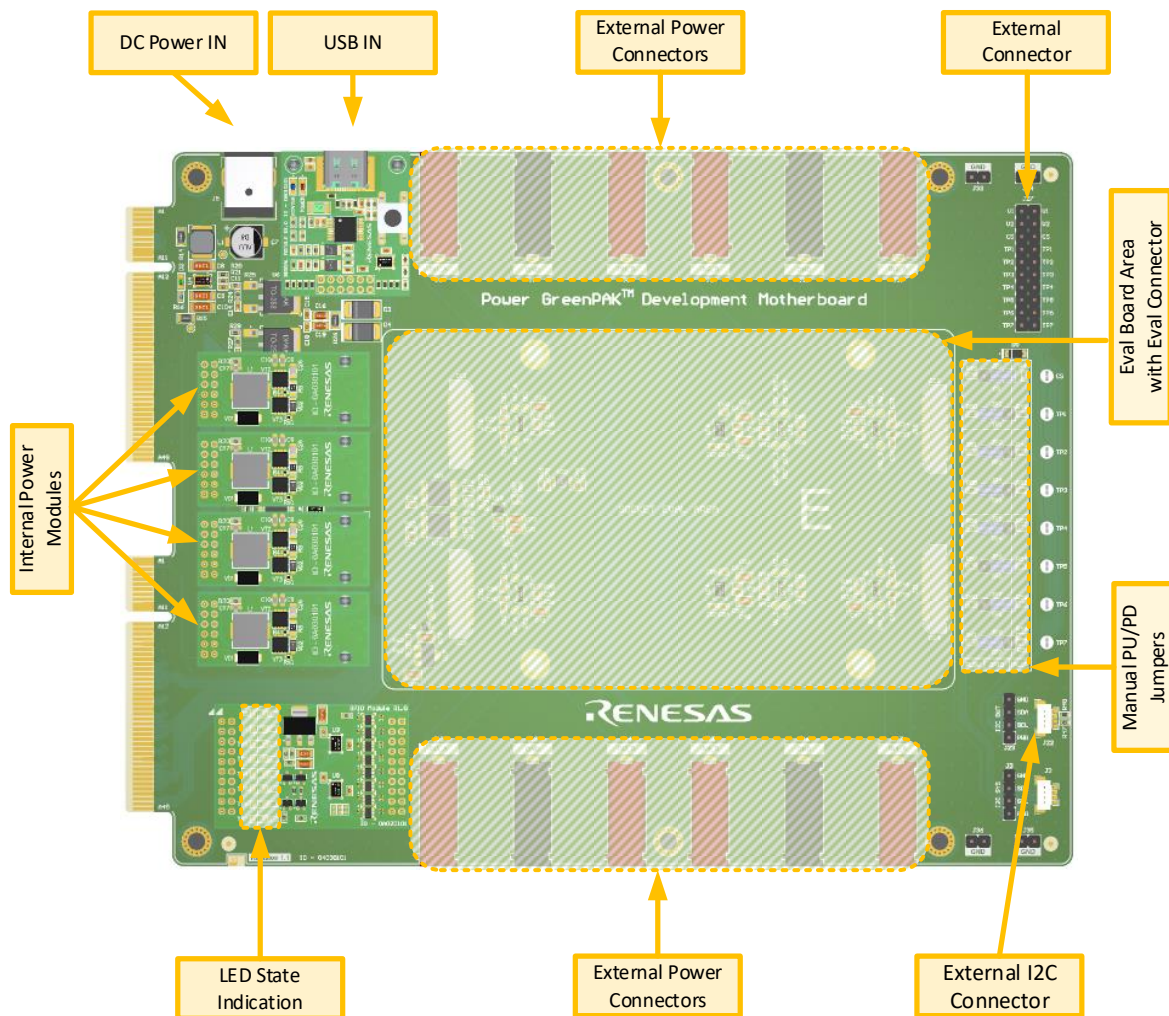


Figure 2. Power GreenPAK™ Development Motherboard Components

Generally, all programming, emulation, and power events are controlled on the PC with the help of the USB control module. Power supply tuning, TP state control, LED state indication, and other features can be set in the Go Configure™ Software. Figure 3 shows a general block diagram that describes the board functions and power domains.

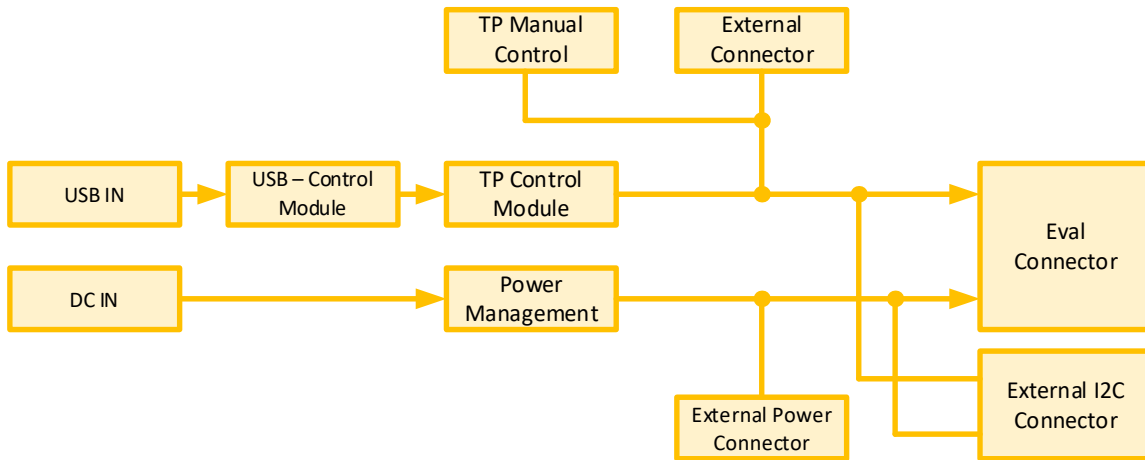


Figure 3. Power GreenPAK™ Development Motherboard General Diagram

The test point state control option is available only by connecting the target device through the Eval Connector and state control is configured in the Go Configure™ Software (GCS). The board supports V<sub>DD</sub>, GND, and Hi-Z states. Additionally, there is an LED indicator option that can also be enabled in the Go Configure™ Software Hub.

Access to all TPs is available via the External Connector. This connector is used for external circuit connection. V1 and V2 are both low-current configurable power sources. TPs are connected to the GPIO pins of the target Power GreenPAK™ device. The correspondence of TPs to the target Power GreenPAK™ device can be checked in the GCS by clicking the TP Map button.

A Manual state control option is implemented by a set of jumpers JP1-JP8. It is also possible to apply a pull-up or pull-down to any TP. If debugging requires a Hi-Z state on certain test points – the corresponding jumper must be removed from the board.

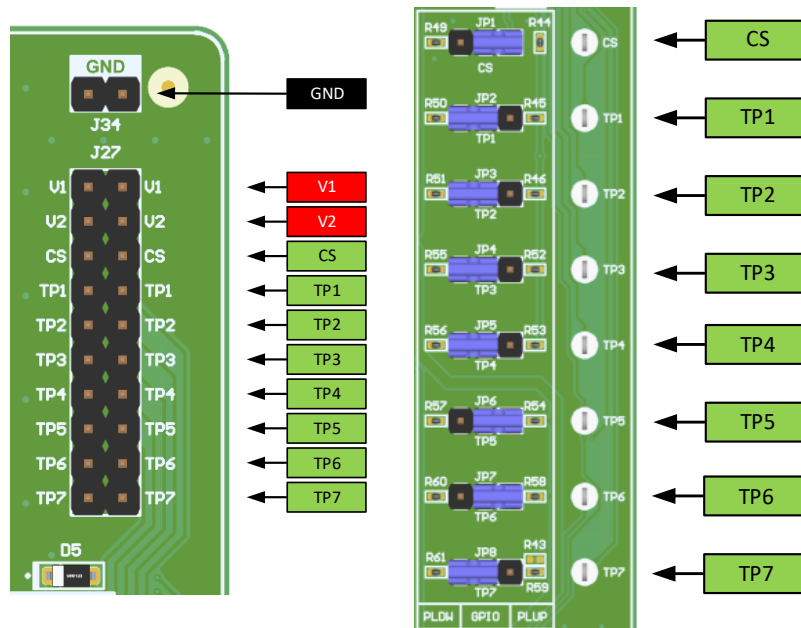


Figure 4. External Connector and Manual Pull-up/Pull-down Control

Figure 5 describes the TP control structure and shows the voltage reference to any TP. All TPs, except TP5 and TP6, belong to the V2 linear power channel. TP5 and TP6 belong to the V\_I2C linear channel and can be used both as I<sup>2</sup>C TPs or state control TPs. The Chip Select (CS) TP belongs to V2 and has a VPP option available that can generate a higher voltage than V<sub>DD</sub> in programming procedures.

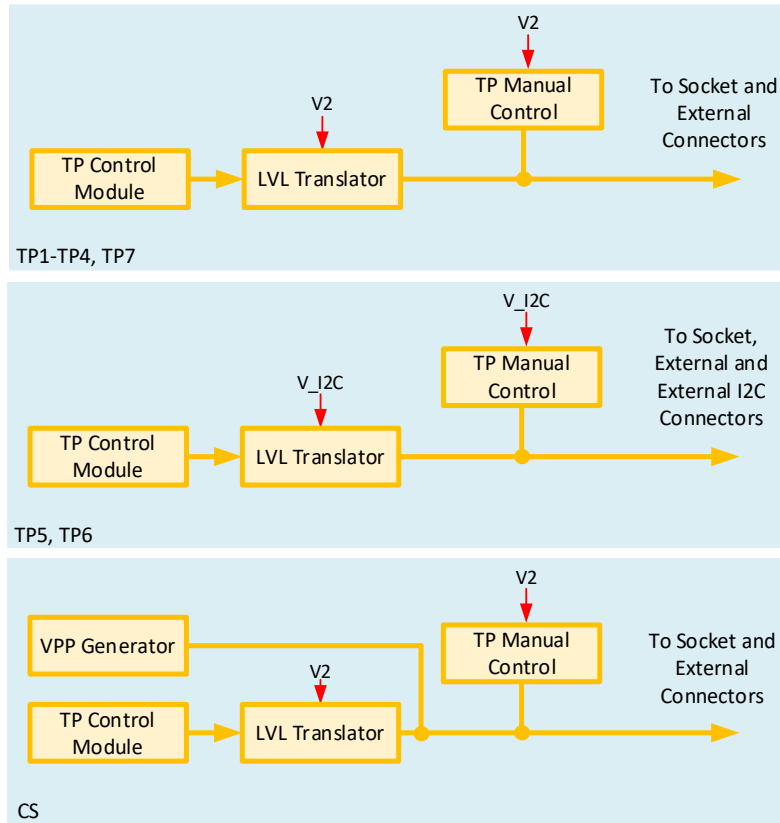


Figure 5. TP Control Structure

Figure 6 shows the manual pull-up and pull-down scheme. By changing a jumper position, it is possible to set pull-up, pull-down, or arrange a Hi-Z state by removing the jumper from the board. All TPs, except TP5 and TP6, belong to the V2 voltage source. TP5 and TP6 belong to V<sub>I2C</sub>. The reference voltage may vary depending on the target device specifications and also the configuration of the Go Configure™ Software.

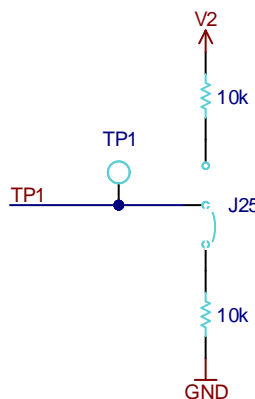


Figure 6. Manual Pull-up and Pull-down Control Scheme

An external I<sup>2</sup>C Connector is used to connect the Evaluation Board to the Power GreenPAK™ Development Motherboard without using the Eval Connector. This can help to avoid additional leakage while testing. In this case, the motherboard works only in USB-I<sup>2</sup>C bridge mode turning the board into GreenPAK™ Serial Debugger. To use this option, the Evaluation Board must be powered from an external power supply (V<sub>DD</sub>, V<sub>DDIO</sub>) and CS

must be pulled up to  $V_{DDIO}$ . The corresponding cable assembly for J22 can be found under the A04SR04SR30K152A manufacturer part number.

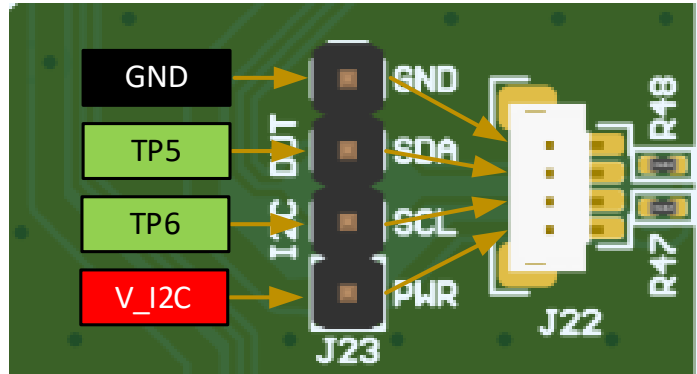


Figure 7. External I<sup>2</sup>C Connector Pinout

The Power GreenPAK™ Development Motherboard has both linear and DC-DC power channels. DC-DC power (IN1-IN4) is used for powering target device LDO inputs directly. Linear supplies are used for  $V_{DD}$ ,  $V_{DDIO}$ , and the I<sup>2</sup>C reference voltage. All power channels have a software range limitation according to the selected Power GreenPAK™ product.

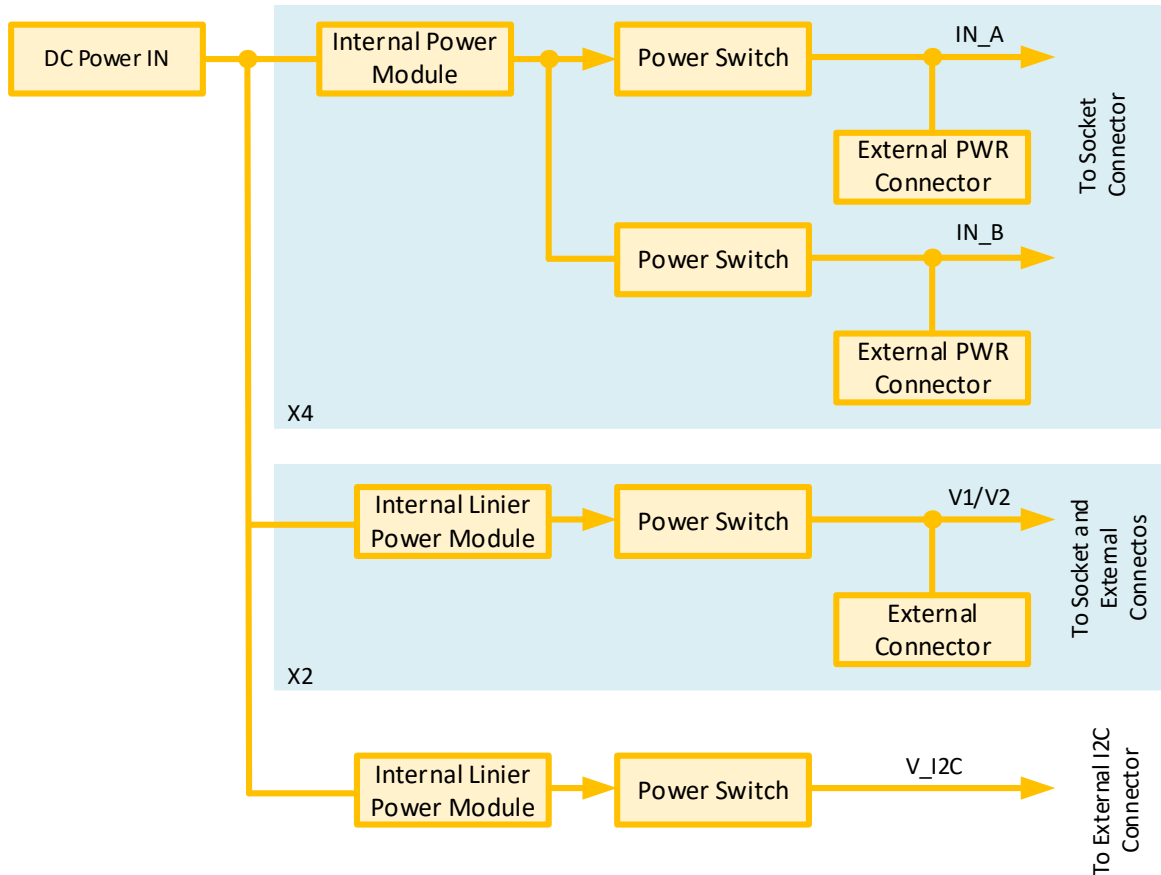


Figure 8. Power Rails Block Diagram

## 2. Operational Characteristics

### 2.1 General Specifications

Parameter	Symbol	Min	Typ	Max	Unit
Voltage Applied to "DC IN" Connector	$V_{DCIN}$	10	12	14	V
Required Current for "DC IN" Connector	$I_{DCIN}$	5	--	--	A
USB Input Voltage	$V_{USB}$	4.75	5	5.25	V
USB Input Current	$I_{USB}$	--	--	100	mA
Operating Ambient Temperature	$T_A$	15	--	45	°C
Board Dimensions		192 x 143			mm <sup>2</sup>
Weight		169			g

### 2.2 TP Specifications

Parameter	Symbol	Condition	Min	Typ	Max	Unit
Output Voltage Level Range	$V_O$	Based on $V_{DD}$ setup	1.2	--	5	V
HIGH-level Output Voltage	$V_{OH}$	$V_{DD} = 5\text{ V}$	4.9	--	--	V
LOW-level Output Voltage	$V_{OL}$	$V_{DD} = 5\text{ V}$	--	--	0.1	V
HIGH-level Output Current	$I_{OH}$	$V_{DD} = 5\text{ V}$	--	--	12	mA
LOW-level Output Current	$I_{OL}$	$V_{DD} = 5\text{ V}$	--	--	-12	mA
Input Voltage Level Range	$V_I$	Based on $V_{DD}$ setup	-0.5	--	$V_{DD} + 0.5\text{ V}$	V
HIGH-level Input Voltage	$V_{IH}$		$0.7 \times V_{DD}$	--	--	V
LOW-level Input Voltage	$V_{IL}$		--	--	$0.3 \times V_{DD}$	V
Input Leakage Current	$I_{LKG}$		-2	--	2	μA
Input Capacitance	$C_{IN}$		--	10	--	pF

### 2.3 Voltage Source Specifications (IN1-IN4)

Parameter	Symbol	Condition	Min	Typ	Max	Unit
Output Voltage	$V_{OUT}$	$I_{OUT} \leq I_{OUT(MAX)}$	0.8	--	5	V
Output Voltage Regulation Step	$V_{STEP}$	$V_{OUT(MIN)} \leq V_{OUT} \leq V_{OUT(MAX)}$	--	5	--	mV
Output Voltage DC Error	$\Delta V_{OUT}$	$I_{OUT} \leq I_{OUT(MAX)}$	-3	--	3	%
Output Load Current	$I_{OUT}$	$V_{OUT(MIN)} \leq V_{OUT} \leq V_{OUT(MAX)}$	0	--	3.0	A
$V_{OUT}$ Slew Rate	SR	$I_{OUT} \leq I_{OUT(MAX)}$	2.24	2.8	4	V/ms

Parameter	Symbol	Condition	Min	Typ	Max	Unit
Load Regulation	DC <sub>LOAD</sub>	$I_{OUT} \leq I_{OUT(MAX)}$	--	5	--	mV
Transient Load Response	AC <sub>LOAD</sub>	$t_r = t_f = 100 \text{ ns}$ ; Step 1.5 A	-20	--	20	mV
Load Capacitance	C <sub>LOAD</sub>		0	--	150	$\mu\text{F}$
Output Ripple	V <sub>RIPPLE</sub>	$I_{OUT} = 1 \text{ A}$	--	15	--	mV

## 2.4 Voltage Source Specifications (V1, V2, V\_I<sup>2</sup>C)

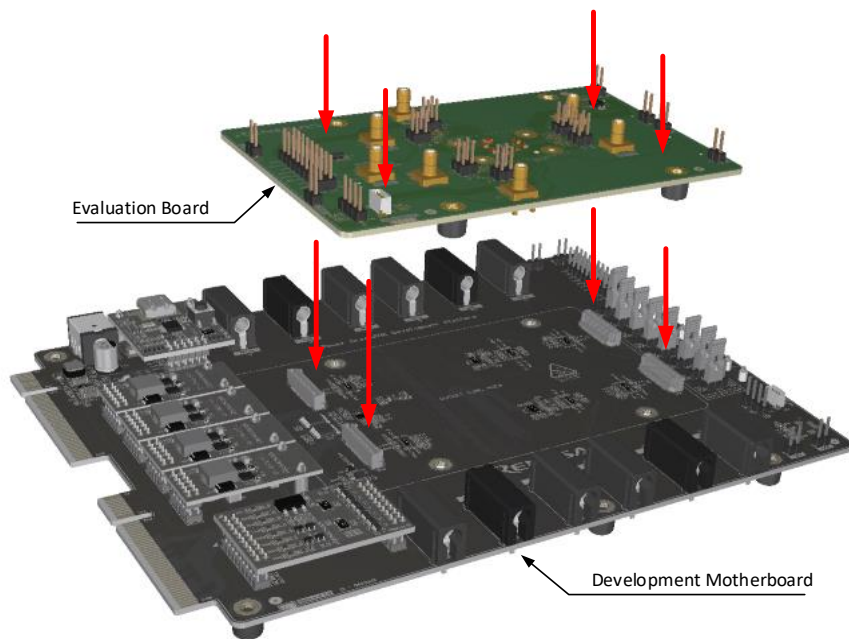
Parameter	Symbol	Condition	Min	Typ	Max	Unit
Output Voltage	V <sub>OUT</sub>	$I_{OUT} \leq I_{OUT(MAX)}$	1.2	--	5	V
Output Voltage DC Error	$\Delta V_{OUT}$	$I_{OUT} \leq I_{OUT(MAX)}$	-3	--	3	%
Output Load Current	I <sub>OUT</sub>	$V_{OUT(MIN)} \leq V_{OUT} \leq V_{OUT(MAX)}$	0	--	100	mA
V <sub>OUT</sub> Slew Rate	SR	$I_{OUT} \leq I_{OUT(MAX)}$	2.24	2.8	4	V/ms



### 3. Setup and Configuration

There are two options to work with the target device using the Power GreenPAK™ Development Motherboard. The first option is the most common, where the Power GreenPAK™ Development Motherboard is connected to the Evaluation Board with the native Eval Connector. The second option is to connect through an external I<sup>2</sup>C interface that can carry I<sup>2</sup>C transfers only.

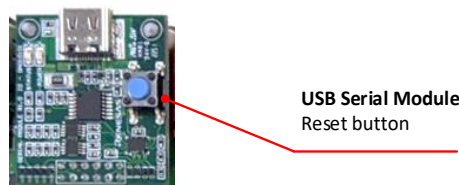
Four identical connectors are used to connect the Evaluation Board to the Development Motherboard. The Evaluation Board connection procedure is shown in Figure 9. Only Evaluation Boards and nothing else can be connected to these connectors.



**Figure 9. Evaluation Board Connection to the Power GreenPAK™ Development Motherboard**

Note that there is only one correct orientation to connect the Evaluation Board to the Development Motherboard.

By pressing the reset button, the board will disappear from the USB device tree for two seconds on the operating system. After disconnecting from the Go Configure™ Software, the board will be reconfigured according to the current project setup.



**Figure 10. Reset Button Location**

The Power GreenPAK™ Development Motherboard includes LEDs that are used to display and indicate the status of some blocks of the entire system. The LEDs are located both on the Motherboard and on the modules (USB Serial Module and GPIO Module). Figure 11 shows their location.

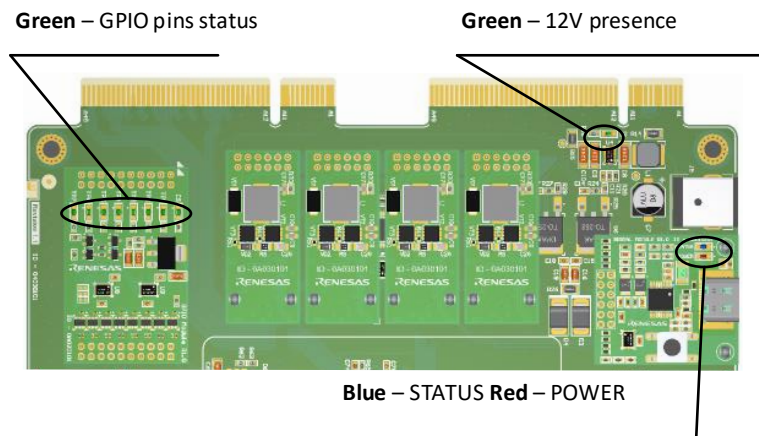


Figure 11. LED Location

Table 1. LED Indication Description

Location	Name	Color	Mode	Description
USB Serial Module	POWER	Red	Soft (Shimmer)/Blink/Static	LED ON (static) – USB bus voltage is within the allowed range and connection to the software is successful. LED OFF – USB disconnected/software did not identify the board/USB bus voltage level out of range. LED is BLINKING – after pressing the reset button, the indicator flashes several times per second.
	STATUS	Blue	ON/Blink	ON – Standby. Blink – USB data transfer active.
Motherboard	D2	Green	Static (ON/OFF)	LED ON – external power supply is connected to the board, and voltage is within the allowed range. LED OFF – external power supply is disconnected, or voltage is out of range.
GPIO Module	TP1-TP7, CS	Green	Static (ON/OFF)	LED ON – high logic level. LED OFF – low logic level or state indication option is disabled.

Probe connectors duplicate signals from an External Connector, excluding V1 and V2 terminals. They also have an identical TP order (CS, TP1-TP7). A typical way of using the hooks is shown in Figure 12.

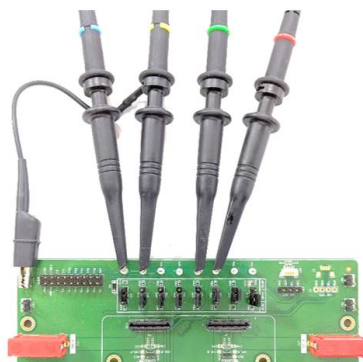





Figure 12. Oscilloscope Connection

## 4. Ordering Information

Part Number	Description
SLG5PGPDM	Power GreenPAK™ Development Motherboard

## 5. Revision History

Revision	Date	Description
1.01	Aug 16, 2024	<p>Update board silkscreen:</p> <p>1) Change board name:  </p> <p>2) Change signal names on "J27":  </p> <p>3) Change LED name:  </p>
1.00	Jul 10, 2024	Initial release