User Manual

GreenPAK Serial Debugger

UM-GP-004

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1 Terms and Definitions

FET	Field-Effect Transistor
GND	Ground
HID	Human Interface Device
ISP	In-System Programming
LDO	Low Dropout Voltage Regulator
LED	Light Emitting Diode
NVM	Non-Volatile Memory
OCP	Over-Current Protection
OTP	Over-Temperature Protection
OVP	Overvoltage Protection
PCB	Printed Circuit Board
PTC	Positive Temperature Coefficient Resistor
SCL	I²C Clock Input
SCP	Short Circuit Protection
SDA	I²C Data Input/Output
USB	Universal Serial Bus
V_{DD}	Power Supply

2 Description

GreenPAK Serial Debugger (GSD) device can be used for programming GreenPAK products with multiple time Non-Volatile Memory (NVM) or for configuring the interconnect logic, the IOs, and the macrocells of all GreenPAK chips with I²C interface.

The GSD works with the GreenPAK Designer version 6.xx and above. Select the GSD in the “Development Platform Selector” window and click on the “Program” or “Emulate” button.

Supported operational systems:

- Windows - XP (SP3), Vista, 7, 8, and 8.1, 10
- Linux - any distribution with support for CDC and HID classes
- Mac OS - all versions starting from 10.7

GSD is the Human Interface Device (HID) and does not require any additional drivers.

The device runs as an I²C Master. The Data to read/write on the I²C Bus is conveyed by the USB interface with a speed of 12 Mb/s. I²C interface clock rate of GreenPAK Serial Debugger is up to 400 kHz.

Chip programming/emulation/debugging is done through the I²C protocol via four chip pins: V_{DD}, SCL, SDA, and GND.

When the GSD is connected to USB, the “Power” LED turns on. The connected chip can be powered from the GSD or from an external power. GSD can deliver voltage from 0.9 V to 5.0 V with a maximum output current of up to 100 mA.

GSD detects the external power and switches off its V_{DD} line (in this case, I²C pull-up resistors will be connected to the external power supply).

Table 1: GreenPAK Serial Debugger LED Indicators

GSD State	Power LED	Status LED
Standby mode	On	Off
Emulation mode	On	Blink
Program mode	On	Blink
Overvoltage protection at V_{DD} line	Blink	Off
Over-temperature protection	Off	Off

Table 2: GreenPAK Serial Debugger On-Board Protection

Protection	Description
Over-current protection (OCP)	PTC limits maximum V_{DD} current equals 100 mA.
Short circuit protection (SCP)	PTC limits maximum V_{DD} current equals 100 mA.
Overvoltage protection (OVP)	When the external power supply voltage exceeded 5.6 V, FET U1 and power supply LDO IC2 are turned off and Power LED starts to blink.
Over-temperature protection (OTP)	When the IC2 temperature exceeds 75 °C, FET U1 and power supply LDO IC2 are turned off and Power and Status LEDs are also turned off.

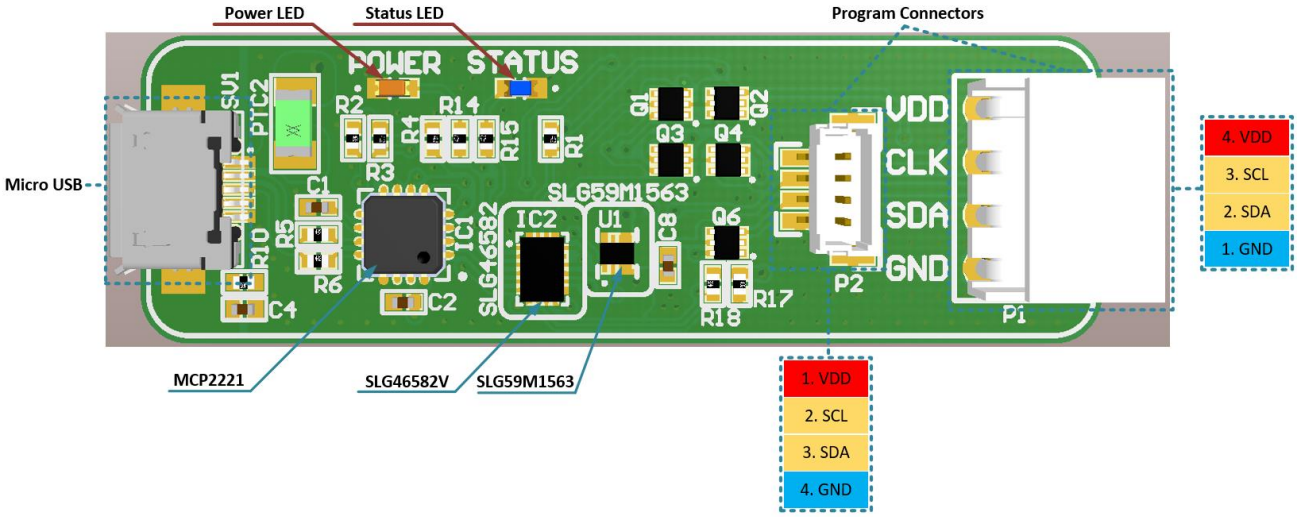


Figure 1: GreenPAK Serial Debugger Top View

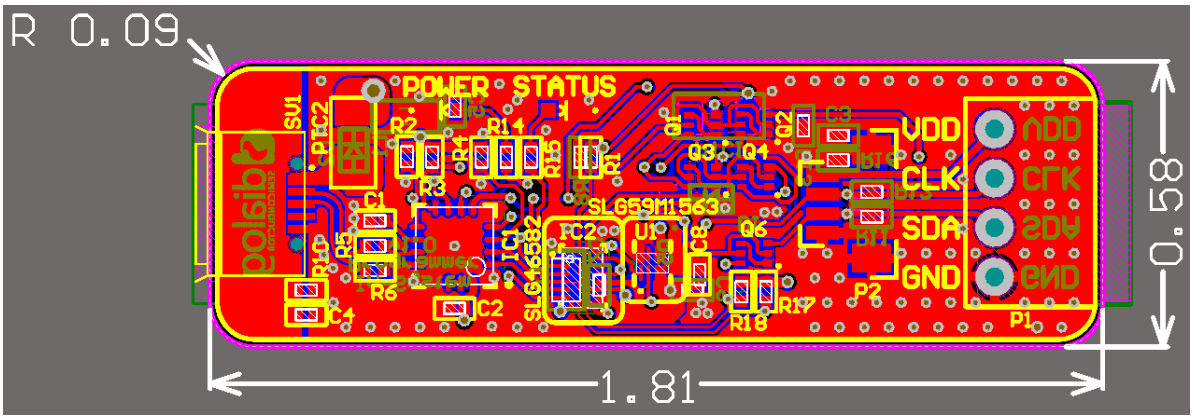


Figure 2: PCB

Note 1 All sizes in inches.

3 Using GreenPAK Serial Debugger

3.1 In-System Programming

The GSD allows emulating and programming chips with multiple time programmable Non-Volatile Memory only. The chip is programmed/emulated through the I²C protocol via four pins: V_{DD}, SCL, SDA, and GND.

When the GSD is connected to the USB port, the "Power" LED turns on. The ISP connector (P1 or P2) should be connected to the external board. The programmed chip can be powered from the GSD or from the external power supply. The GSD detects the external power and switches off its V_{DD} line (in this case, I²C pull-up resistors are connected to the external power supply).

There are two options for the User to make a connection between the GSD and their target board:

- The P1 connector has four signals for SDA, SCL, power, and ground. This connector can be used to make physical and electrical connection to the target board. To enable this, the User should place a duplicate of this connector on the target board. The part number of this connector is Molex Connector Corporation 0022152046. This connector was chosen for its small physical size.

- The P2 connector also has the same four signals for SDA, SCL, power, and ground. This connector has 0.1" spacing, which will support a variety of industry-standard cabling options. Additionally, Target Board Cable is included with the GSD. If the User prefers to use this option, the cabling mating connector on the target board must be chosen. The part number for this connector is BM04B-SRSS-TB(LF)(SN).

The GSD is equipped with on-board protection and LED indicators, please refer to Table 1 and Table 2 for more information.

For more detailed description of the programming/emulating procedure please refer to the In-System Programming Guide.

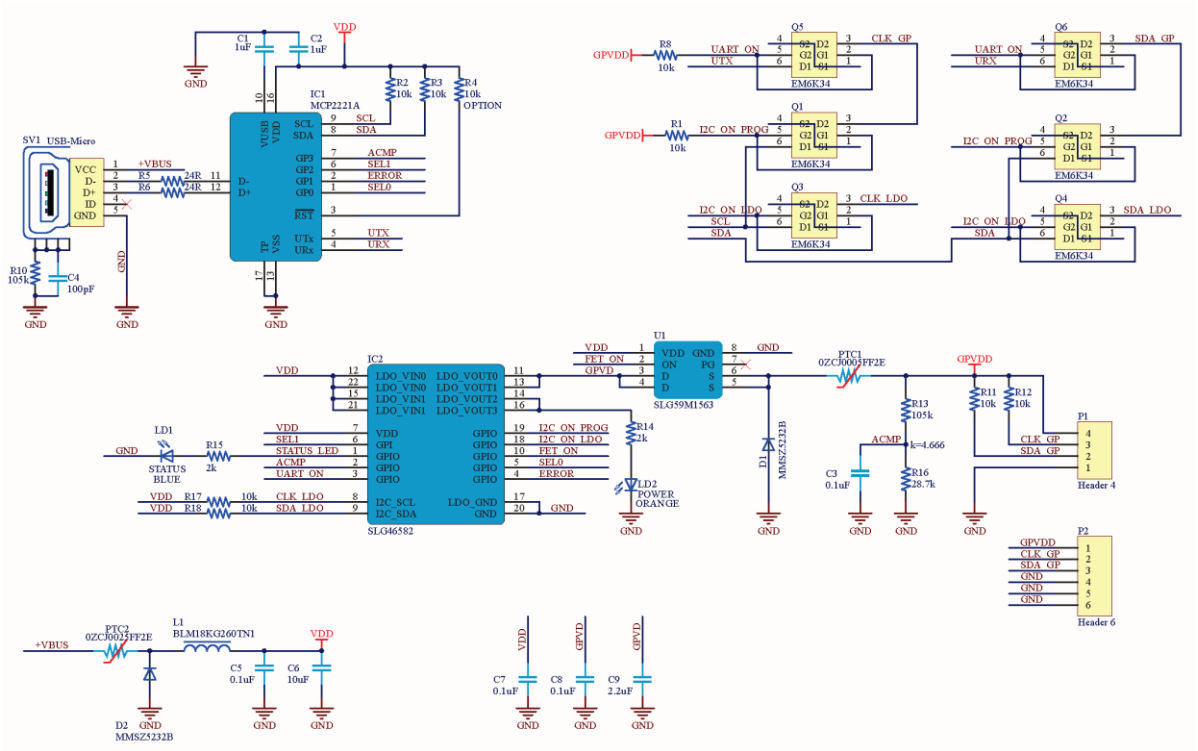
3.2 In-System Debugging

GreenPAK Serial Debugger can be used for debugging/emulating any pre-programmed or blank GreenPAK chips that support I²C interface. It is possible to reconfigure the interconnect logic, the IOs, and the macrocells. However, all NVM changes cannot be saved and will be discarded after power off. The debugging/emulating process is done through the I²C protocol via four chip pins: V_{DD}, SCL, SDA, and GND.

When the GSD is connected to the USB port, the "Power" LED turns on. The ISP connector (P1 or P2) should be connected to the external board. The debugged/emulated chip can be powered from the GSD or from the external power supply. The GSD detects the external power and switches off its V_{DD} line (in this case, I²C pull-up resistors are connected to the external power supply).

See Section 3.1 for physical connections between the GSD and the target board.

Appendix A Schematic Diagram



Appendix B BOM

#	Designator	Description	Footprint	Quantity
1	C1, C2	CAP CER 1UF 10V Y5V 0402	C0402	2
2	C4	CAP CER 100PF 10V X7R 0402	C0402	1
3	C3, C5, C7, C8	CAP CER 0.1UF 10V X5R 0402	C0402	4
4	C6	CAP CER 10UF 10V X5R 0805	C0805	1
5	C9	CAP CER 2.2UF 10V X5R 0402	C0402	1
6	D1, D2	TVS DIODE 5VWM 9.2VC SOD123W	SOD123	2
7	IC1	USB Bridge, USB to I²C/UART USB 2.0 I²C, UART Interface 16-QFN (4x4)	QFN16-4.0x4.0	1
8	IC2	IC2_SLG46582V_ISDP_Adress0001	STQFN-20L-2.0x3.0	1
9	L1	FERRITE BEAD 26 OHM 0603 1LN	F0603	1
10	LD1	LED BLUE CLEAR 0603 SMD	LED0603_BLUE	1
11	LD2	Orange 605nm LED Indication - Discrete 2.2V 0603 (1608 Metric)	LED0603_ORANGE	1
12	P1	CONN RECEPT 4POS .100 R/A PCB	MOLEX_4pin	1
13	PTC1	PTC RESET FUSE 60V 50MA 1206	R_1206	1
14	PTC2	PTC RESET FUSE 16V 250MA 1206	R_1206	1
15	Q1, Q2, Q3, Q4, Q5, Q6	MOSFET 2N-CH 50V 0.2A EMT6	SOT-563	6
16	R1, R2, R3, R8, R11, R12, R17, R18	RES SMD 10K OHM 1% 1/16W 0402	RES 0402L (1005)	8
17	R5, R6	RES SMD 24 OHM 1% 1/16W 0402	RES 0402L (1005)	2
18	R10, R13	RES SMD 105K OHM 1% 1/16W 0402	RES 0402L (1005)	2
19	R14, R15	RES SMD 2K OHM 1% 1/16W 0402	RES 0402L (1005)	2
20	R16	RES SMD 28.7K OHM 1% 1/16W 0402	RES 0402L (1005)	1
21	SV1	CONN USB MICRO B RECPT SMT R/A	m_USB	1
22	U1	SLG59M1563V	STDFN_1.0x1.6-8L1	1
23	P2	CONN HEADER SH 4POS TOP 1MM TIN	BM04B_WHITE	1

Revision History

Revision	Date	Description
1.1	22-Mar-2022	Renesas rebranding
1.0	20-Oct-2020	Initial version

Status Definitions

Status	Definition
DRAFT	The content of this document is under review and subject to formal approval, which may result in modifications or additions.
APPROVED or unmarked	The content of this document has been approved for publication.

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(Rev.1.0 Mar 2020)

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