GreenPAK Extension Card #1

Add-on for the Go Configure™ Development Board

Description

The GreenPAK Extension Card #1 is designed to interface with the Go Configure Development Board, allowing development and testing of the GreenPAK™ family mixed-signal ICs. The extension card works in pair with the Go Configure Software Hub.

Specifications

The board's functionality is provided by the Go Configure Development Board from Renesas. The GreenPAK Extension Card #1 provides a connection between the pins of the GreenPAK products and the development board.

Features

- DIP and socket adapters support
- Dual V_{DD} support
- Configurable dual-pin header for the user schematic integration and signal monitoring (expansion connector)
- 32 individually configurable test points (TP)
  - Onboard LED state indication
  - Pull-up, Pull-down, GND, V_{DD}, Hi-Z, V_{DD2}
- Four floating hooks for probe connection
- Current measurement connector
- Four independent prototyping connectors

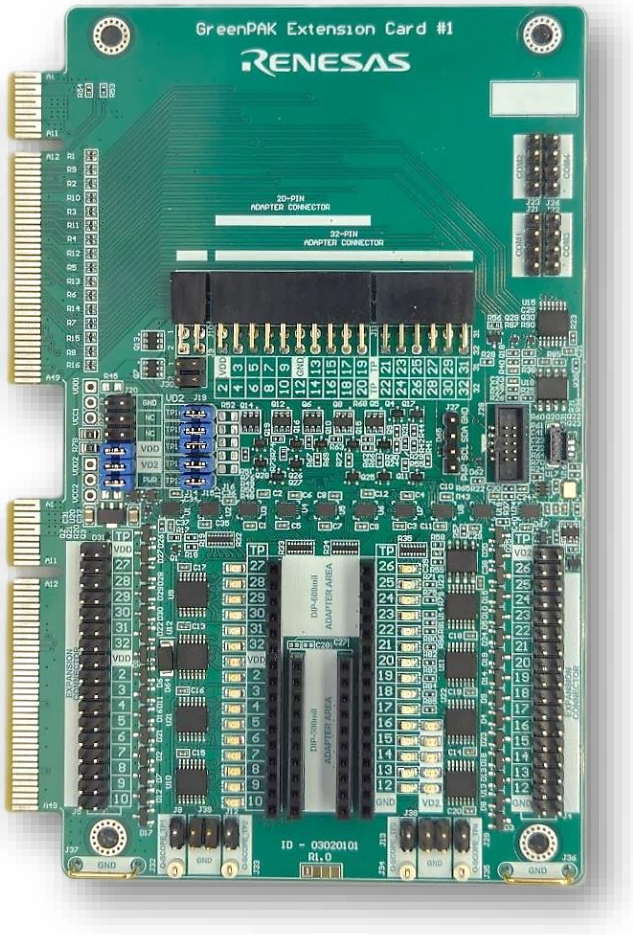

Figure 1. GreenPAK Extension Card #1

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1. Functional Description

The GreenPAK Extension Card #1 provides full debugging capabilities for the GreenPAK family ICs. It transmits the required operating signals from the development board to the GreenPAK target device. An expansion connector is designed to connect the GreenPAK Extension Card #1 to external circuits and to apply external power, signal sources, and loads. It can be used to integrate the GreenPAK chip into your custom design with minimal additional tools.

The main components and their basic functions are shown in Figure 2.

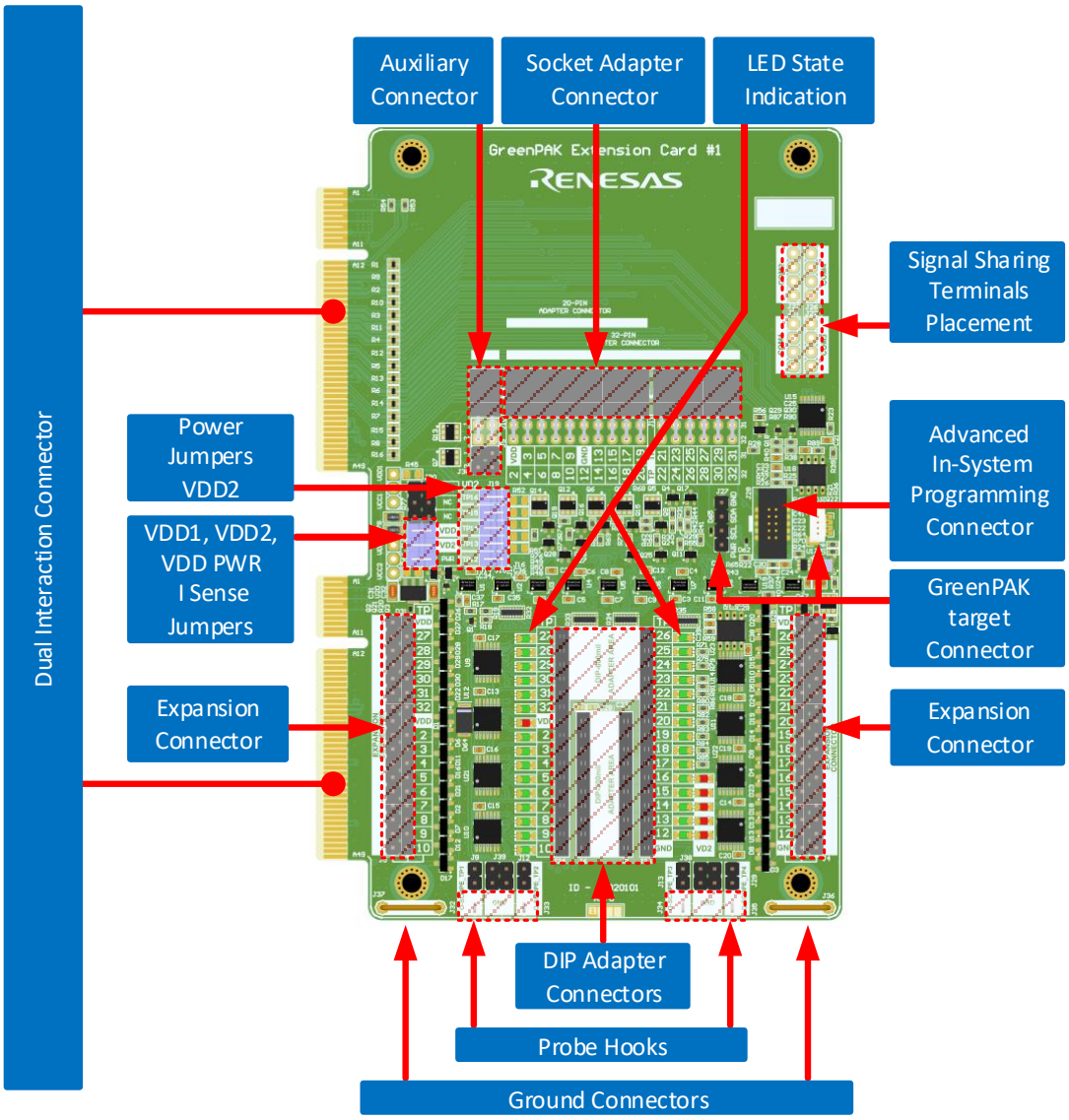

Figure 2. Block Diagram

1.1 Operational Characteristics

All interactions between the extension card and the GreenPAK ICs are provided by a set of test points configured by the software depending on the actual IC's manufacturer part number. There are three main options for test points: programming interface, real-time control interface, and configurable power source. Programming interface works only during programming and emulation sequences. When programming or emulation entry is done, programming interface test points move their functionality to a real-time control or a power source, depending on the GreenPAK part number. The real-time control allows to apply a pull-up or pull-down to the selected test points, connecting an LED for indication, or triggering a virtual button press. Table 1 describes a set of functions for each certain test point.

Table 1. Test Point Functions

Connector		Pin Label	Set to V_{DD1}	Set to V_{DD2}	Set to GND	Pull-Up (V1)	Pull-Up (V2)	Pull-Down	SET Button	Buffered LED	V_{DD1} (V1)	V_{DD2} (V2)	Not connected	EC Connection
32-pin Adapter Connector	20-pin Adapter Connector	TP1 (V_{DD})	+	-	-	-	-	-	-	+	+	-	+	+
		TP2	+	-	+	+	-	+	+	+	-	-	+	+
		TP3	+	-	+	+	-	+	+	+	-	-	+	+
		TP4	+	-	+	+	-	+	+	+	-	-	+	+
		TP5	+	-	+	+	-	+	+	+	-	-	+	+
		TP6	+	-	+	+	-	+	+	+	-	-	+	+
		TP7	+	-	+	+	-	+	+	+	-	-	+	+
		TP8	+	-	+	+	-	+	+	+	-	-	+	+
		TP9	+	-	+	+	-	+	+	+	-	-	+	+
		TP10	+	-	+	+	-	+	+	+	-	-	+	+
		GND	-	-	+	-	-	-	-	-	-	-	-	-
		TP12	-	+	+	-	+	+	+	+	-	+	+	+
		TP13	-	+	+	-	+	+	+	+	-	+	+	+
		TP14	-	+	+	-	+	+	+	+	-	+	+	+
		TP15	-	+	+	-	+	+	+	+	-	+	+	+
		TP16	-	+	+	-	+	+	+	+	-	+	+	+
		TP17	-	+	+	-	+	+	+	+	-	-	+	+
		TP18	-	+	+	-	+	+	+	+	-	-	+	+
		TP19	-	+	+	-	+	+	+	+	-	-	+	+
		TP20	-	+	+	-	+	+	+	+	-	-	+	+
		TP21	-	+	+	-	+	+	+	+	-	-	+	+
		TP22	-	+	+	-	+	+	+	+	-	-	+	+
		TP23	-	+	+	-	+	+	+	+	-	-	+	+
		TP24	-	+	+	-	+	+	+	+	-	-	+	+
		TP25	-	+	+	-	+	+	+	+	-	-	+	+
		TP26	-	+	+	-	+	+	+	+	-	-	+	+
		TP27	+	-	+	+	-	+	+	+	-	-	+	+
		TP28	+	-	+	+	-	+	+	+	-	-	+	+
		TP29	+	-	+	+	-	+	+	+	-	-	+	+
		TP30	+	-	+	+	-	+	+	+	-	-	+	+
		TP31	+	-	+	+	-	+	+	+	-	-	+	+
		TP32	+	-	+	+	-	+	+	+	-	-	+	+

1.2 Power Distribution

Figure 3 shows a simplified power distribution scheme within the GreenPAK Extension Card #1. The extension card does not contain power sources and acts as a power distribution add-on to the compatible Go Configure Development Board. The V_{DD1} power rail has direct connection to corresponding pins of the DIP and socket connectors, while the V_{DD2} line has a software – controlled power selector switches. This option provides a possibility to support multiple dual power GreenPAK products by sourcing the V_{DD2} power line to one of the possible test points. V_{DDC} is used for work with the low-voltage GreenPAK products and applied only to Four Pins GreenPAK Target Connectors.

V_{DD1}, V_{DD2}, and V_{DDC} power rails can also be connected to one of the multiple external connectors through the software – controlled bidirectional switches SW1, SW2, SW3. The same circuits provide a possibility to use the GreenPAK Extension Card #1 in an external power supply mode, when the GreenPAK devices are powered via the external connectors and the development board is used only as a control hub. Buffers 1, 2, 3 eliminate possible leakage currents and allow external voltage sensing on E_V_{DD1}, E_V_{DD2}, and V_{PWR} lines. Corresponding feature selector is available in the Go Configure Software Hub window. More information about the connector pinouts and external voltage level requirements can be found in section 2 Working with GreenPAK.

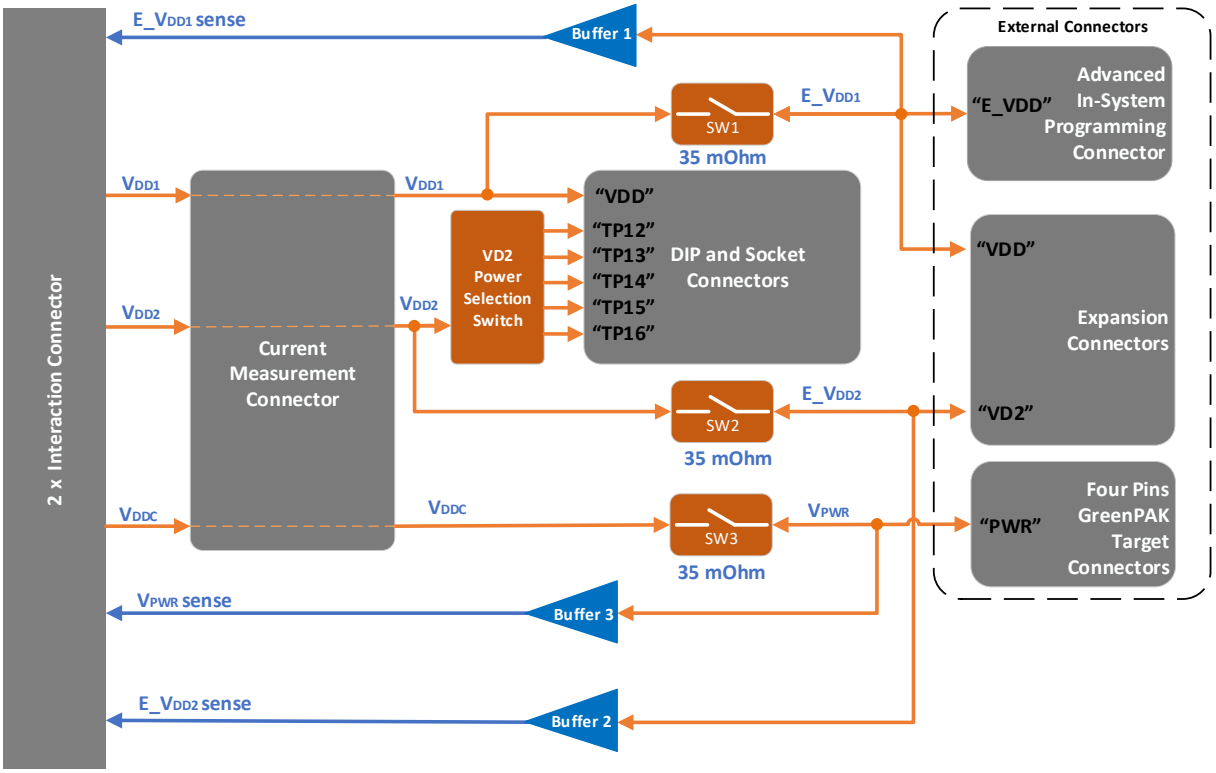

Figure 3. Simplified Power Distribution Diagram

1.3 Setup and Configuration

The GreenPAK Extension Card #1 is designed as an add-on for the Go Configure Development Board. All functions and custom features are controlled via the Go Configure Software Hub.

To start working with the GreenPAK products:

1. Download and install Go Configure™ Software Hub.
2. Connect the Go Configure Development Board to the GreenPAK Extension Card #1 (see Figure 4).
3. Connect the GreenPAK family device (see section 2 Working with GreenPAK).
4. Connect the platform to the PC via a USB Type-C cable.

More information about the Go Configure Software Hub can be found in the Go Configure™ Software Hub User Guide.

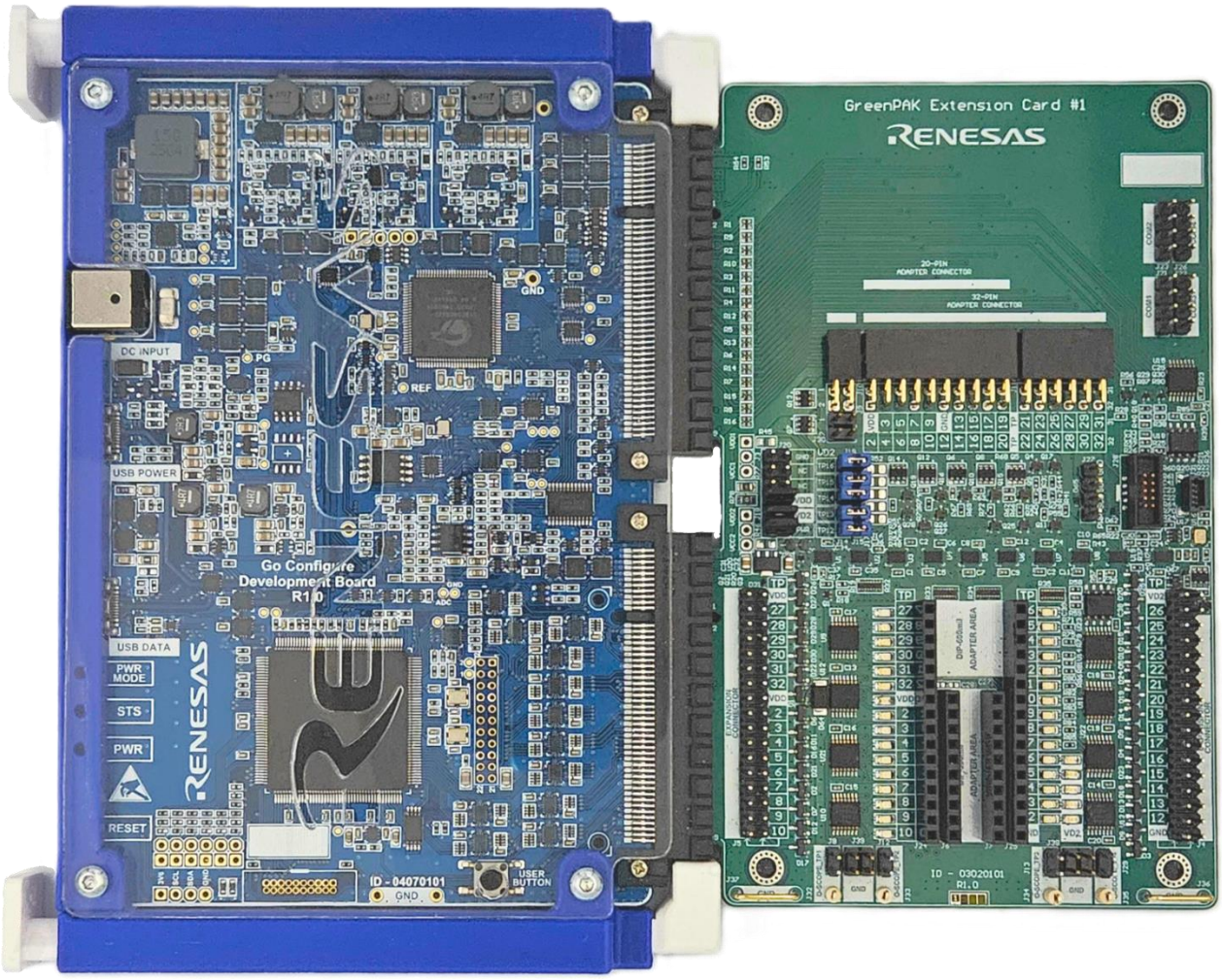

Figure 4. Go Configure Development Board and GreenPAK Extension Card #1 Stack

2. Working with GreenPAK

There are five connectors that can establish a connection between the GreenPAK products and the GreenPAK Extension Card #1. For more information about GreenPAK products, visit the Renesas website.

2.1 DIP and Socket Connectors

The extension card works with the GreenPAK family products using socket and DIP adapters. TP12-TP16 can be configured as V_{DD2} power sources for dual power devices. The difference between the socket adapter and the DIP adapter is in the pinout and the overall form factor, while functionality for each specific TP remains unchanged.

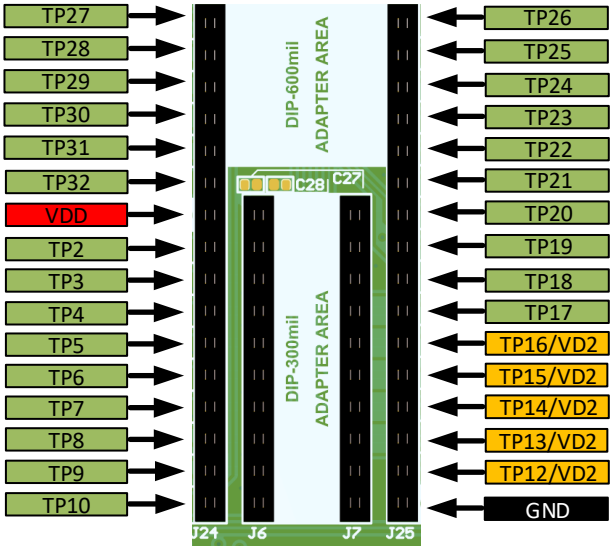

Figure 5. DIP Adapter Pinout

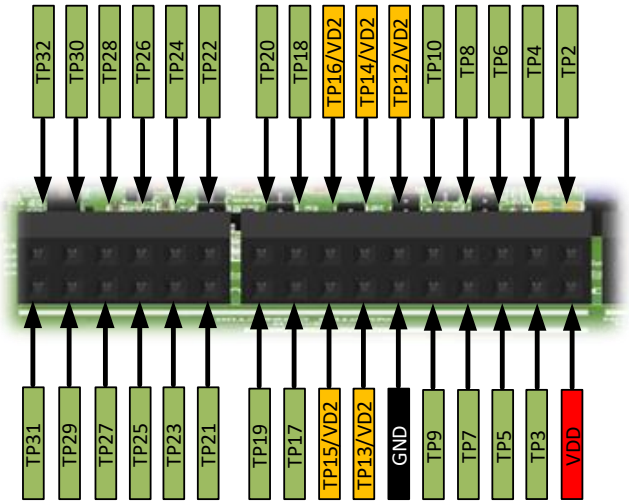

Figure 6. Socket Adapter Pinout

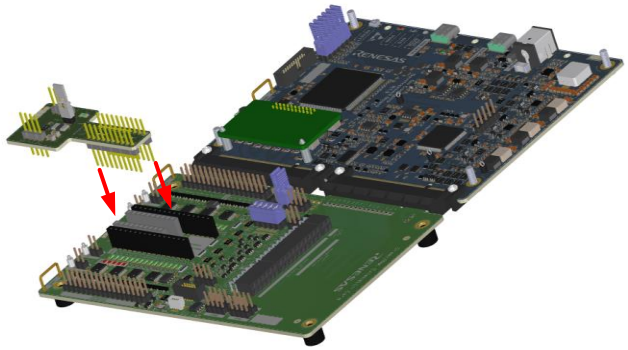

Figure 7. DIP Adapter Connection

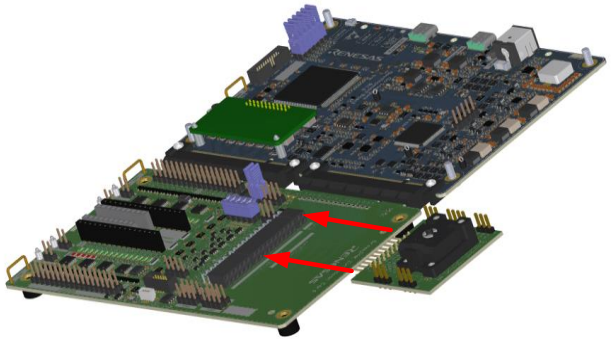

Figure 8. Socket Adapter Connection

Note: Do not use the socket and DIP adapters at the same time.

2.1.1 DIP and Socket Connector Specification

The V_{DD1}, V_{DD2}, and TPs specifications are fully controlled and defined by the development board. The GreenPAK Extension Card #1 does not provide any power source, neither voltage nor current. For detailed information about the specifications of the V_{DD1} and V_{DD2} power rails, see the documentation of the Go Configure Development Board.

Table 2 describes TPs' specifications. All TPs can be configured as inputs or outputs. Depending on the socket or DIP adapter type, TPs can be shared with digital programming interfaces as I^2C or SPI. When working with OTP devices, high voltage can be present on TP2 during emulating and programming sequences.

Table 2. TP2-TP10, TP12-TP32 Specifications

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
As Output						
Output Voltage Level Range	V_O	-	V_{OL}	-	V_{DD}	V
High-level Output Voltage	V_{OH}	V_{DD} = 5.5 V, I_{OH} = 5 mA	5.3	-	-	V
Low-level Output Voltage	V_{OL}	V_{DD} = 5.5 V, I_{OL} = 5 mA	-	-	0.2	V

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
High-level Output Current	I_{OH}	V_{DD} = 5.5 V	-	-	30	mA
Low-level Output Current	I_{OL}	V_{DD} = 5.5 V	-	-	30	mA
As Input						
Input Voltage Level Range	V_I	-	-0.2	-	V_{DD} + 0.2	V
High-level Input Voltage	V_{IH}	-	0.7 x V_{DD}	-	-	V
Low-level Input Voltage	V_{IL}	-	-	-	0.3 x V_{DD}	V
Input Leakage Current	I_I	V_{DD} = 5.5 V	-	-	5	µA
Configurable Pull-up and Pull-down Resistance	R_{PULL}	-	–	5.6	–	kΩ
Input Capacitance	C_{IN}	-	-	30	-	pF

2.2 Expansion Connector

An expansion connector is used for an external circuit connection and signal monitoring. This connector duplicates DIP and socket connectors functionality. The only difference is that the signals of this connector can be disconnected from the DIP and socket connectors via the software control. E_V_{DD1} and E_V_{DD2} are configurable power sources that follow the V_{DD1} and V_{DD2} configuration and connected to the expansion connector through “SW1” and “SW2” (see Figure 3). E_V_{DD1} and E_V_{DD2} can also be set as a voltage reference input to synchronize the voltage level with an external circuit. E_V_{DD1} and E_V_{DD2} voltage outputs and connection between TP and E_TP are controlled via the Go Configure Software Hub.

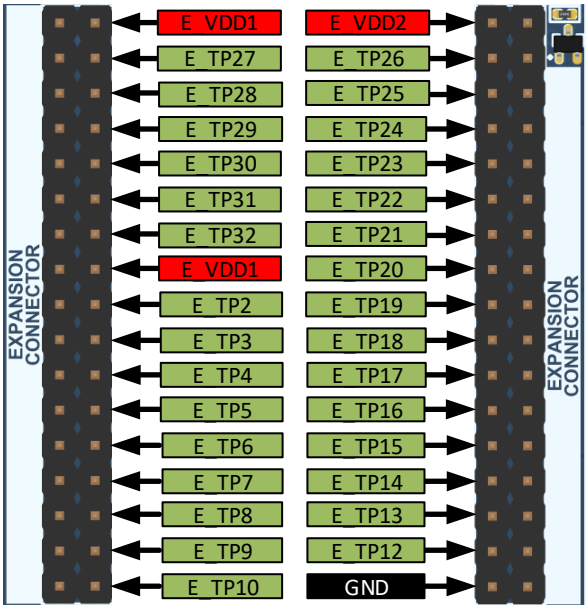

Figure 9. Expansion Connector Pinout

The GreenPAK Training Board #2 works with the GreenPAK Extension Card #1 through the expansion connector.

Figure 10 shows the correct connection example. Jumper “J4” on the training board should be removed.

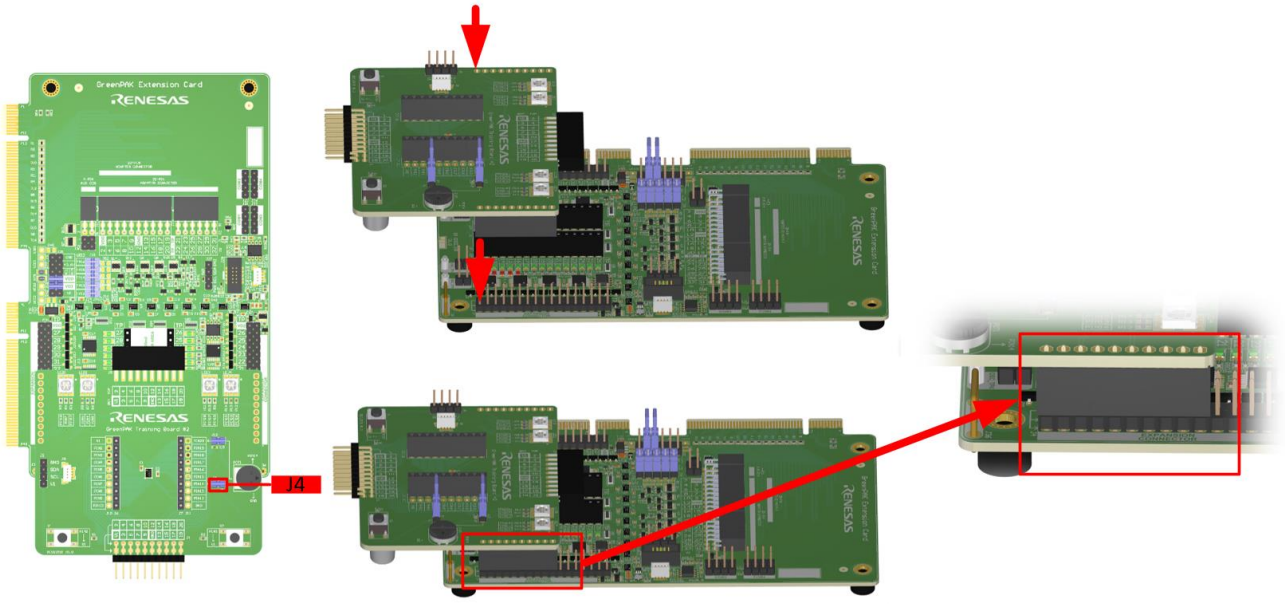

Figure 10. GreenPAK Training Board #2 Connection

2.2.1 Expansion Connector Specifications

E_V_{DD1} and E_V_{DD2} correspond to V_{DD1} and V_{DD2}, respectively, but are connected through a power switch. Their specifications fully match the specifications of V_{DD1} and V_{DD2}, except for E_V_{DD1} and E_V_{DD2} can operate as inputs for an external power supply. The external power source parameters must be within the limits provided in Table 3. The operation of these power rails is fully controlled through the Go Configure Software Hub.

Table 3. E_V_{DD1}, E_V_{DD2} Specifications

Parameter	Symbol	Min	Typ	Max	Unit
Input Voltage Range	E_V_{VDD}	1.71	-	5.5	V
Input Bias Current	I_{BIAS}	-	-	35	nA
Input Capacitance	C_I	-	1	-	µF
Discharge Resistance	R_{dsch}	-	1000	-	Ω
Discharge Pulse Duration	T_{dsch}	-	-	1	s

Table 4 describes E_TP specifications. All E_TP can be configured as inputs or outputs. Connection between E_TP and TP, E_V_{DD} and V_{DD} automatically disables during programming and emulation seances.

Table 4. E_TP2-E_TP10, E_TP12-E_TP32 Specifications

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
As Output						
Output Voltage Level Range	V_O	-	V_{OL}	-	V_{OH}	V
High-level Output Voltage	V_{OH}	E_V_{VDD} = 5.5 V, I_{OH} = 5mA	5.0	-	-	V
Low-level Output Voltage	V_{OL}	E_V_{VDD} = 5.5 V, I_{OL} = 5mA	-	-	0.5	V
High-level Output Current	I_{OH}	E_V_{VDD} = 5.5 V	-	-	10	mA
Low-level Output Current	I_{OL}	E_V_{VDD} = 5.5 V	-	-	10	mA
As Input						
Input Voltage Level Range	V_I	-	-0.2	-	E_V_{VDD} + 0.2	V

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
High-level Input Voltage	V_{IH}	-	0.7 x E_V_{VDD}	-	-	V
Low-level Input Voltage	V_{IL}	-	-	-	0.3 x E_V_{VDD}	V
Off-state Input Leakage Current	I_I	E_V_{VDD} = 5.5 V	-	-	2.5	µA
Configurable Pull-up and Pull-down Resistance	R_{PULL}	-	-	5.6	-	kΩ
Input Capacitance	C_{IN}	-	-	40	-	pF

2.3 Four Pins GreenPAK Target Connectors

Connectors provide a standard in-system debugging option for the GreenPAK family integrated circuits. Basically, it is I²C interface with a regulated voltage-level option. Pin PWR is a configurable power source. This power source replicates the functionality of the V_{DDC} power rail on the attached development board through the switch “SW3” (see Figure 3). It can also be set as a voltage reference input to synchronize the voltage level with an external circuit. PWR output voltage is controlled via the Go Configure Software Hub.

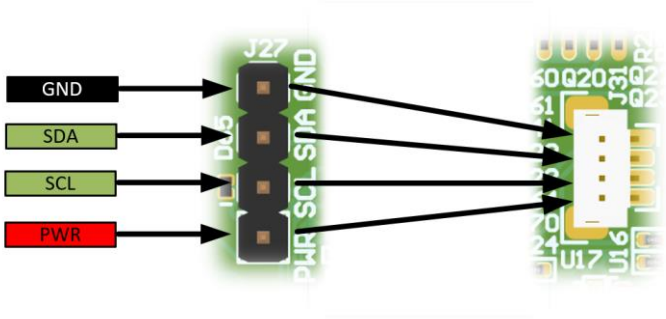

Figure 11. Four Pins GreenPAK Target Connectors Pinout

2.3.1 Four Pins GreenPAK Target Connectors Specifications

The output power specifications of the connectors depend on, and are controlled by, the development board. Detailed specifications of these parameters can be found in the Go Configure Development Board documentation. The requirements for the input voltage supplied to this connector from an external power source are provided in Table 5.

Table 5. PWR Specifications

Parameter	Symbol	Min	Typ	Max	Unit
Input Voltage Range	V_{PWR}	0.9	-	5.5	V
Input Bias Current	I_{BIAS}	-	-	35	nA
Input Capacitance	C_I	-	650	-	pF
Discharge Resistance	R_{dsch}	-	1000	-	Ω
Discharge Pulse Duration	T_{dsch}	-	-	1	s

Table 6 describes I²C pins specifications of the connectors. The specifications of the SCL and SDA pins are given relative to the connected Go Configure Development Board. When the interface is not active, pull-up resistors are disabled.

Table 6. SCL, SDA Specifications

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Low-level Output Voltage	V_{OL}	I_{OL} = 1 mA	-	-	0.045	V
		I_{OL} = 5 mA	-	-	0.3	V
		I_{OL} = 10 mA	-	-	0.575	V
High-level Input Voltage	V_{IH}	-	0.7 x V_{PWR}	-	-	V
Low-level Input Voltage	V_{IL}	-	-	-	0.3 x V_{PWR}	V
Low-level Output Current	I_{OL}	V_{PWR} = 5.5 V	-	-	10	mA
Onboard Pull-up Resistance	R_{PULL}	-	-	2.2	-	kΩ
Input Capacitance	C_{IN}	-	-	70	-	pF

1. V_{PWR} = 0.9 V to 5.5 V.

2.4 Advanced In-System Programming Connector

The advanced In-System Programming (ISP) connector is used for the GreenPAK integrated circuits with SPI and I²C interfaces. E_V_{DD} is a configurable power source. It can also be set as a voltage reference input to synchronize the V_{DD1} voltage level with an external circuit. The E_V_{DD} source or reference configuration, output voltage, and the connection between TP and E_TP are controlled through the Go Configure Software Hub. This connector is controlled in the Go Configure Software Hub using the same command as for the expansion connector. The KEY pin is used for software detection.

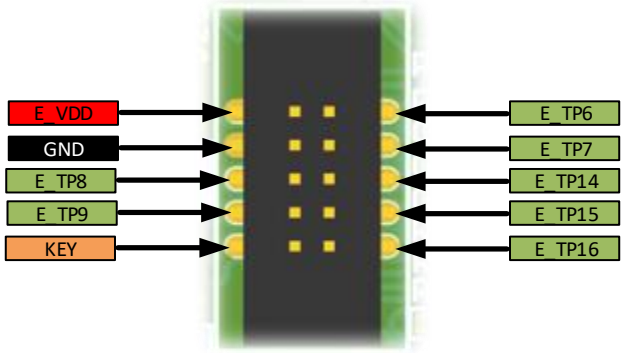

Figure 12. Advanced ISP Connector Pinout

2.4.1 Advanced In-System Programming Connector Specification

The Advanced In-System Programming Connector E_V_{DD} and all E_TP Specification follows the expansion connector. The only unique pin of this connector is KEY. Table 7 describes specifications for the KEY pin.

Table 7. KEY Specifications

Parameter	Symbol	Min	Typ	Max	Unit
Pull-up Voltage	V_{PULL}	-	3.45	-	V
Pull-up Resistance	R_{PULL}	-	10	-	kΩ
Input Voltage Level Range	V_I	-0.2	-	3.65	V
High-level Input Voltage	V_{IH}	2.5	-	-	V
Low-level Input Voltage	V_{IL}	-	-	1.0	V
Input Capacitance	C_{IN}	-	20	-	pF

3. Additional Features

3.1 Current Measurement

The GreenPAK Extension Card #1 includes an IC power consumption measurement feature. To measure current, the jumpers shown in Figure 13 should be removed – this exposes a dedicated inline connector, into which a current meter can be plugged. The typical load should not exceed 200 mA. During normal operation (when current measurement is not needed), the jumpers must remain installed to restore the default power path.

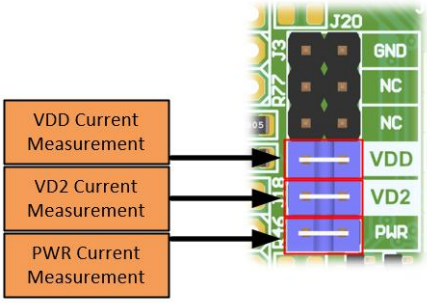

Figure 13. Current Measuring Connector Pinout

3.1.1 Jumpers Default Position

Figure 14 shows default position of jumpers. If jumpers are not installed, some functions may not work.

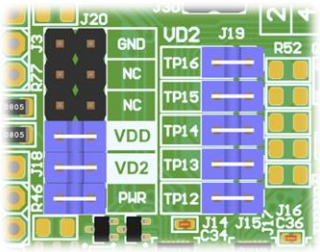

Figure 14. Jumpers Default Position

3.2 LED Indication

An LED state indication option is available for all TPs except for TP10 (GND). Note that the input thresholds for LED are the same as in the test point input specification. If the dual V_{DD} GreenPAK is used and V_{DD2} voltage value is less then V_{DD1}*0.7 – indication can work incorrectly, as the input high threshold will never be reached. Figure 15 shows LED indication configuration in the Go Configure software.

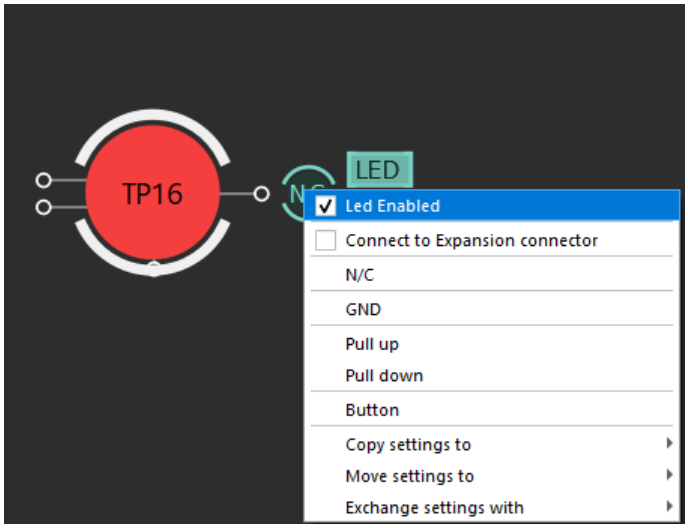

Figure 15. TP LED Indication Configuration

3.3 Probe Connection

The GreenPAK Extension Card #1 has two ground terminals, four oscilloscope hooks, and four dual-pin terminals for connecting an oscilloscope. These features provide convenient attachment of the oscilloscope probes to the hooks, as well as easy branching and connection of signals through the terminals.

Figure 16 shows the oscilloscope connection hooks.

Figure 16. Probe Connection Hooks

3.4 Independent Prototyping Connectors

The GreenPAK Extension Card #1 has four independent, four-pin terminal blocks for signal branching, provided for the user convenience. Only four 1×4 pin headers (2.54 mm pitch) should be soldered at positions J21, J22, J23, and J26. A connection diagram of these terminal blocks is provided in section 4 Schematic Diagrams.

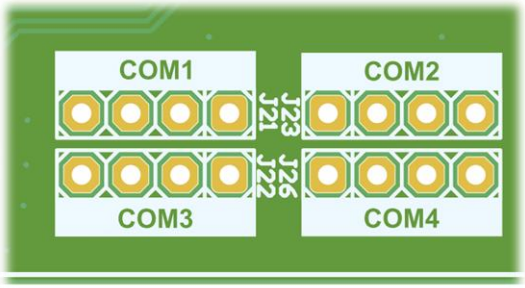

Figure 17. Signal Sharing Terminals, COM1, COM2, COM3, COM4

3.5 Marking Place

A special place is provided on the board for attaching information labels.

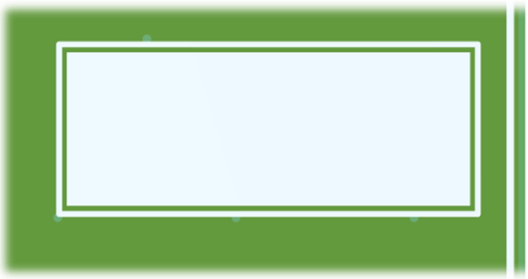

Figure 18. Marking Place

3.6 Auxiliary Connector

A special internal connector provides an expansion control functionality to a device connected through the socket adapter connector. An auxiliary connector is an additional optional element that is used only in certain socket-adapter. The presence of the auxiliary connector is determined by the design of a specific socket adapter. It is not used in standard configurations. When required, the corresponding adapter already includes this connector. The system automatically detects the type of connected socket adapter: when an adapter with an auxiliary connector is connected, the required functions are activated automatically; when an adapter without an auxiliary connector is connected, all basic functionality remains fully available. No additional configuration or user selection is required. Figure 2 shows the location of the auxiliary connector.

4. Schematic Diagrams

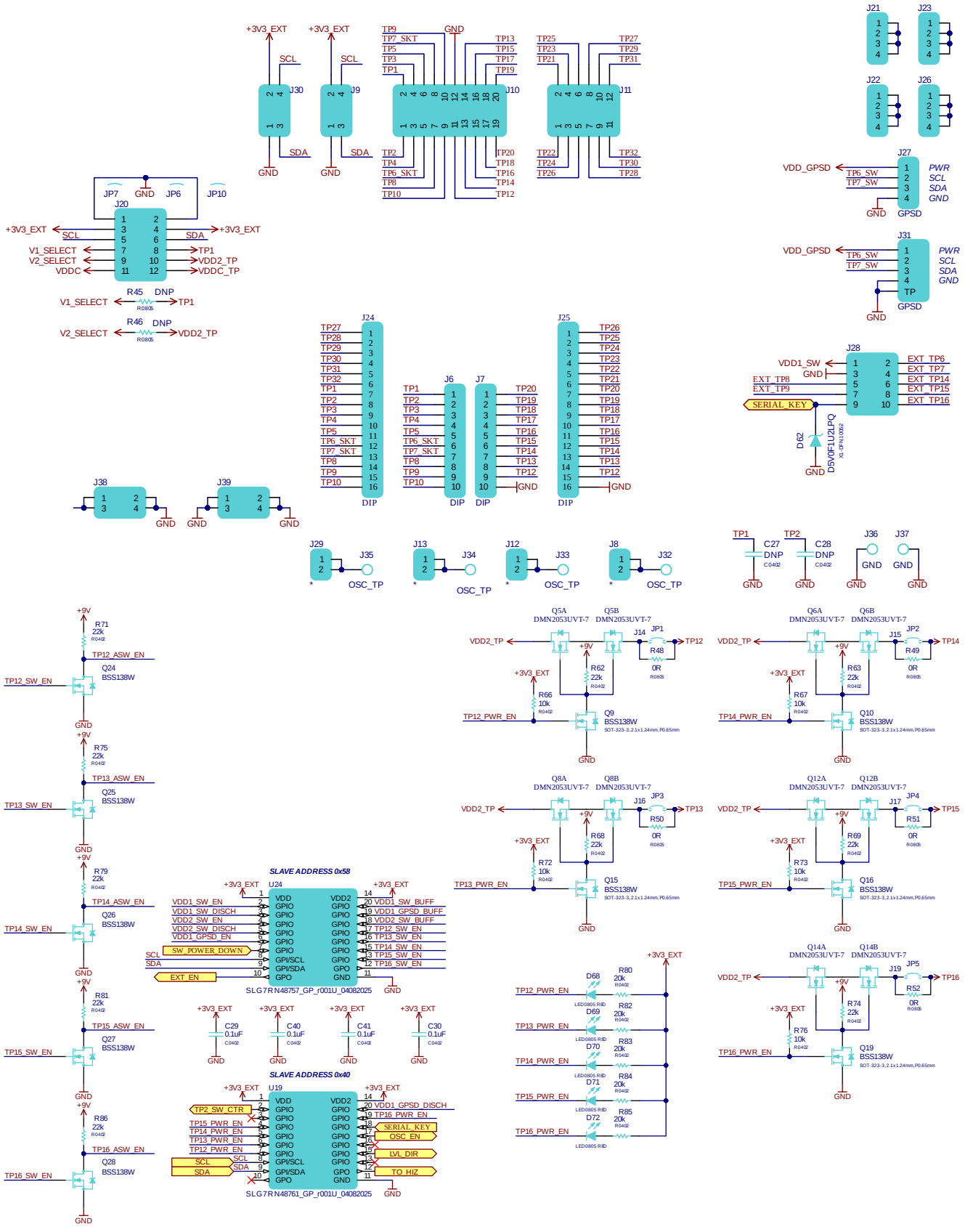

Figure 19. GreenPAK Extension Card #1 Schematic – Part 1

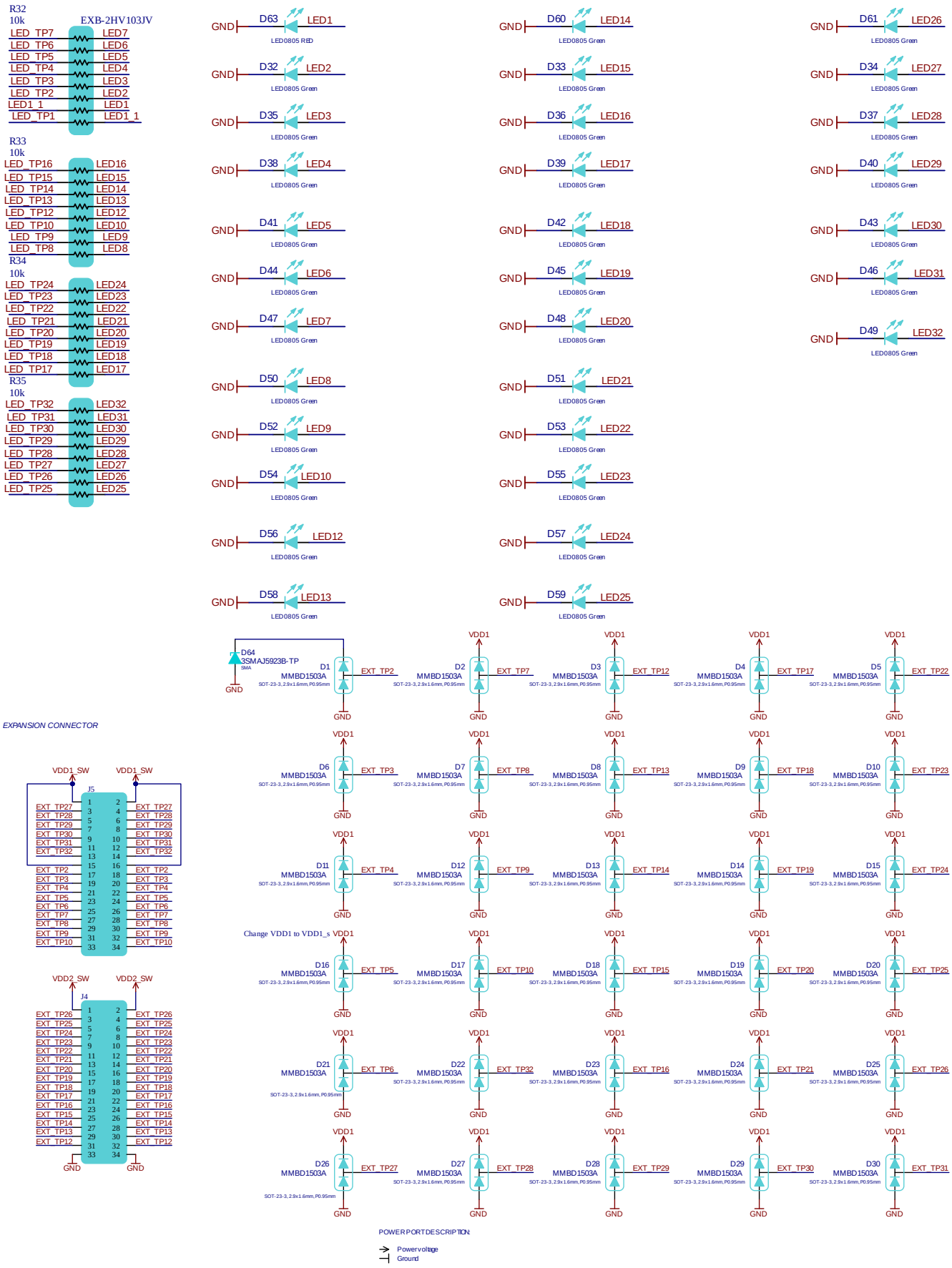

Figure 20. GreenPAK Extension Card #1 Schematic – Part 2

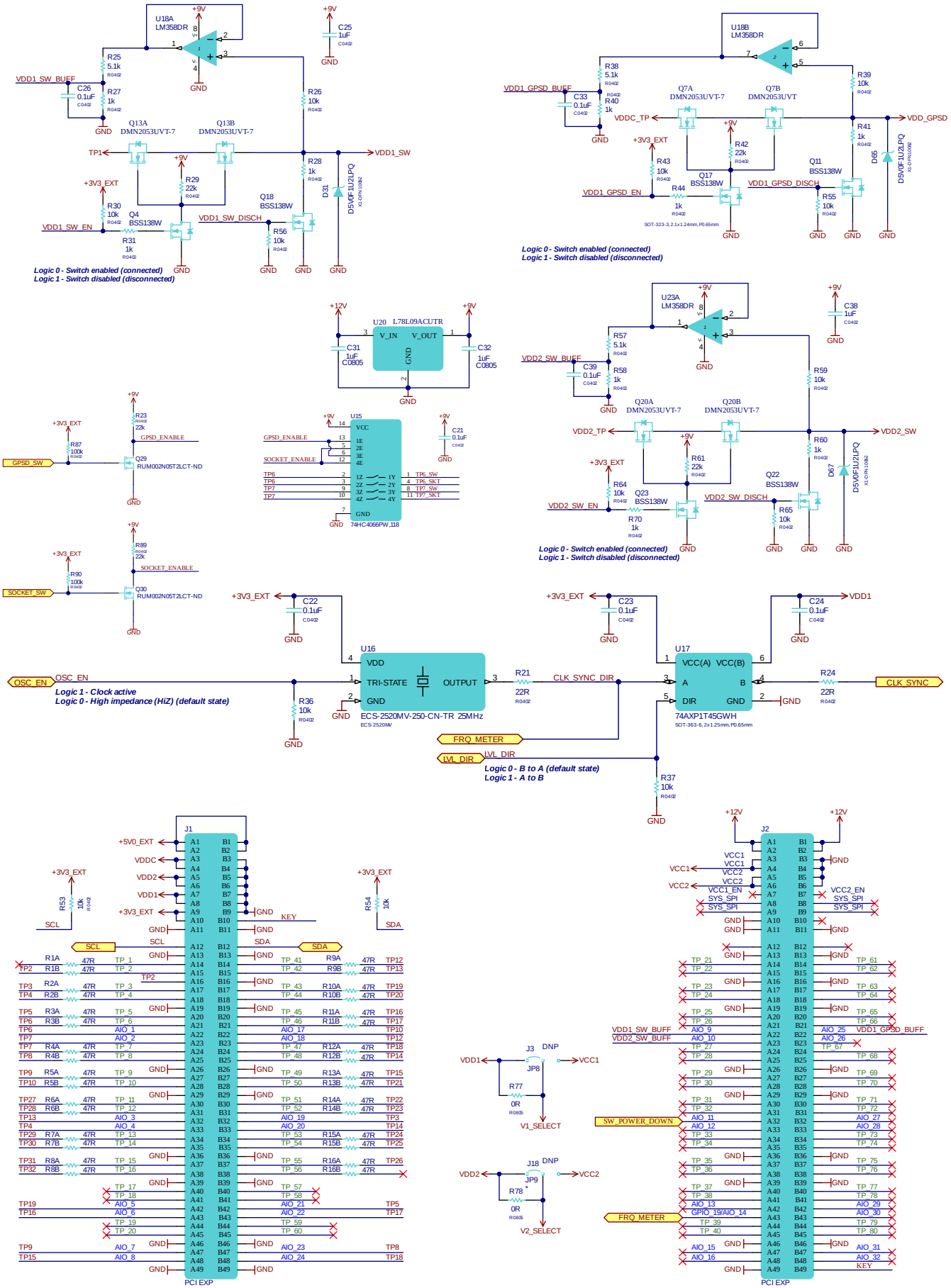

Figure 21. GreenPAK Extension Card #1 Schematic – Part 3

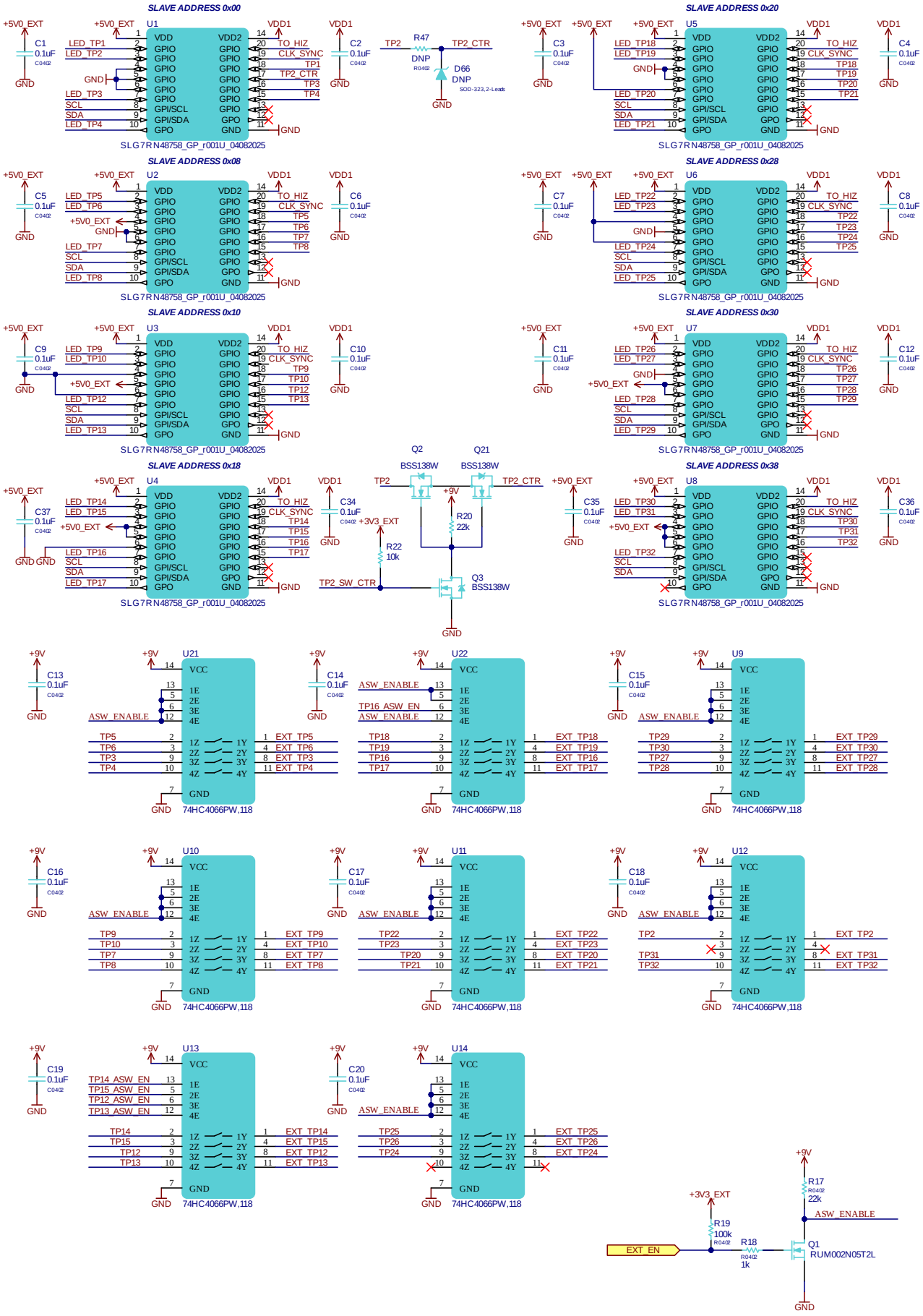

Figure 22. GreenPAK Extension Card #1 Schematic – Part 4

5. Bill of Materials

#	Designator	Manufacturer Part Number	Manufacturer	Quantity
1	BP1, BP2, BP3, BP4, BP5	SJ61A6	3M	6
2	C1, C2, C3, C4, C5, C6, C7, C8, C9, C10, C11, C12, C13, C14, C15, C16, C17, C18, C19, C20, C21, C22, C23, C24, C26, C29, C30, C33, C34, C35, C36, C37, C39, C40, C41	GCM155R71C104KA55D	Murata	35
3	C25, C38	CL05A105KA5NQNC	Samsung	2
4	C31, C32	CL21B105KBFNNNE	Samsung	2
5	D1, D2, D3, D4, D5, D6, D7, D8, D9, D10, D11, D12, D13, D14, D15, D16, D17, D18, D19, D20, D21, D22, D23, D24, D25, D26, D27, D28, D29, D30	MMBD1503A	ON Semiconductor/Fairchild	30
6	D31, D62, D65, D67	D5V0F1U2LPQ-7B	Diodes	4
7	D32, D33, D34, D35, D36, D37, D38, D39, D40, D41, D42, D43, D44, D45, D46, D47, D48, D49, D50, D51, D52, D53, D54, D55, D56, D57, D58, D59, D60, D61	17-215/G6C-BM1N2L/4T	Everlight	30
8	D63, D68, D69, D70, D71, D72	17-215/R6C-AP1Q2B/4T	Everlight	6
9	D64	3SMAJ5923B-TP	MCC	1
10	J4, J5	PRPC017DAAN-RC	Sullins	2
11	J6, J7	PPPC101LFBN-RC	Sullins	2
12	J8, J12, J13, J29	PREC001DAAN-RC	Sullins	4
13	J9	PPPC022LJBN-RC	Sullins	1
14	J10	PPPC102LJBN-RC	Sullins	1
15	J11	PPPC062LJBN-RC	Sullins	1
16	J14, J15, J16, J17, J19	PREC001DAAN-RC	Sullins	5
17	J20	PRPC006DAAN-RC	Sullins	1
18	J21, J22, J23, J26 (DNP)	PRPC004SAAN-RC	Sullins	4
19	J24, J25	PPPC161LFBN-RC	Sullins	2
20	J27	PRPC004SAAN-RC	Sullins	1
21	J28	3220-10-0300-00	CNC Tech	1
22	J30, J38, J39	PREC002DAAN-RC	Sullins	3
23	J31	2367197-4	TE Connectivity AMP	1
24	J32, J33, J34, J35	500-2	Keystone Electronics	4
25	J36, J37	D3082-05	Harwin	2
26	JP1, JP2, JP3, JP4, JP5, JP6, JP7, JP8	M7583-46	Harwin	8
27	Q1, Q3, Q29, Q30	RUM002N05T2L	Rohm	4
28	Q2, Q4, Q9, Q10, Q11, Q15, Q16, Q17, Q18, Q19, Q21, Q22, Q23, Q24, Q25, Q26, Q27, Q28	BSS138W	ON Semiconductor/Fairchild	18

#	Designator	Manufacturer Part Number	Manufacturer	Quantity
29	Q7, Q13, Q20	DMN2053UVT-7	Diodes	3
30	Q5, Q6, Q8, Q12, Q14	NDC7002N	Onsemi	5
31	R1, R2, R3, R4, R5, R6, R7, R8, R9, R10, R11, R12, R13, R14, R15, R16	S41X043470JP	CTS	16
32	R17, R20, R23, R29, R42, R61, R62, R63, R68, R69, R71, R74, R75, R79, R81, R86, R89	RC0402FR-0722KL	YAGEO	17
33	R18, R27, R28, R31, R40, R41, R44, R58, R60, R70	RC0402FR-071KL	YAGEO	10
34	R19	RC0402FR-07100KL	YAGEO	1
35	R21, R24	ERJ-2RKF22R0X	Panasonic	2
36	R22, R26, R30, R36, R37, R39, R43, R53, R54, R55, R56, R59, R64, R65, R66, R67, R72, R73, R76, R87, R90	RC0402FR-0710KL	YAGEO	21
37	R25, R38, R57	RC0402FR-075K1L	YAGEO	3
38	R32, R33, R34, R35	EXB-2HV222JV	Panasonic	4
39	R77, R78	RC0805JR-070RP	YAGEO	2
40	R80, R82, R83, R84, R85	RC0402FR-072K2L	YAGEO	5
41	U1, U2, U3, U4, U5, U6, U7, U8, U19, U24	SLG46826V	Renesas Electronics America Inc.	10
42	U9, U10, U11, U12, U13, U14, U15, U21, U22	74HC4066PW,118	Nexperia USA Inc.	9
43	U16	ECS-2520MV-250-CN-TR	ECS International	1
44	U17	74AXP1T45GWH	Nexperia USA Inc.	1
45	U18, U23	LM358DR	Texas Instruments	2
46	U20	L78L09ACUTR	STMicroelectronics	1

6. Ordering Information

Part Number	Description
SLG4EXTCARD1	GreenPAK Extension Card #1 R1.0

7. Certifications

The GreenPAK Extension Card #1 complies with the following certifications/standards.

7.1 EMC/EMI Standards

- FCC Notice (Class A)

This device complies with FCC 47 CFR part 15, subpart B. Operation is subject to the following two conditions:
(1) This equipment should be handled using standard CMOS device precautions. The user must take all precautions to avoid the build-up of static electricity while working with this equipment. All test and measurement tools, including the workbench, must be grounded. The user/operator must be grounded using the wrist strap. The connectors and/or device pins should not be touched with bare fingers.

(2) This Class A digital device complies with the FCC rules outlined in 47 CFR Part 15. This equipment may cause radio frequency noise when used in a residential area. In such cases, the user/operator of the equipment may be required to take appropriate countermeasures at their own responsibility.

- CE Class B (EMC)

This product is in conformity with the following Directive(s) of the European Parliament and of the Council on the harmonization of the laws of the Member States relating to Electromagnetic Compatibility 2014/30/EU (EMC Directive). The equipment can be operated under the following conditions:

(1) This equipment should be handled using standard CMOS device precautions. The user must take all precautions to avoid the build-up of static electricity while working with this equipment. All test and measurement tools, including the workbench, must be grounded. The user/operator must be grounded using the wrist strap. The connectors and/or device pins should not be touched with bare fingers.

(2) This is a ‘Class B’ (EN 55032:2015) device. This equipment may cause radio frequency noise when used in a residential area. In such cases, the user/operator of the equipment may be required to take appropriate countermeasures at their own responsibility.

- UKCA Class B (EMC)

This product conforms to the following relevant UK Statutory Instrument(s) (and their amendments): 2016 No. 1091 Electromagnetic Compatibility Regulations 2016. The equipment can be operated under the following conditions:

(1) This equipment should be handled using standard CMOS device precautions. The user must take all precautions to avoid the build-up of static electricity while working with this equipment. All test and measurement tools, including the workbench, must be grounded. The user/operator must be grounded using the wrist strap. The connectors and/or device pins should not be touched with bare fingers.

(2) This is a ‘Class B’ (BS EN 55032:2015) equipment. This equipment may cause radio frequency noise when used in a residential area. In such cases, the user/operator of the equipment may be required to take appropriate countermeasures at their own responsibility.

7.2 Material Selection, Waste, Recycling, and Disposal Standards

- 2011/65/EU Restriction of Hazardous Substances (RoHS Directive) + amendment (EU) 2015/863 (RoHS3)
- 2012/19/EU Waste Electrical and Electronic Equipment (WEEE Directive)
- 2012 No. 3032 The Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment Regulations
- 2013 No. 3113 Waste Electrical and Electronic Equipment Regulations

8. Revision History

Revision	Date	Description
1.00	Apr 15, 2026	Initial release