ForgeFPGA Socket Card #2

ForgeFPGA™ Socket Card #2 is a development board designed for emulation and prototyping of ForgeFPGA integrated circuits.

Specifications

The "ForgeFPGA Socket Card #2" provides a connection between the pins of a ForgeFPGA and a Development Board. This board can be used for design prototyping with various boot modes. The Socket Card supports the PMOD standard, allowing the connection of different PMOD adapters.

Board Contents

Includes ForgeFPGA Socket Card #2 board.

Features

- Programming and Emulation
- Standalone Boot Option
- Onboard 4-Mbit SPI Flash
- PMOD Connectors
- Clock Generator from 2.5 kHz to 200 MHz
- Standalone Power Connectors

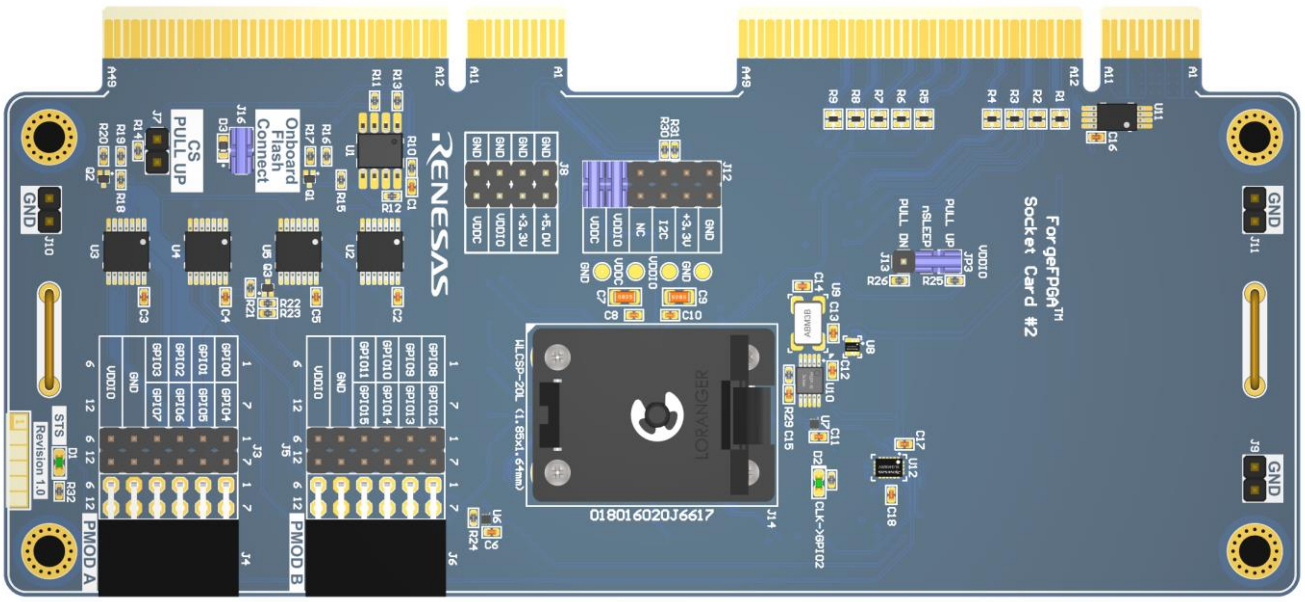


Figure 1. ForgeFPGA Socket Card #2

Contents

Figures

1. Functional Description

The figure below shows the board view and identifies its main components. This board can be used in conjunction with the Go Configure Development Board via the Dual Interaction Connector to transmit and process signals. It can also operate as a standalone unit. The chip can be powered either by the Development Board or through the External Power connector, and signals on the GPIO are accessible through the 12-pin GPIO connectors or PMOD connectors.

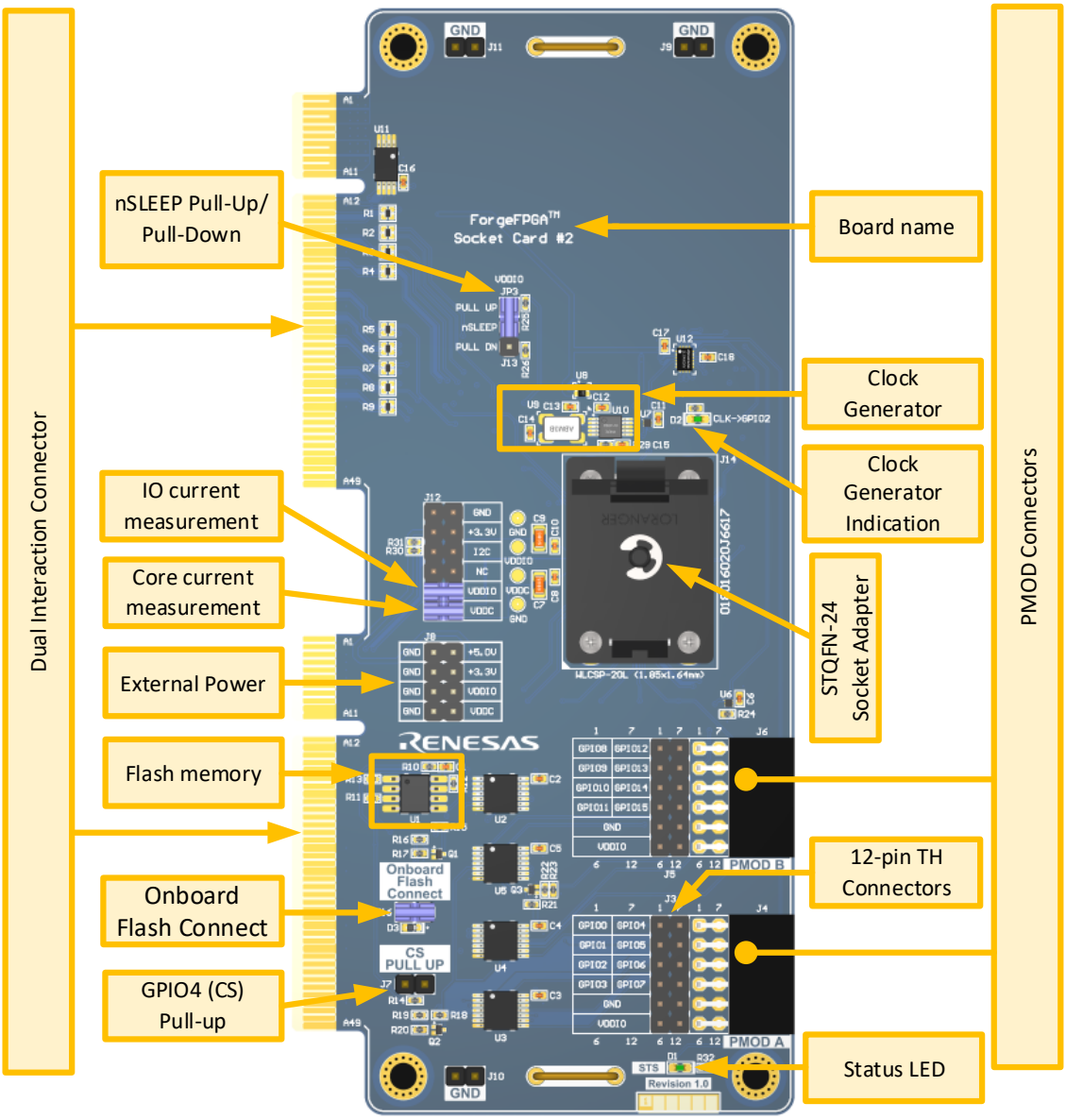
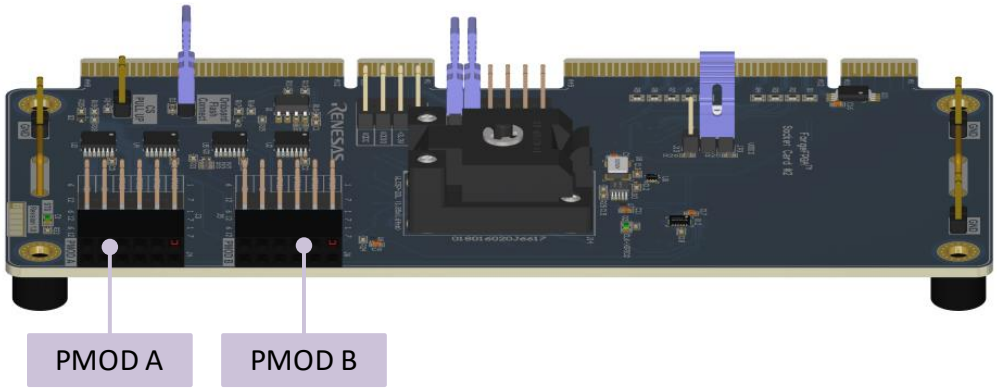


Figure 2. ForgeFPGA Socket Card #2 Components

1.1 PMOD and GPIO Connectors

Access to the socket pins is provided through the GPIO and PMOD connectors, both of which share the same pinout. Note that programming signals from the Interaction Connector to the GPIO/PMOD are gated during programming and emulation entry sequences.



6	5	4	3	2	1
12	11	10	9	8	7

Figure 3. PMOD and GPIO Connector

Table 1. PMOD A-C and External Connectors Pinout

GPIO/PMOD A	
PMOD PIN #	GPIO #
1	GPIO0
2	GPIO1
3	GPIO2
4	GPIO3
5	GND
6	VDDIO0
7	GPIO4
8	GPIO5
9	GPIO6
10	GPIO7
11	GND
12	VDDIO0

GPIO/PMOD B	
PMOD PIN #	GPIO #
1	GPIO8
2	GPIO9
3	GPIO10
4	GPIO11
5	GND
6	VDDIO0
7	GPIO12
8	GPIO13
9	GPIO14
10	GPIO15
11	GND
12	VDDIO0

Table 2. GPIO and PMOD Connector Characteristics

Parameter	Description	Min	Typ	Max	Unit
I_L	Input leakage current	-	2	-	µA
C_{IO}	Input-Output Pin Capacitance	-	7	-	pF
R_{ON}	Series Resistance	-	25	52	Ω
V_{IN}	Input Voltage	-0.5	-	VDDIO	V

1.2 ForgeFPGA Current Measuring

ForgeFPGA Socket Card #2 also includes an option for measuring IC power consumption. To perform this measurement, remove the jumpers (as shown in **Figure 4**) and connect a current meter in their place. The typical load should not exceed 200 mA. Under normal operation, when current measurement is not required, the jumpers should remain installed on the board.

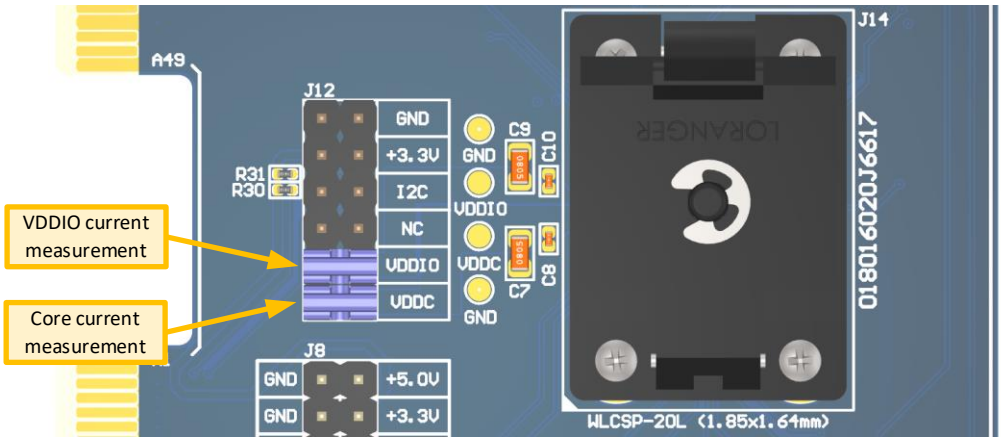


Figure 4. ForgeFPGA Current Measurement Setup

1.3 SPI Interface between ForgeFPGA and Flash Memory

Figure 5 shows the SPI flash interface connection between ForgeFPGA IC and Flash Memory.

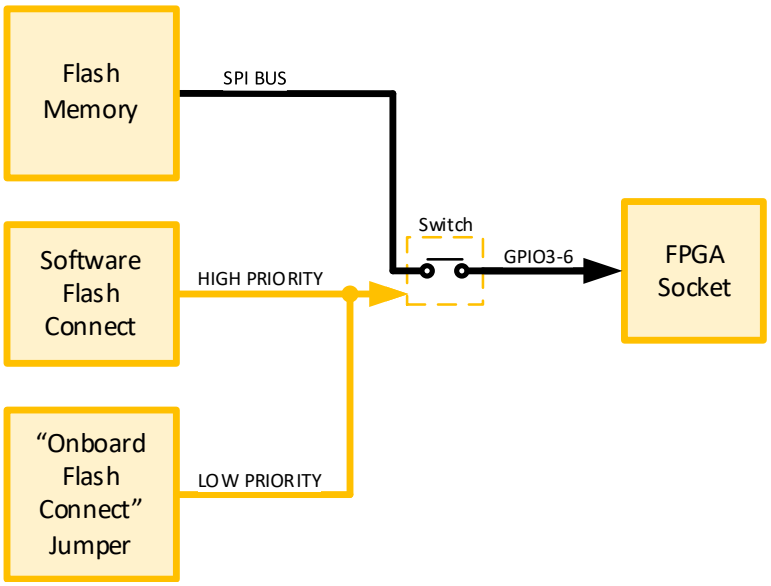
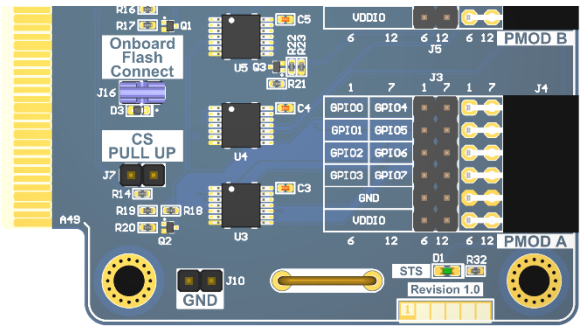


Figure 5. SPI interface connection

The "Onboard Flash Connect" and "CS PULL UP" jumpers should be installed when using the board with the Development Board. Note that jumper removal or configuration changes are overridden and controlled by the Development Board. The table on **Figure 6** shows the correct jumper setup for standalone operation.



Mode	Onboard Flash Connect	CS PULL UP
Internal OTP Memory	0	0
SPI FLASH Memory	1	X
EXT Flash Memory	0	1

Figure 6. Memory Selection Table for Boot Configuration

External Flash Memory can be connected to Socket Card by using PMOD A.

Figure 7 shows how to connect External Flash Memory to PMOD A.

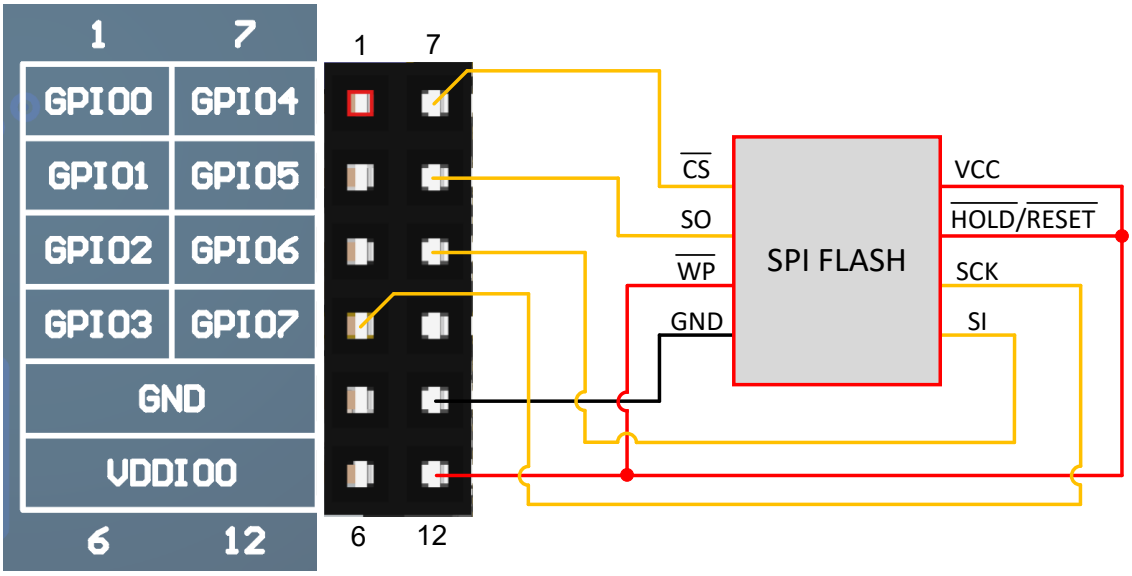


Figure 7. Connection of External Flash Memory to PMOD A

1.4 “External Power” Connector

ForgeFPGA Socket Card #2 can also operate with an external power supply. In this case, four separate power supply channels must be connected to the “External Power” (J8) connector (shown in **Figure 8**). The voltage and current levels for VDDIO0, VDDIO1, and VDDC must comply with the ForgeFPGA IC specifications. The “5.0V” terminal should be supplied with 5.0 V to power the commutation switches. The external power supply option can only be used when the Socket Card is not connected to the Go Configure Development Board.

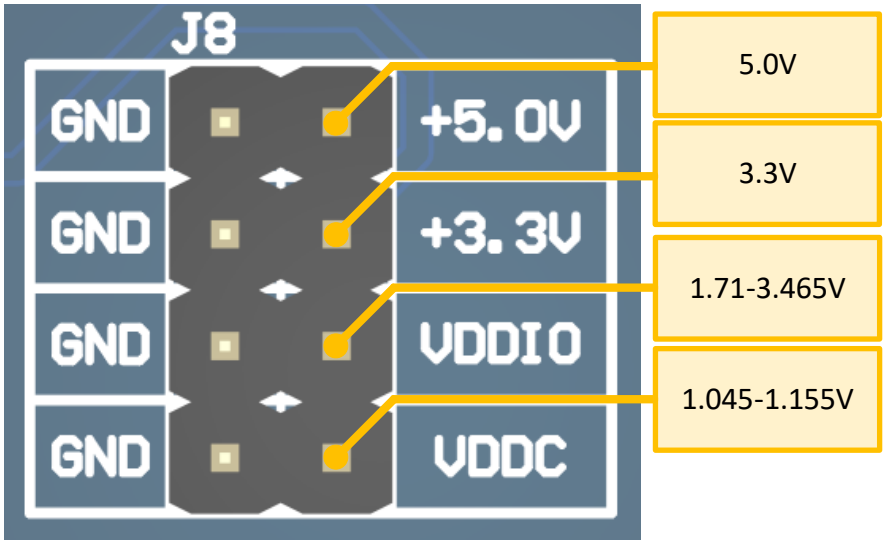


Figure 8. External Power Connector Pinout

1.5 Clock Generator

ForgeFPGA Socket Card #2 has I2C Programmable CMOS Clock Generator – Si5351A-B-GTR.

It used for drive PLL input of ForgeFPGA – GPIO2.

Below in **Table 3** shown main characteristics of Clock Generator.

Table 3. Main Characteristics of Clock Generator

Parameter	Description	Min	Typ	Max	Unit
F_{CLK}	Frequency Range	0.0025	-	200	MHz
J_{PER}	Period Jitter	-	70	155	ps, pk-pk
V_{DDOx}	Output Buffer Voltage	-	VDDIO	-	V
I_{DDOx}	Output Buffer Supply Current (Per Output)	-	2.2	5.6	mA

1.6 Status LED

The status LED indicates the current operation being performed on the chip:

Chip Standard operations:

- **Read**
- **Program**
- **Emulation**
- **Test Mode**

Flash operations:

- **Read**
- **Program**
- **Erase**
- **Test Mode**

The position of Status LED (D1) is shown on **Figure 9**.

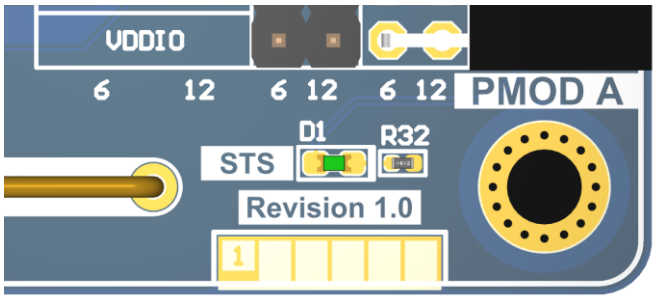


Figure 9. Status LED

2. Working with ForgeFPGA Products

To start working with ForgeFPGA products using the Socket Card, two methodologies are available:

- Using the Go Configure Development Board.
- In standalone mode, where the ForgeFPGA configuration is downloaded from the onboard SPI flash.

2.1 Standalone Working Mode

As previously described, ForgeFPGA can boot from onboard flash as an SPI host. There are two ways of programming onboard flash: program with the Development Board or program the flash IC manually. The programming pins for the flash chip are accessible through the PMOD A connector. To program manually, the Socket Card must be powered via the “EXT Power” connector. If the VDDIO voltage is equal to or greater than 3.0 V, the “5V” and “VDDIO” pins can be powered from the same source.

For these operations, the ForgeFPGA chip must also be removed from the socket. During this process, the “Onboard Flash Connect” and “CS PULL UP” jumpers must be installed.

2.2 Configuration with Go Configure Development Board

To begin working with ForgeFPGA products, connect the platform to a PC using a USB Type-C cable and apply power.
Important: The USB cable should be connected directly to the PC. Avoid using USB hubs or docking stations.
Ensure the Socket Card is properly connected to the Go Configure Development Board as shown on **Figure 10**.

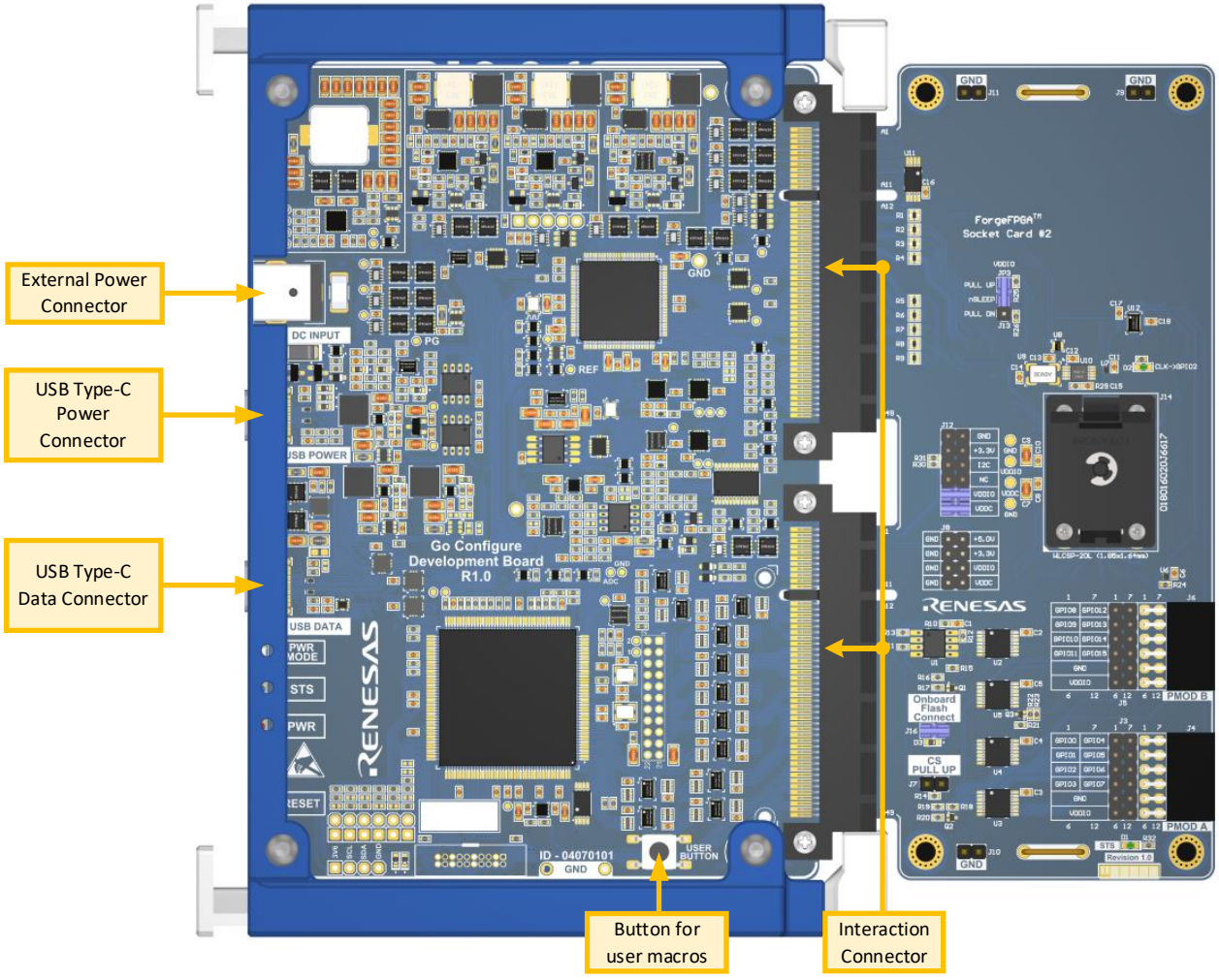


Figure 10. Development Kit

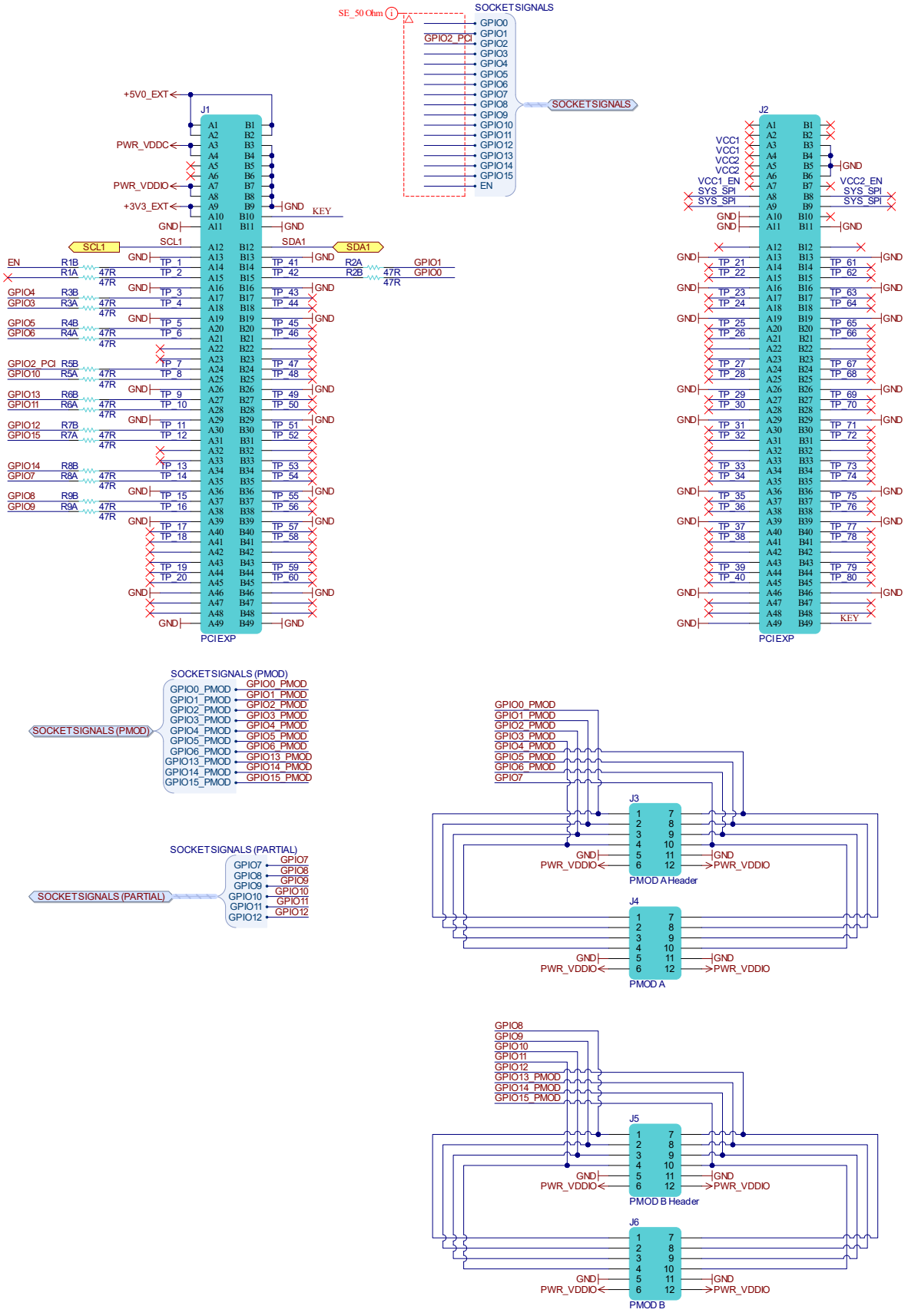
If all the connections are correct, then the red LED (PWR) will automatically turn on. After selecting “Go Configure Development Board” in Go Configure “Debug” tab, the blue LED will blink several times, and the “HW-FW” version will appear in the bottom-left corner of the debugging control window.

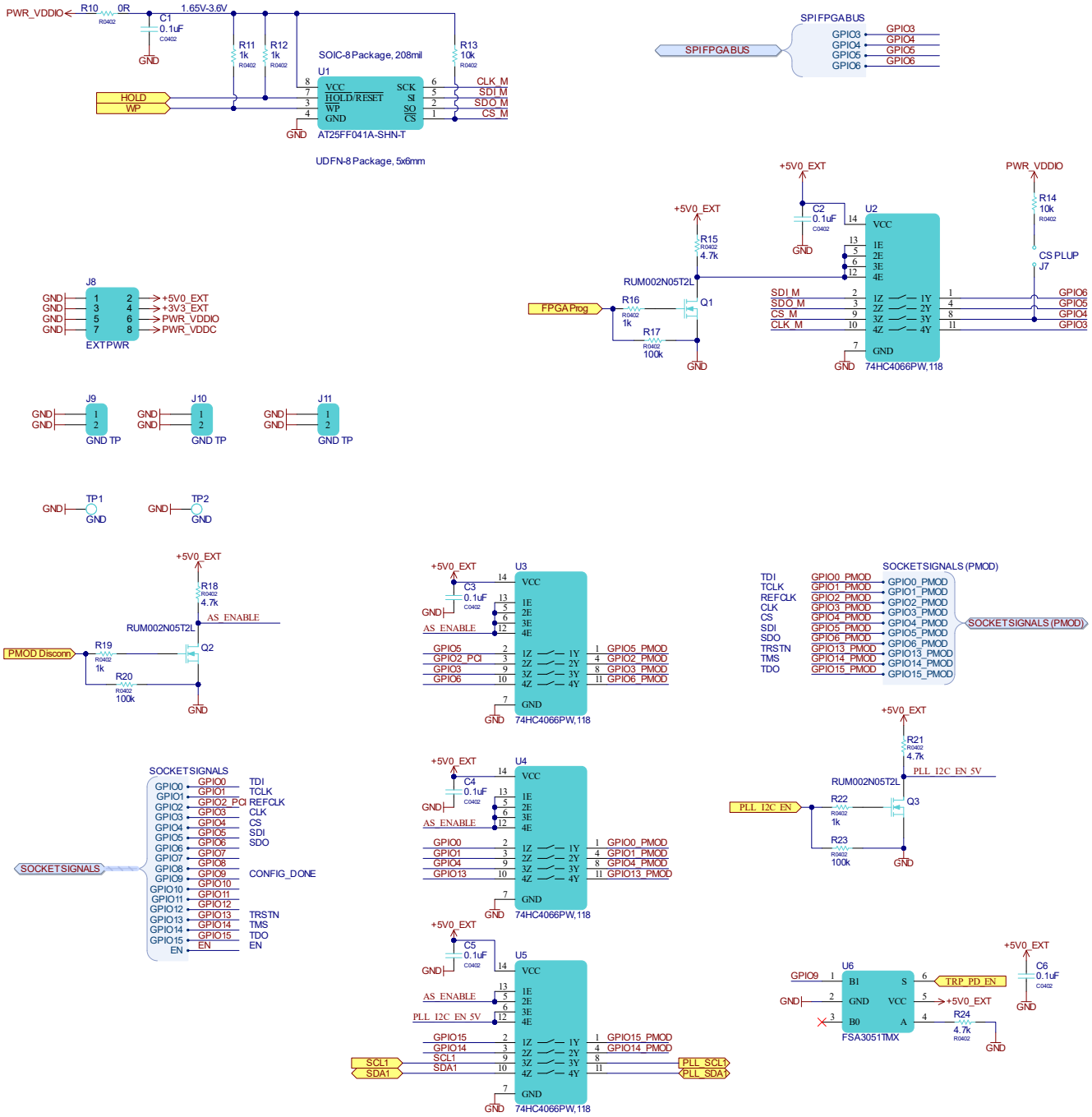
The following debug options are available:

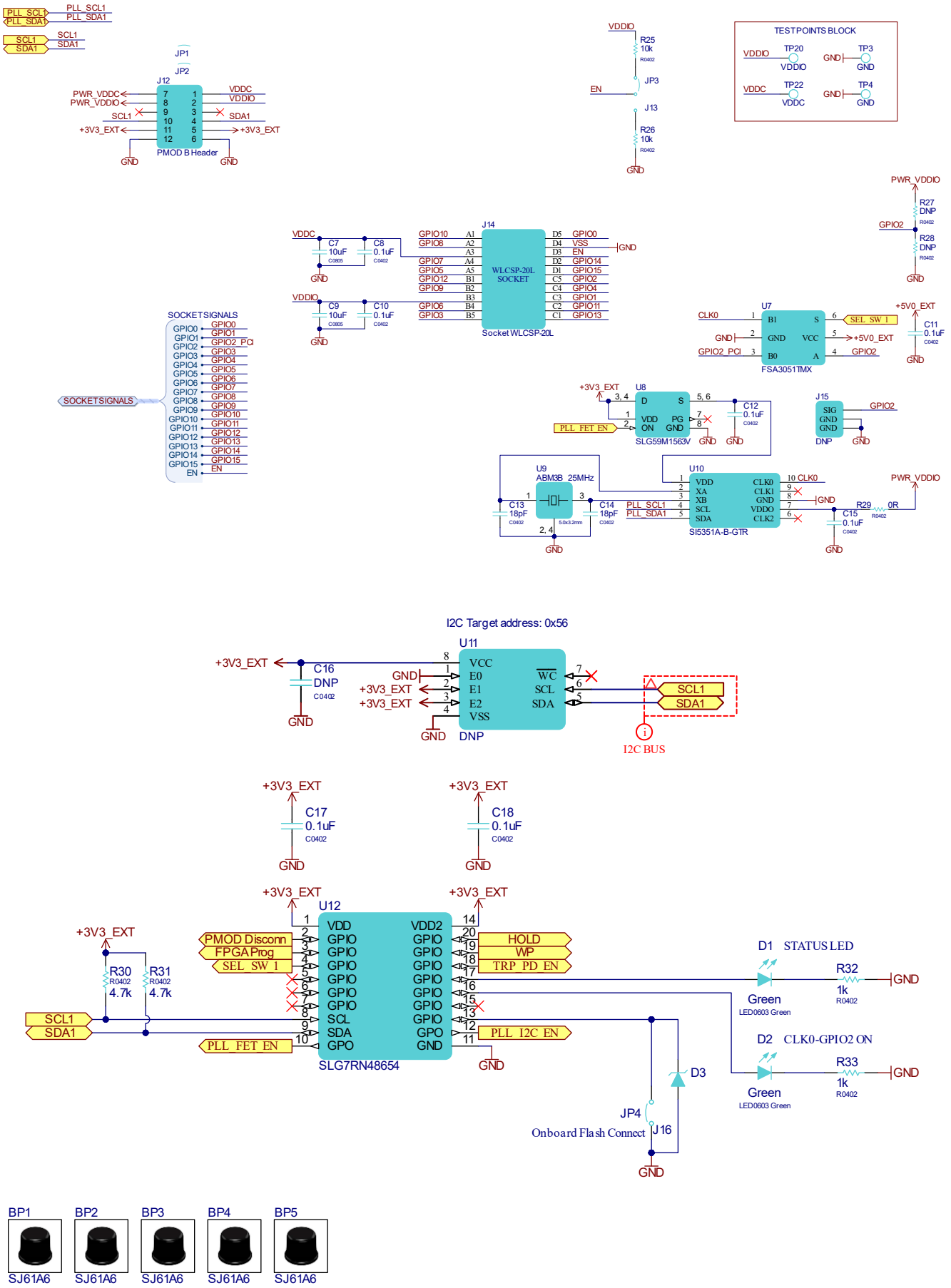
- Emulation – allows debugging of the current project. This mode is available only after synthesis and bitstream generation in the FPGA Editor.
- Test Mode – enables debugging of a programmed project.
- Test Mode* – used to debug a project loaded from SPI Flash.
- Read – reads the configuration from the programmed chip and opens the project in a new software instance or in the “Project Data” window of the current instance.
- Program – programs the chip with the current project.
- TP Map – displays the test point map in the workspace, reflecting the physical test points on the development platform.

The more detailed information about Go Configure software can be found in Go Configure™ Software Hub User Guide.

3. Schematic Diagram




PWR_VDDIO
R10
0R
1.65V-3.6V
C1
0.1uF
GND
R11
1k
R12
1k
R13
10k
SOIC-8 Package, 208mil
U1
VCC
HOLD/RESET
WP
GND
SCK
SI
SO
CS
HOLD
WP
CLK_M
SDI_M
SDO_M
CS_M
AT25FF041A-SHN-T
UDFN-8 Package, 5x6mm
SPIFPGABUS
GPIO3
GPIO4
GPIO5
GPIO6
J8
EXTPWR
+5V0_EXT
+3V3_EXT
PWR_VDDIO
PWR_VDDC
+5V0_EXT
R15
4.7k
RUM002N05T2L
FPGAProg
R16
1k
R17
100k
Q1
C2
0.1uF
U2
74HC4066PW,118
PWR_VDDIO
R14
10k
CS PLUP
J7
SDI_M
SDO_M
CS_M
CLK_M
J9
J10
J11
GND TP
TP1
TP2
+5V0_EXT
R18
4.7k
AS_ENABLE
RUM002N05T2L
PMOD Disconn
R19
1k
R20
100k
Q2
U3
C3
0.1uF
AS_ENABLE
GPIO5
GPIO2_PCI
GPIO3
GPIO6
GPIO5_PMOD
GPIO2_PMOD
GPIO3_PMOD
GPIO6_PMOD
74HC4066PW,118
SOCKETSIGNALS (PMOD)
TDI
TCLK
REFCLK
CLK
CS
SDI
SDO
TRSTN
TMS
TDO
GPIO0_PMOD
GPIO1_PMOD
GPIO2_PMOD
GPIO3_PMOD
GPIO4_PMOD
GPIO5_PMOD
GPIO6_PMOD
GPIO13_PMOD
GPIO14_PMOD
GPIO15_PMOD
SOCKETSIGNALS
GPIO0
GPIO1
GPIO2_PCI
GPIO3
GPIO4
GPIO5
GPIO6
GPIO7
GPIO8
GPIO9
GPIO10
GPIO11
GPIO12
GPIO13
GPIO14
GPIO15
EN
CONFIG_DONE
TRSTN
TMS
TDO
U4
C4
0.1uF
AS_ENABLE
GPIO0
GPIO1
GPIO4
GPIO13
GPIO0_PMOD
GPIO1_PMOD
GPIO4_PMOD
GPIO13_PMOD
74HC4066PW,118
U5
C5
0.1uF
AS_ENABLE
PLL_I2C_EN_5V
GPIO15
GPIO14
SCL1
SDA1
GPIO15_PMOD
GPIO14_PMOD
PLL_SCL
PLL_SDA
74HC4066PW,118
PLL_I2C_EN_5V
R21
4.7k
RUM002N05T2L
PLL_I2C_EN
R22
1k
R23
100k
Q3
U6
GPIO9
TRP_PD_EN
+5V0_EXT
R24
4.7k
C6
0.1uF
FSA3051TMX


PLL_SCL1
PLL_SDA1
SCL1
SDA1
JP1
JP2
J12
PWR_VDDC
PWR_VDDIO
VDDC
VDDIO
+3V3_EXT
PMOD B Header
GND
R25
10k
R26
10k
JP3
J13
EN
TESTPOINTS BLOCK
TP20
TP3
TP22
TP4
J14
WLCSP-20L SOCKET
Socket WLCSP-20L
C7
C8
C9
C10
10uF
0.1uF
SOCKETSIGNALS
GPIO0
GPIO1
GPIO2_PCI
GPIO3
GPIO4
GPIO5
GPIO6
GPIO7
GPIO8
GPIO9
GPIO10
GPIO11
GPIO12
GPIO13
GPIO14
GPIO15
EN
R27
DNP
R28
DNP
U7
FSA3051TMX
SEL_SW_1
+5V0_EXT
C11
0.1uF
U8
SLG59M1563V
PLL_FET_EN
C12
0.1uF
J15
SIG
GND
DNP
U9
ABM3B 25MHz
C13
18pF
C14
18pF
U10
SI5351A-B-GTR
CLK0
CLK1
CLK2
SCL
SDA
VDDO
R29
0R
C15
0.1uF
I2C Target address: 0x56
U11
VCC
E0
E1
E2
VSS
WC
SCL
SDA
DNP
C16
DNP
I2C BUS
C17
0.1uF
C18
0.1uF
U12
SLG7RN48654
PMOD Disconn
FPGAProg
SEL_SW_1
PLL_FET_EN
HOLD
WP
TRP_PD_EN
PLL_I2C_EN
R30
4.7k
R31
4.7k
D1 STATUS LED
Green
LED0603 Green
R32
1k
D2 CLK0-GPIO2 ON
R33
1k
D3
JP4
Onboard Flash Connect
J16
BP1
BP2
BP3
BP4
BP5
SJ61A6

4. Bill Of Materials

#	Designator	Manufacturer Part Number	Manufacturer	Quantity
1	BP1, BP2, BP3, BP4, BP5	SJ61A6	3M	5
2	C1- C6, C8, C10-C12, C15, C17, C18	GCM155R71C104KA55D	Murata	13
3	C7, C9	GRM21BR61C106KE15L	Murata	2
4	C13, C14	CL05C180JB5NNNC	Samsung	2
5	C16	DNP	DNP	1
6	D1, D2	150060GS75000	Wurth Electronics	2
7	D3	DESD5V0U1BB-7	Diodes	1
8	J3, J5, J12	67996-212HLF	Amphenol ICC / FCI	3
9	J4, J6	PPPC062LJBN-RC	Sullins	2
10	J7, J16	68000102HLF	Amphenol ICC / FCI	2
11	J8	10129381-908001BLF	Amphenol ICC / FCI	1
12	J9, J10, J11	68000102HLF	Amphenol ICC / FCI	3
13	J13	68000103HLF	Amphenol ICC / FCI	1
14	J14	018016020J6617	Renesas Electronics	1
15	J15	DNP	DNP	1
16	JP1, JP2, JP3, JP4	NPC02SXON-RC	Sullins	4
17	Q1, Q2, Q3	RUM002N05T2L	Rohm	3
18	R1- R9	S41X043470JP	CTS	9
19	R10, R29	RC0402JR-070RL	Yageo	2
20	R11, R12, R16, R19, R22, R32, R33	RC0402JR-071KL	Yageo	7
21	R13, R14, R25, R26	RC0402JR-0710KL	Yageo	4
22	R15, R18, R21, R24, R30, R31	RC0402JR-074K7L	Yageo	6
23	R17, R20, R23	RC0402JR-07100KL	Yageo	3
24	R27, R28	DNP	DNP	2
25	U1	AT25FF041A-SHN-T	Renesas	1
26	U2, U3, U4, U5	74HC4066PW,118	Nexperia	4
27	U6, U7	FSA3051TMX	ON Semiconductor / Fairchild	2
28	U8	SLG59M1563V	Renesas Electronics America Inc	1
29	U9	ABM3B-25.000MHZ-D2Y-T	Abracon	1
30	U10	SI5351A-B-GTR	Skyworks Solutions	1
31	U11	DNP	DNP	1
32	U12	SLG7RN48654	Renesas Electronics America Inc	1

5. Ordering Information

Part Number	Description
SLG7SC2	ForgeFPGA Socket Card #2 (ID-06080101)
SLG47910C-SKT	ForgeFPGA Socket Card #2, 20 Samples of SLG47910C and SLG479PMODLED Adapter

6. Certifications

The ForgeFPGA Socket Card #2 complies with the following certifications/standards.

6.1 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) The 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 harmonisation 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) The 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) The 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.

6.2 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

7. Revision History

Revision	Date	Description
1.02	Mar 18, 2026	Fixed typos
1.01	Mar 05, 2026	Added Certifications section
1.00	Nov 10, 2025	Initial release.