

Development Kit S7G2 (DK-S7G2)

User's Manual

Renesas Synergy™ Platform
Synergy Tools & Kits
Kits: DK-S7G2 v4.1

All information contained in these materials, including products and product specifications, represents information on the product at the time of publication and is subject to change by Renesas Electronics Corp. without notice. Please review the latest information published by Renesas Electronics Corp. through various means, including the Renesas Electronics Corp. website (<http://www.renesas.com>).

Notice

1. Descriptions of circuits, software and other related information in this document are provided only to illustrate the operation of semiconductor products and application examples. You are fully responsible for the incorporation or any other use of the circuits, software, and information in the design of your product or system. Renesas Electronics disclaims any and all liability for any losses and damages incurred by you or third parties arising from the use of these circuits, software, or information.
2. Renesas Electronics hereby expressly disclaims any warranties against and liability for infringement or any other claims involving patents, copyrights, or other intellectual property rights of third parties, by or arising from the use of Renesas Electronics products or technical information described in this document, including but not limited to, the product data, drawings, charts, programs, algorithms, and application examples.
3. No license, express, implied or otherwise, is granted hereby under any patents, copyrights or other intellectual property rights of Renesas Electronics or others.
4. You shall not alter, modify, copy, or reverse engineer any Renesas Electronics product, whether in whole or in part. Renesas Electronics disclaims any and all liability for any losses or damages incurred by you or third parties arising from such alteration, modification, copying or reverse engineering.
5. Renesas Electronics products are classified according to the following two quality grades: "Standard" and "High Quality". The intended applications for each Renesas Electronics product depends on the product's quality grade, as indicated below.

"Standard": Computers; office equipment; communications equipment; test and measurement equipment; audio and visual equipment; home electronic appliances; machine tools; personal electronic equipment; industrial robots; etc.

"High Quality": Transportation equipment (automobiles, trains, ships, etc.); traffic control (traffic lights); large-scale communication equipment; key financial terminal systems; safety control equipment; etc.

Unless expressly designated as a high reliability product or a product for harsh environments in a Renesas Electronics data sheet or other Renesas Electronics document, Renesas Electronics products are not intended or authorized for use in products or systems that may pose a direct threat to human life or bodily injury (artificial life support devices or systems; surgical implantations; etc.), or may cause serious property damage (space system; undersea repeaters; nuclear power control systems; aircraft control systems; key plant systems; military equipment; etc.). Renesas Electronics disclaims any and all liability for any damages or losses incurred by you or any third parties arising from the use of any Renesas Electronics product that is inconsistent with any Renesas Electronics data sheet, user's manual or other Renesas Electronics document.

6. When using Renesas Electronics products, refer to the latest product information (data sheets, user's manuals, application notes, "General Notes for Handling and Using Semiconductor Devices" in the reliability handbook, etc.), and ensure that usage conditions are within the ranges specified by Renesas Electronics with respect to maximum ratings, operating power supply voltage range, heat dissipation characteristics, installation, etc. Renesas Electronics disclaims any and all liability for any malfunctions, failure or accident arising out of the use of Renesas Electronics products outside of such specified ranges.
7. Although Renesas Electronics endeavors to improve the quality and reliability of Renesas Electronics products, semiconductor products have specific characteristics, such as the occurrence of failure at a certain rate and malfunctions under certain use conditions. Unless designated as a high reliability product or a product for harsh environments in a Renesas Electronics data sheet or other Renesas Electronics document, Renesas Electronics products are not subject to radiation resistance design. You are responsible for implementing safety measures to guard against the possibility of bodily injury, injury or damage caused by fire, and/or danger to the public in the event of a failure or malfunction of Renesas Electronics products, such as safety design for hardware and software, including but not limited to redundancy, fire control and malfunction prevention, appropriate treatment for aging degradation or any other appropriate measures. Because the evaluation of microcomputer software alone is very difficult and impractical, you are responsible for evaluating the safety of the final products or systems manufactured by you.
8. Please contact a Renesas Electronics sales office for details as to environmental matters such as the environmental compatibility of each Renesas Electronics product. You are responsible for carefully and sufficiently investigating applicable laws and regulations that regulate the inclusion or use of controlled substances, including without limitation, the EU RoHS Directive, and using Renesas Electronics products in compliance with all these applicable laws and regulations. Renesas Electronics disclaims any and all liability for damages or losses occurring as a result of your noncompliance with applicable laws and regulations.
9. Renesas Electronics products and technologies shall not be used for or incorporated into any products or systems whose manufacture, use, or sale is prohibited under any applicable domestic or foreign laws or regulations. You shall comply with any applicable export control laws and regulations promulgated and administered by the governments of any countries asserting jurisdiction over the parties or transactions.
10. It is the responsibility of the buyer or distributor of Renesas Electronics products, or any other party who distributes, disposes of, or otherwise sells or transfers the product to a third party, to notify such third party in advance of the contents and conditions set forth in this document.
11. This document shall not be reprinted, reproduced or duplicated in any form, in whole or in part, without prior written consent of Renesas Electronics.
12. Please contact a Renesas Electronics sales office if you have any questions regarding the information contained in this document or Renesas Electronics products.

(Note1) "Renesas Electronics" as used in this document means Renesas Electronics Corporation and also includes its directly or indirectly controlled subsidiaries.

(Note2) "Renesas Electronics product(s)" means any product developed or manufactured by or for Renesas Electronics.

(Rev.4.0-1 November 2017)

Corporate Headquarters

TOYOSU FORESIA, 3-2-24 Toyosu,
Koto-ku, Tokyo 135-0061, Japan
www.renesas.com

Trademarks

Renesas and the Renesas logo are trademarks of Renesas Electronics Corporation. All trademarks and registered trademarks are the property of their respective owners.

Contact information

For further information on a product, technology, the most up-to-date version of a document, or your nearest sales office, please visit:
www.renesas.com/contact/.

Renesas Synergy™ Development Kit (DK-S7G2) Disclaimer

By using this DK-S7G2, the user accepts the following terms, which are in addition to, and control in the event of disagreement, with Renesas' General Terms and Conditions available at <https://www.renesas.com/en-us/legal/disclaimer.html>.

The DK-S7G2 is not guaranteed to be error free, and the entire risk as to the results and performance of the DK-S7G2 is assumed by the User. The DK-S7G2 is provided by Renesas on an "as is" basis without warranty of any kind whether express or implied, including but not limited to the implied warranties of satisfactory quality, fitness for a particular purpose, title, and non-infringement of intellectual property rights with regard to the DK-S7G2. Renesas expressly disclaims all such warranties.

Renesas does not consider the DK-S7G2 a finished product and therefore the DK-S7G2 may not yet comply with some requirements applicable to finished products, including, but not limited to recycling (WEEE), CE, UL, restricted substances (ROHS), FCC, FEE, and electromagnetic compatibility regulations. Renesas or its affiliates shall in no event be liable for any loss of profit, loss of data, loss of contract, loss of business, damage to reputation or goodwill, any economic loss, any reprogramming or recall costs (whether the foregoing losses are direct or indirect) nor shall Renesas or its affiliates be liable for any other direct or indirect special, incidental or consequential damages arising out of or in relation to the use of this DK-S7G2, even if Renesas or its affiliates have been advised of the possibility of such damages.

Renesas has used reasonable care in preparing the information included in this document, but Renesas does not warrant that such information is error free nor does Renesas guarantee an exact match for every application or parameter to part numbers designated by other vendors listed herein. The information provided in this document is intended solely to enable the use of Renesas products. No express or implied license to any intellectual property right is granted by this document or in connection with the sale of Renesas products. Renesas reserves the right to make changes to specifications and product descriptions at any time without notice. Renesas assumes no liability for any damages incurred by you resulting from errors in or omissions from the information included herein. Renesas cannot verify, and assumes no liability for, the accuracy of information available on another company's website.

Precautions

This Renesas Synergy™ Development Kit is only intended for use in a laboratory environment under ambient temperature and humidity conditions. A safe separation distance should be used between this and any sensitive equipment. Its use outside the laboratory, classroom, study area, or similar such area invalidates conformity with the protection requirements of the Electromagnetic Compatibility Directive and could lead to prosecution.

The product generates, uses, and can radiate radio frequency energy and may cause harmful interference to radio communications. There is no guarantee that interference will not occur in a particular installation. If this equipment causes harmful interference to radio or television reception, which can be determined by turning the equipment off or on, you are encouraged to try to correct the interference by one or more of the following measures:

- Ensure attached cables do not lie across the equipment.
- Reorient the receiving antenna.
- Increase the distance between the equipment and the receiver.
- Connect the equipment into an outlet on a circuit different from that which the receiver is connected.
- Power down the equipment when not in use.
- Consult the dealer or an experienced radio/TV technician for help.

Note: It is recommended that wherever possible shielded interface cables are used.

The product is potentially susceptible to certain EMC phenomena. To mitigate against them it is recommended that the following measures be undertaken:

- The user is advised that mobile phones should not be used within 10 m of the product when in use.
- The user is advised to take ESD precautions when handling the equipment.

The Renesas Synergy™ Development Kit does not represent an ideal reference design for an end product and does not fulfill the regulatory standards for an end product.

Renesas Synergy™ Platform

Development Kit S7G2 (DK-S7G2) v4.1**Contents**

1. Overview	2
2. Kit Contents	5
3. Getting Started with Embedded Application Development on DK-S7G2	5
4. DK-S7G2 Hardware Details	6
4.1 Jumpers and DIP Switch Settings	6
4.1.1 Default Board Configuration	6
5. Hardware Layout	7
5.1 System Block Diagram	7
5.2 Power Requirements	8
5.2.1 Power-up Behavior	8
5.2.2 Battery Supply Configuration	8
5.2.3 Measuring Current Consumption	9
5.3 Main Components	9
5.4 Connectivity and Settings	11
5.4.1 Device USB	11
5.4.2 Host USB	11
5.4.3 Debug USB	12
5.4.4 JTAG/SWD/TRACE	13
5.4.5 LEDs	13
5.4.6 Switches	14
5.4.7 PMOD A	14
5.4.8 PMOD B	15
5.4.9 PMOD C	16
5.4.10 PMOD D	17
5.4.11 Ethernet 0	18
5.4.12 Ethernet 1	19
5.4.13 RS232/485 Transceiver	20
5.4.14 CAN Transceiver	21
5.4.15 QSPI Flash	21
5.4.16 SDRAM	22
5.4.17 SD Card Socket	23
5.4.18 eMMC	24
5.4.19 Camera Interface	25

5.4.20	Audio Jack	26
5.4.21	LCD	26
5.4.22	External LCD Connector	28
5.4.23	User Potentiometer	30
5.4.24	Kit Data Serial EEPROM	30
5.5	Breakout Pin Headers	30
5.6	Configuration	31
5.6.1	Function select DIP switches	31
5.6.2	Ethernet 0 Multiplexing	33
5.6.3	Ethernet 1 Multiplexing	34
5.6.4	LCD Multiplexing	35
5.6.5	SDRAM Multiplexing	36
6.	Electrical Schematics	37
7.	Mechanical Drawing	62
8.	Certifications	63
	Revision History	65

1. Overview

The Development Kit S7G2 (DK-S7G2) provides easy-to-access interfaces to the peripherals of the S7G2 microcontroller for application development. The kit includes breakout pin headers for direct access to the S7G2 microcontroller I/O pins. DIP configuration switches allow easy transition between different board configurations and ensure that the signal lines are always properly connected.

- Renesas Synergy™ S7G2 Microcontroller Group
 - R7FS7G27H2A01CBD
 - 224-pin Ball Grid Array package
 - 240 MHz Arm® Cortex® M4 core with FPU
 - 640 KB on-chip SRAM
 - 4 MB on-chip code flash memory
 - 64 KB on-chip data flash memory
- Connectivity
 - One HS Host USB and one FS Device USB connector for the Main MCU
 - SEGGER J-Link® On-board (OB) interface for debugging and programming of the S7G2 MCU. A 20-pin JTAG/SWD interface is also provided for connecting optional external debuggers and programmers.
 - Four PMOD connectors, allowing use of appropriate PMOD compliant peripheral plug-in modules for rapid prototyping
 - Pin headers for access to power and signals for the Main MCU
 - Terminal block connector for access to RS233/485 and CAN interfaces
 - 3.5 mm analog audio output jack
 - Right-angle socket for connecting an optional external LCD display
- Multiple clock sources
 - Main MCU oscillator crystals, providing precision 24.000 MHz and 32,768 Hz reference clocks
 - Additional low-precision clocks are available internal to the Main MCU
- MCU reset push button switch

- Operating voltage
 - External 5 V input through a 5 mm barrel jack connector supplies the on-board power regulator to power the Development Kit logic and interfaces.
 - Button cell battery holder for on-board battery backup
 - Current sense resistors and power measurement test points for precision current consumption measurement.
- A green LED indicating availability of regulated power
- Two green and two red User LEDs, controlled by the Main MCU firmware
- Three User push-button switches and a User Potentiometer, all of which are monitored by the Main MCU firmware
- MCU boot configuration jumper
- 256 Mb SDRAM
- 256 Mb QSPI Serial Flash
- 4-GB e.MMC
- SD Card socket
- On-board 4.3" 480x272 RGB Graphic TFT LCD module with Resistive Touch overlay
- Parallel Data Capture (PDC) Camera Module
- Configuration DIP switches with LED indicators for each functional block

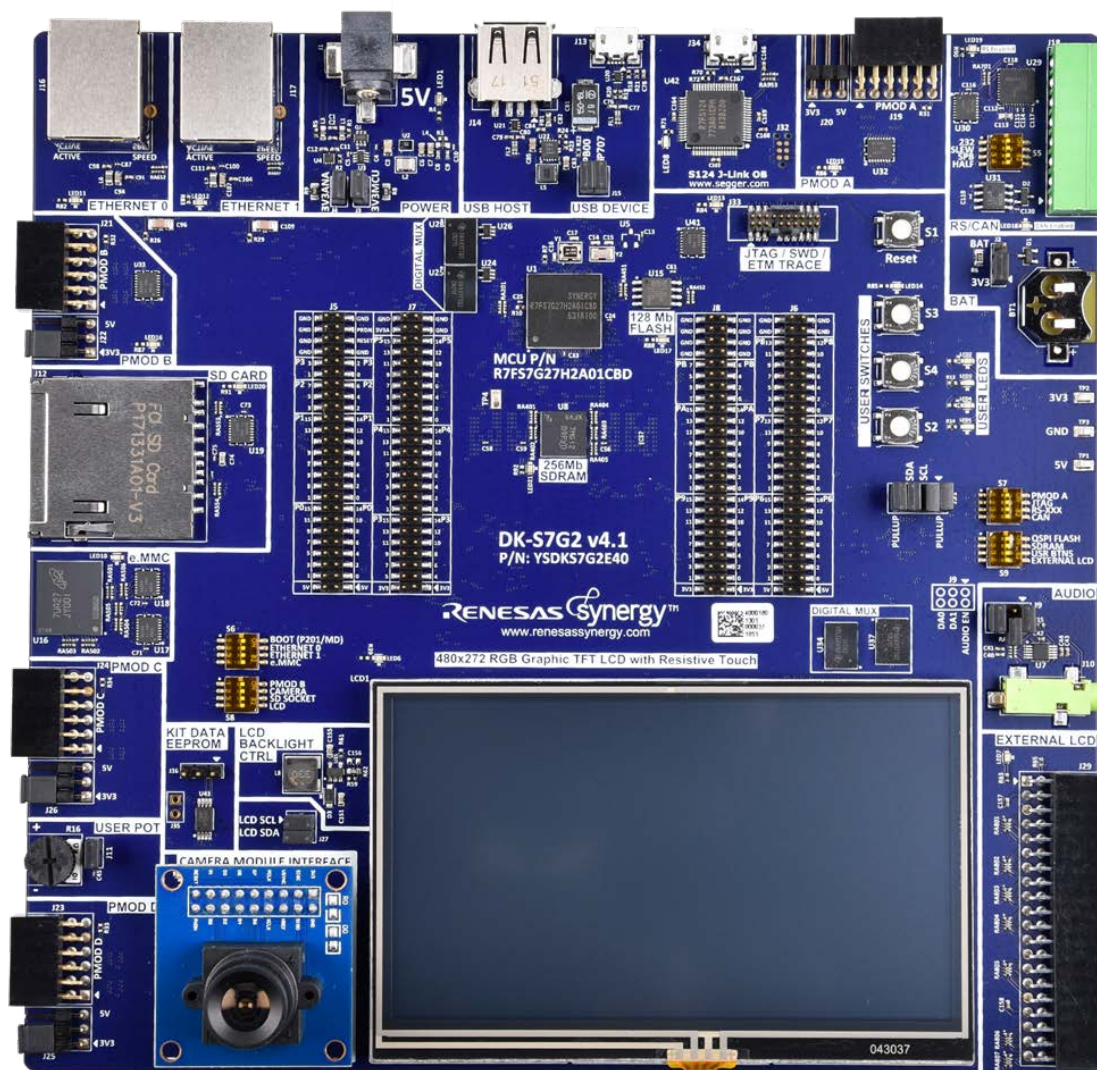


Figure 1. DK-S7G2 Top Side

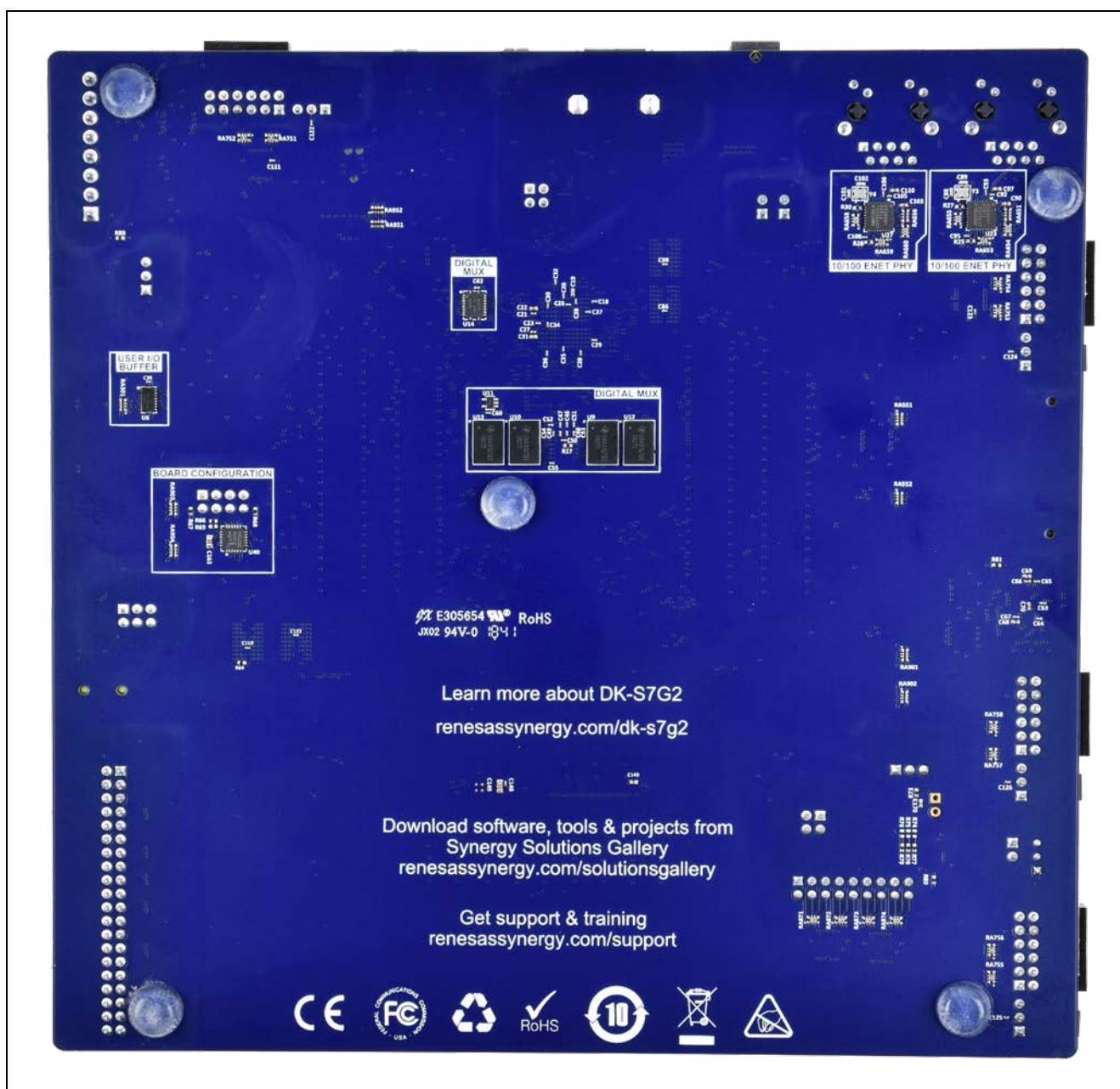


Figure 2. DK-S7G2 Bottom Side

2. Kit Contents

The following components are included in the Development Kit S7G2 (DK-S7G2):

- 1x DK-S7G2 board
- Detachable CMOS VGA camera module
- 1x USB Type-A to Micro-B cable
- 1x Ethernet patch cable
- UART and CAN adapter block
- Multi-region 5 V power supply

3. Getting Started with Embedded Application Development on DK-S7G2

To develop and execute embedded applications on the DK-S7G2 using the Synergy Platform, Synergy Software Package and development tools are required to be installed on your computer.

Step 1: Create My Renesas Account (if you do not have one already)

You need a **My Renesas** account to download software, development tools, and application projects. Log in to or Sign up for a **My Renesas** account at www.update.renesas.com/SSO/login.

Step 2: Download and Install Synergy Software Package and Development Tools

The Synergy Software Package, J-Link USB drivers, and one of the two supported tool chains are bundled and available as single downloadable file as follows:

- IAR Platform Installer** installs Synergy Software Package and IAR Embedded Workbench® for Renesas Synergy™ IDE with IAR compiler and J-Link USB drivers.
Download from www.renesas.com/synergy/ewsynergy.
- e² studio Platform Installer** installs Synergy Software Package and e² studio for Synergy IDE with IAR compiler and J-Link USB drivers.
Download from www.renesas.com/synergy/e2studio.

Note: The DK-S7G2 uses J-Link® On-board (OB) debug interface. While J-Link drivers are necessary to establish debug connection between the host PC and the DK-S7G2, they are not required to run the Out-of-Box (OoB) Demonstration Application that the DK-S7G2 comes pre-programmed with. Refer to the *DK-S7G2 Quick Start Guide* for more details.

Step 3: Explore Existing Application Projects for the DK-S7G2

Renesas provides several application projects to demonstrate different capabilities of the S7G2 MCU Group. These application projects can also serve as a good starting point for you to develop your custom applications. Application projects available for the DK-S7G2 are listed at www.renesas.com/synergy/dk-s7g2.

- Notes:
1. Every application project includes the project files, an application note, and instructions to import the application project.
 2. On downloading the application project from the website to your computer, the application projects have to be built using one of the two supported tool chains before they can be downloaded on to the DK-S7G2 board.

4. DK-S7G2 Hardware Details

4.1 Jumpers and DIP Switch Settings

4.1.1 Default Board Configuration

The Circuit Group for each jumper is the designation found in the board schematic. See Section 6, Electrical Schematics. Functional details for many of the listed jumpers may be found in Section 5.4, Connectivity and Settings. The following table describes the default settings for each jumper on the DK-S7G2.

Table 1. Default Jumper Settings

Location	Circuit Group	Default Open/Closed	Function
J2	Power	Jumper on pins 1-2	MCU VBAT source
J3	Power	Open	MCU main 3.3 V current measurement
J4	Power	Open	MCU analog 3.3 V current measurement
J9	Audio	All open	Connects audio amplifier to MCU
J11	User	Jumper on pins 1-2	Connects user potentiometer to MCU
J15	USB	Jumper on pins 1-2 and on pins 3-4	Connects USBH_OC (P707) and USBH_VBUSEN (PB00) to USB power regulator
J20	PMOD	Jumper on pins 1-2	Configures PMOD A for 3.3 V operation
J22	PMOD	Jumper on pins 1-2	Configures PMOD B for 3.3 V operation
J26	PMOD	Jumper on pins 1-2	Configures PMOD C for 3.3 V operation
J25	PMOD	Jumper on pins 1-2	Configures PMOD D for 3.3 V operation
J27	LCD	Jumper on pins 1-2 and on pins 3-4	Connects LCD I2C to system I2C
J31	Configuration	Jumpers on pins 1-2, pins 3-4, pins 5-6, and pins 7-8	Connects configuration I/O expander I2C to system I2C and connects pullup resistors to the system I2C signals.
J35	Kit Data	Not Populated	For factory use only

The following table describes the default settings for each DIP switch on the DK-S7G2.

Note: An ON setting means that the switch is closed, and an OFF setting means that the switch is open.

Table 2. Default Jumper Settings

Location	Circuit Group	Default Open/Closed	Function
S5-1	RS Config	ON	Sets the transceiver to RS-232 mode
S5-2	RS Config	OFF	Sets the RS Slew Rate (N/A for RS-232 mode)
S5-3	RS Config	OFF	Sets the RS SPB (N/A for RS-232 mode)
S5-4	RS Config	OFF	Enables the RX output
S6-1	Peripheral Config	OFF	Sets Boot mode (MD) to normal boot
S6-2	Peripheral Config	OFF	Disables Ethernet 0
S6-3	Peripheral Config	OFF	Disables Ethernet 1
S6-4	Peripheral Config	OFF	Disables the e.MMC
S7-1	Peripheral Config	OFF	Disables PMOD A
S7-2	Peripheral Config	ON	Enables the JTAG interface
S7-3	Peripheral Config	OFF	Disables the Serial Port (RS232/485) interface
S7-4	Peripheral Config	OFF	Disables the CAN interface
S8-1	Peripheral Config	OFF	Disables PMOD B
S8-2	Peripheral Config	OFF	Disables the Camera Module
S8-3	Peripheral Config	OFF	Disables the SD Card
S8-4	Peripheral Config	ON	Enables the on-board LCD
S9-1	Peripheral Config	OFF	Disables the QSPI Flash
S9-2	Peripheral Config	OFF	Disables the SDRAM
S9-3	Peripheral Config	OFF	Disables the User Pushbuttons
S9-4	Peripheral Config	OFF	Disables the External LCD interface

5. Hardware Layout

5.1 System Block Diagram

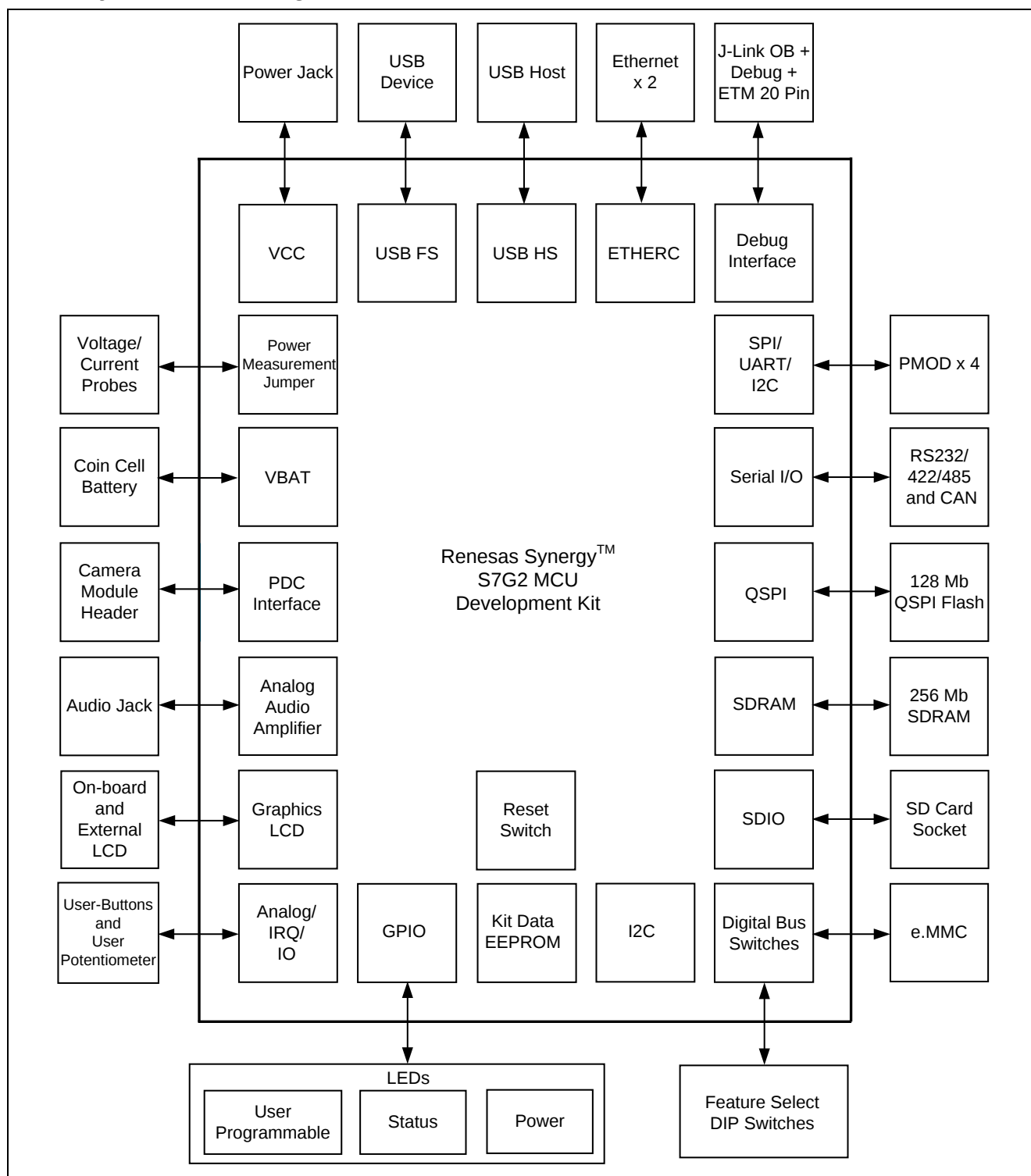


Figure 3. DK-S7G2 Block Diagram

5.2 Power Requirements

DK-S7G2 is designed for +5 V operation. A 5 V, 2.5 A wall-mounted power supply provides power through a barrel jack connector (J1) on DK-S7G2. The input power jack J1 supplies the main 5 V power to the system. This input supplies power to a +3.3 V regulator (U2), which supplies power to most of the digital devices on the board. DK-S7G2 cannot be powered using any of the USB connectors on the board.

5.2.1 Power-up Behavior

When powered, the green LED in the POWER section (LED1) lights up. See the *DK-S7G2 Quick Start Guide (QSG)* for details on the default power-on behavior of the DK-S7G2.



Figure 4. Input Power section

5.2.2 Battery Supply Configuration

An external battery may be installed in the CR1220 coin cell battery holder. This battery is connected only to VBAT on the S7G2 MCU and is used for backup power. The VBAT voltage powers the Realtime Clock (RTC) power domain of the S7G2 microcontroller, and keeps this domain powered even when the main power is removed.

J2 configures the source for VBAT. Place a jumper on pins 1-2 to connect the battery to VBAT. Place a jumper on pins 2-3 to connect the main +3.3 V power to VBAT.

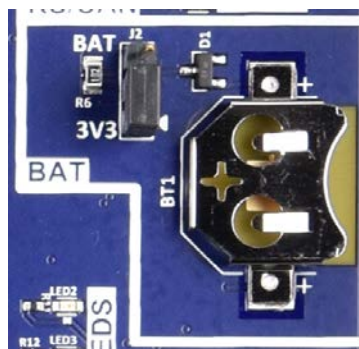


Figure 5. Battery Holder

5.2.3 Measuring Current Consumption

DK-S7G2 provides precision 50 mΩ resistors (Bourns, part number CRM0805-FW-R050ELF) for current measurement of the main 3.3 V MCU power, and the 3.3 V analog MCU power. Measure the voltage drop across these resistors and use Ohm's Law to calculate the current. For convenience, J3 is provided to measure the main 3.3 V MCU power, and J4 is provided to measure the 3.3 V analog MCU power. See Figure 4 for the location of J3 and J4.

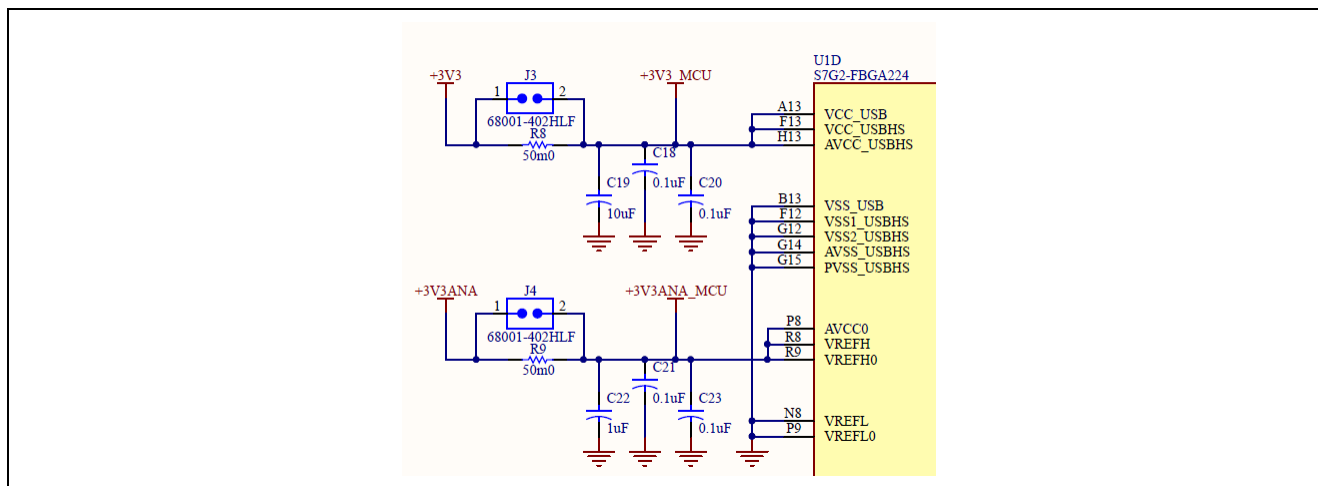


Figure 6. MCU Current Measurement Circuit

5.3 Main Components

- Main MCU
 - Renesas Synergy™ S7G2 MCU device, part number R7FS7G27C3A01CFB#AA0 (U1)
 - Main MCU
- J-Link MCU
 - Renesas Synergy™ S124 MCU device, part number R7FS124773A01CFM#AA0 (U42)
 - J-Link MCU
- USB Connectors
 - FCI, part number 10118192-0001LF (J13, J34)
 - Micro USB 2.0 Female connector
 - Primary communication with Main MCU and J-Link MCU
 - FCI, part number 87583-3010RPALF (J15)
 - USB Type-A Female connector for Host USB
- Ethernet
 - Abracon, part number ARJC02-111009D (J16, J17)
 - Ethernet 10/100 Base-TX RJ45 connector with integrated magnetics
 - Microchip/Micrel, part number KSZ8091RNBIA (U23, U27)
 - Ethernet 10/100 Base-TX PHY controller
- RS232/485 and CAN
 - Amphenol FCI, part number 20020110-C081A01LF (J18)
 - 3.5 mm pitch terminal block for RS232/485 and CAN signals
 - Renesas Intersil, part number ISL41387IRZ (U29)
 - RS232/485 transceiver
 - Infineon, part number IFX1050GVIO (U31)
 - CAN transceiver, 1M Baud
- Push-Buttons
 - C&K, part number KSC222J LFS (S1, S2, S3, S4)
 - Momentary push-button switch
 - Used for system reset and user-defined functions

- DC-DC Buck-Boost Switching Regulator
 - Renesas Intersil, part number ISL91107IINZ (U2)
 - Generates system 3.3 V from main 5 V input
- LDO Regulator
 - Texas Instruments, part number TLV70033DSE (U4)
 - Low-dropout linear regulator
 - Generates analog 3.3 V from main 5 V input
- PMOD Connectors
 - Sullins, part number PPPC062LJBN-RC (J19, J21, J23, J24)
 - 12-pin right angle connector for PMOD
- Pin Headers
 - Amphenol ICC / FCI, part number 57202-G52-25LF (J4, J6, J7, J8)
 - 50 position pin header, 2 mm pitch
 - Provides signal breakout and access for Main MCU signals
- LCD
 - LXD, part number M1790C (LCD1)
 - 480 x 272 RGB Graphic TFT LCD with Resistive Touch
 - FCI, part number 62684-401100ALF (J28)
 - 40 position FPC connector
 - Semtech, part number SX8676IWLTRT (U36)
 - Touchscreen controller for Resistive Touch
- SDRAM
 - Micron, part number MT48LC16M16A2B4-7E IT:G (U8)
 - 256 Mb 16M x 16, 3.3 V
- eMMC
 - Micron, part number MTFC4GACAJCN-4M IT (U16)
 - 4 GB, 3.3 V
- QSPI Flash
 - Macronix, part number MX25L12835FM2I-10G (U15)
 - 256 Mb QSPI serial flash

5.4 Connectivity and Settings

5.4.1 Device USB

The DEVICE USB Micro-B connection jack (J13) connects the Main MCU to an external USB Host, FS capable, allowing communications for testing and use of the Main MCU firmware. Power for the DK-S7G2 cannot be received from this connector. The DEVICE USB interface can detect the presence of power from the USB Host PC. USB Host power received at the DEVICE USB interface is not connected to the DK-S7G2 5 V power bus.

Table 3. Device USB Connector (J13)

USB Device Connector		DK-S7G2
Pin	Description	Signal/Bus
1	+5VDC, connected to a sense voltage 2/3 divider to allow Main MCU sensing of Host presence	+5VUSB $P407/USB_VBUS = 2/3(5VUSB)$
2	Data-	USB_DM
3	Data+	USB_DP
4	USB ID, jack internal switch, cable inserted	N.C.
5	Ground	GND

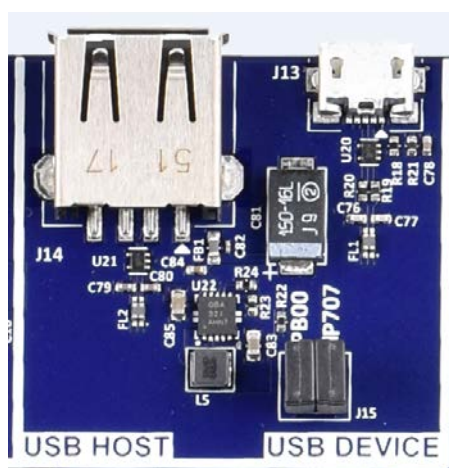


Figure 7. USB Connectors

5.4.2 Host USB

The Host USB Type-A connection jack (J14) connects the Main MCU to external USB devices, HS capable, allowing communications for testing and use of the Main MCU firmware. The USB Host connection includes a TBS2501 USB Power Switch (U22) to provide regulated 5 V USB power to connected devices. The Power Switch provides a nominal 500 mA, and maximum of 720 mA to connected USB devices.

The USB Power Switch is controlled by the S7G2 MCU using P707 (USBHS Overcurrent) and PB00 (USBHS VBUS Enable). To use these ports for other DK-S7G2 functions, these signals may be disconnected from the USB Power Switch by removing the jumpers from J15.

Table 4. Device USB Connector (J14)

USB Device Connector		DK-S7G2
Pin	Description	Signal/Bus
1	+5VDC	+5VUSB Host Power, from U22
2	Data-	USBHS_DM
3	Data+	USBHS_DP
4	Ground	GND

5.4.3 Debug USB

The J-Link OB USB Micro-B connection jack (J34) connects the S124 J-Link MCU to an external USB Host, FS capable, allowing re-programming and debugging of the Main MCU firmware. Power for the DK-S7G2 can NOT be received from this connector.

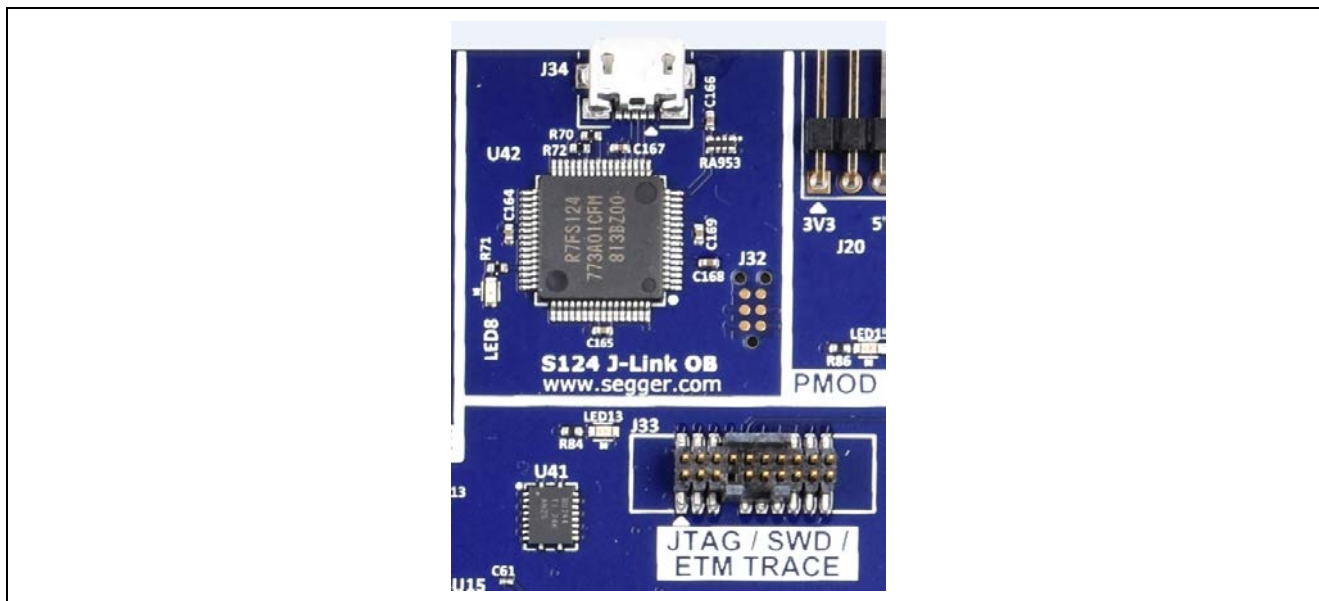


Figure 8. S124 J-Link OB and JTAG

The J-Link OB interface is multiplexed with the JTAG interface and can collectively be referred to as the Programming Interface.

Table 5. Debug USB Connector (J34)

Debug USB Connector		DK-S7G2
Pin	Description	Signal/Bus
1	+5VDC	+5V_JUSB
2	Data-	U2 USB_DM (U2-18)
3	Data+	U2 USB_DP (U2-19)
4	USB ID, jack internal switch, cable inserted	N.C.
5	Ground	GND

5.4.4 JTAG/SWD/TRACE

A 20-pin Cortex® Debug Connector is provided at J33. See Figure 8.

A digital bus switch (U41) is provided to isolate the JTAG signals from the rest of the system. To enable the JTAG header (J33), set DIP Switch S7-2 to ON. When the JTAG interface is enabled, LED13 is illuminated.

Table 6. JTAG/SWD/TRACE Connector (J33)

JTAG Connector				DK-S7G2
Pin	JTAG Pin Name	SWD Pin Name	ETM Pin Name	Signal/Bus
1	VTref	VTref	VTref	+3V3
2	TMS	SWDIO	N/A	P108/SWDIO (U1-51)
3	GND	GND	GND	GND
4	TCK	SWCLK	N/A	P300/SWCLK (U1-50)
5	GND	GND	GND	GND
6	TDO	SWO	N/A	P109 (U1-52)
7	Key	Key	Key	N.C.
8	TDI	NC/EXTb	N/A	P110 (U1-53)
9	GNDDetect	GNDDetect	GNDDetect	N.C. (short E31 to connect to GND)
10	nSRST	nSRST	nSRST	RESET# (U1-38)
11	N/A	N/A	N/A	N.C.
12	N/A	N/A	TCLK	PA12
13	N/A	N/A	N/A	N.C.
14	N/A	N/A	TDATA0	PA13
15	N/A	N/A	GND	GND
16	N/A	N/A	TDATA1	PA14
17	N/A	N/A	GND	GND
18	N/A	N/A	TDATA2	PA15
19	N/A	N/A	GND	GND
20	N/A	N/A	TDATA3	P813

The Cortex® Debug Connector is fully described in the Arm® CoreSight™ Architecture Specification.

5.4.5 LEDs

There are 21 LEDs provided on the DK-S7G2. In addition, each Ethernet connector has built-in link status and link speed LEDs.

The behavior of the LEDs on the DK-S7G2 is described in the following table.

Table 7. DK-S7G2 LED Functions

Designator	Color	Function	MCU Control Port	MCU Pin
LED1	Green	Main Power Indicator	N/A	N/A
LED2	Green	User LED	P807	U1-P12
LED3	Red	User LED	P808	U1-K7
LED4	Green	User LED	P809	U1-K8
LED5	Red	User LED	P810	U1-P3
LED6	Green	LCD Enabled	N/A	N/A
LED7	Green	External LCD Enabled	N/A	N/A
LED8	Red	J-Link connect status	S124 P103	S124 pin 45
LED9	Green	Camera Module Enabled	N/A	N/A
LED10	Green	eMMC Enabled	N/A	N/A
LED11	Green	Ethernet 0 Enabled	N/A	N/A
LED12	Green	Ethernet 1 Enabled	N/A	N/A
LED13	Green	JTAG Enabled	N/A	N/A
LED14	Green	User Buttons and LEDs Enabled	N/A	N/A

LED15	Green	PMOD A Enabled	N/A	N/A
LED16	Green	PMOD B Enabled	N/A	N/A
LED17	Green	QSPI Enabled	N/A	N/A
LED18	Green	CAN Enabled	N/A	N/A
LED19	Green	RS-232/485 Enabled	N/A	N/A
LED20	Green	SD Card Enabled	N/A	N/A
LED21	Green	SDRAM Enabled	N/A	N/A

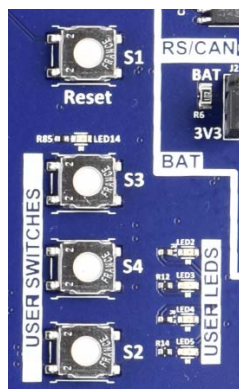


Figure 9. Reset Switch, User Switches, and User LEDs

5.4.6 Switches

Four miniature, momentary, mechanical push-button type SMT switches are mounted on DK-S7G2.

Pressing the Reset switch (S1) generates a reset signal to restart the Main MCU.

Table 8. DK-S7G2 Switches

Designator	Function	MCU Control Port	MCU Pin
S1	MCU Reset Switch	RESET#	U1-F8
S2	User Switch	P006 (AN102)	U1-P10
S3	User Switch	P010 (AN103)	U1-M10
S4	User Switch	P011 (AN104)	U1-N10

A digital bus switch (U6) is provided to isolate the User Switch signals from the rest of the system. To enable the User Switches, set DIP Switch S9-3 to ON. When the User Switches are enabled, LED14 is illuminated.

5.4.7 PMOD A

A 12-pin PMOD Type-2A connector is provided at PMOD A. The Main MCU acts as the SPI master, and the connected module acts as an SPI slave device. This interface may additionally be re-configured in firmware as several other PMOD types.

This PMOD interface may supply either 5 V or 3.3 V to the PMOD device. This can be selected by placing a jumper on the appropriate pins of J20. For 3.3 V operation, place a jumper on pins 1-2, or place a jumper on pins 2-3 for 5 V operation.

A digital bus switch (U32) is provided to isolate the PMOD A signals from the rest of the system. To enable PMOD A, set DIP Switch S7-1 to ON. When the PMOD A is enabled, LED15 is illuminated.

Table 9. PMOD A Connector (J19)

PMOD A Connector		DK-S7G2
Pin	Description	Signal/Bus
1	SS/CTS_RTS	PB02, U1-J11
2	MOSI/TXD	PB04, U1-H10
3	MISO/RXD	PB05, U1-J12
4	SCK	PB03, U1-K12
5	GND	GND

6	VCC	Select using J20
7	INT (slave to master)	P004 (IRQ9), U1-M11
8	RESET (master to slave)	P911, U1-A7
9	Not Specified (GPIO)	P912, U1-B7
10	Not Specified (GPIO)	P913, U1-H8
11	GND	GND
12	VCC	Select using J20

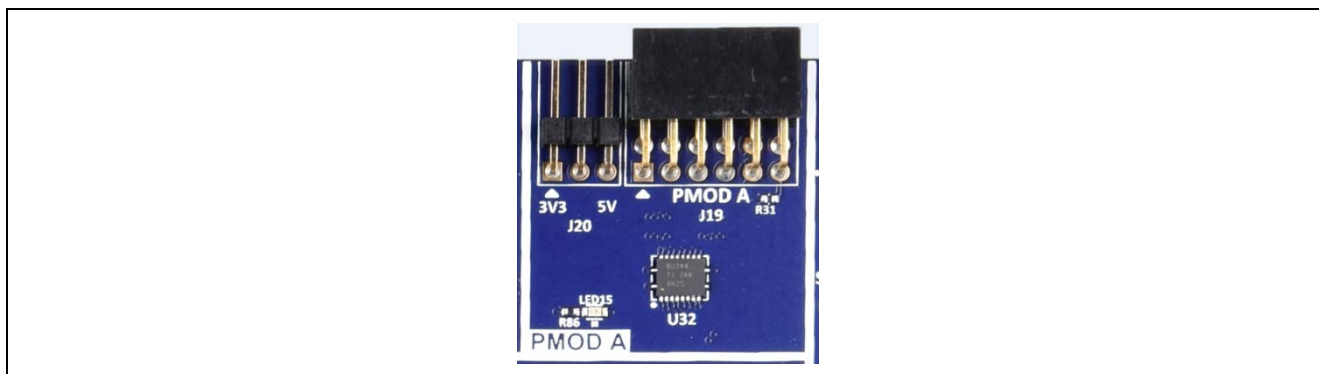


Figure 10. PMOD A

5.4.8 PMOD B

A 12-pin PMOD Type-2A connector is provided at PMOD B. The Main MCU acts as the SPI master, and the connected module acts as an SPI slave device. This interface may additionally be re-configured in firmware as several other PMOD types.

This PMOD interface may supply either 5 V or 3.3 V to the PMOD device. This can be selected by placing a jumper on the appropriate pins of J22. For 3.3 V operation, place a jumper on pins 1-2, or place a jumper on pins 2-3 for 5 V operation.

A digital bus switch (U33) is provided to isolate the PMOD B signals from the rest of the system. To enable PMOD B, set DIP switch S8-1 to ON. When the PMOD B is enabled, LED16 is illuminated.

Table 10: PMOD B Connector (J21)

PMOD B Connector		DK-S7G2
Pin	Description	Signal/Bus
1	SS/CTS_RTS	P507, U1-N6
2	MOSI/TXD	P509, U1-P6
3	MISO/RXD	P510, U1-N7
4	SCK	P508, U1-M7
5	GND	GND
6	VCC	Select using J22
7	INT (slave to master)	P005 (IRQ10), U1-R11
8	RESET (master to slave)	PA05, U1-J3
9	Not Specified (GPIO)	PA06, U1-J2
10	Not Specified (GPIO)	PA07, U1-J1
11	GND	GND
12	VCC	Select using J22



Figure 11. PMOD B

5.4.9 PMOD C

A 12-pin PMOD Type-2A connector is provided at PMOD C. The Main MCU acts as the SPI master, and the connected module acts as an SPI slave device. This interface may additionally be re-configured in firmware as several other PMOD types.

This PMOD interface may supply either 5 V or 3.3 V to the PMOD device. This can be selected by placing a jumper on the appropriate pins of J26. For 3.3 V operation, place a jumper on pins 1-2, or place a jumper on pins 2-3 for 5 V operation.

The ports used for PMOD C are also used for the SDRAM interface. A set of digital bus switches is provided to isolate the SDRAM signals from the rest of the system. To enable PMOD C, the SDRAM must be disabled. To disable the SDRAM, and enable other functions including PMOD C, set DIP switch S9-2 to OFF.

Table 11. PMOD C Connector (J24)

PMOD C Connector		DK-S7G2
Pin	Description	Signal/Bus
1	SS/CTS_RTS	P103, U1-N2
2	MOSI/TXD	P101, U1-P1
3	MISO/RXD	P100, U1-R1
4	SCK	P102, U1-N1
5	GND	GND
6	VCC	Select using J26
7	INT (slave to master)	P008 (IRQ12), U1-N11
8	RESET (master to slave)	P600, U1-L3
9	Not Specified (GPIO)	P601, U1-L2
10	Not Specified (GPIO)	P602, U1-L1
11	GND	GND
12	VCC	Select using J26

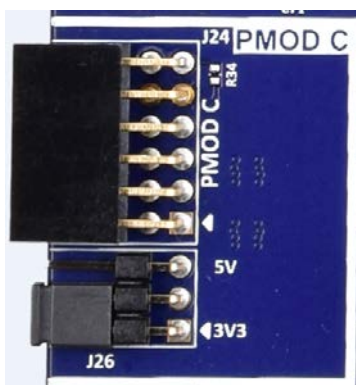


Figure 12. PMOD C

5.4.10 PMOD D

A 12-pin PMOD Type-2A connector is provided at PMOD D. The Main MCU acts as the SPI master, and the connected module acts as an SPI slave device. This interface may additionally be re-configured in firmware as several other PMOD types.

This PMOD interface may supply either 5 V or 3.3 V to the PMOD device. This can be selected by placing a jumper on the appropriate pins of J25. For 3.3 V operation, place a jumper on pins 1-2, or place a jumper on pins 2-3 for 5 V operation.

The ports used for PMOD D are also used for the SDRAM interface. A set of digital bus switches is provided to isolate the SDRAM signals from the rest of the system. To enable PMOD D, the SDRAM must be disabled. To disable the SDRAM, and enable other functions including PMOD D, set DIP switch S9-2 to OFF.

Table 12. PMOD D Connector (J23)

PMOD D Connector		DK-S7G2
Pin	Description	Signal/Bus
1	SS/CTS_RTS	P307, U1-D6
2	MOSI/TXD	P305, U1-D4
3	MISO/RXD	P304, U1-C4
4	SCK	P306, U1-D5
5	GND	GND
6	VCC	Select using J25
7	INT (slave to master)	P009 (IRQ13), U1-R10
8	RESET (master to slave)	P603, U1-K3
9	Not Specified (GPIO)	P604, U1-K2
10	Not Specified (GPIO)	P605, U1-K1
11	GND	GND
12	VCC	Select using J25



Figure 13. PMOD D

5.4.11 Ethernet 0

The Ethernet 0 interface uses an RMII Ethernet Physical Layer Transceiver (PHY) (U23), connected to an RJ45 standard Ethernet connector (J16) with integrated magnetics and status indicators. The Ethernet clock is sourced from a precision 25 MHz clock crystal connected directly to the Ethernet PHY.

A digital bus switch (U25) is provided to isolate the Ethernet 0 signals from the rest of the system. To enable Ethernet 0, set DIP switch S6-2 to ON. When Ethernet 0 is enabled, LED11 is illuminated.

Table 13. Ethernet 0 Port Assignments

Ethernet 0 Signal Description	DK-S7G2 Port
IRQ	P015
RESET#	P903
MDC	P401
MDIO	P402
CRS_DV	P408
TXD_EN	P415
TXD0	P413
TXD1	P414
RXD1	P410
RXD0	P411
RX_ER	P409
REF50CK	P412

Table 14. Ethernet 0 Components

Component	Manufacturer	Manufacturer Part Number
Ethernet PHY	Microchip	KSZ8091RBN
RJ-45 Connector	Abracon	ARJC02-111009D
25 MHz Oscillator	TXC	8Y-25.000MEEQ-T

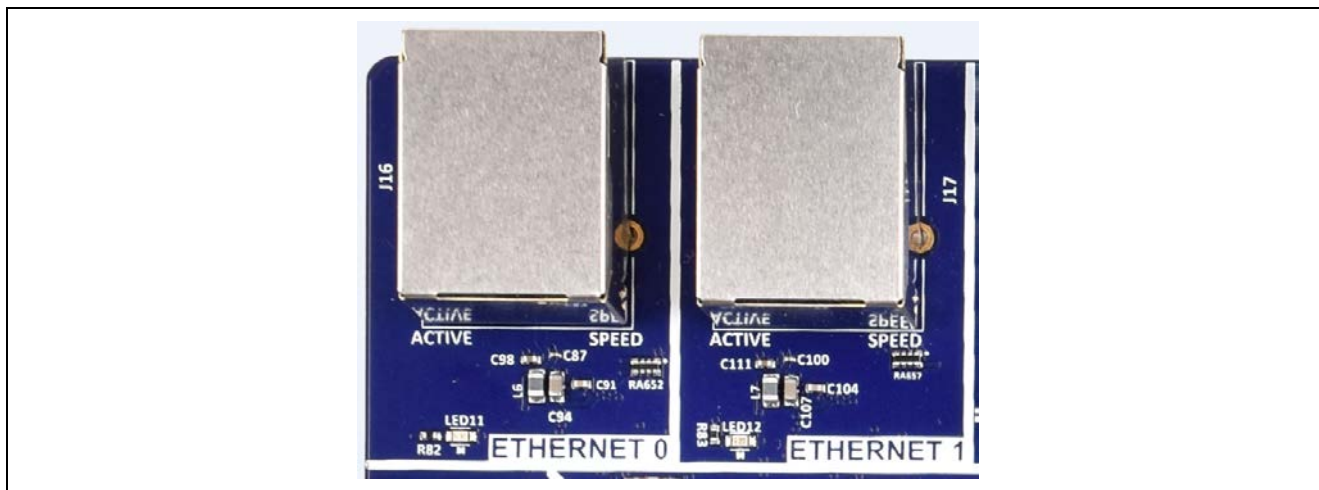


Figure 14. Ethernet Connectors

5.4.12 Ethernet 1

The Ethernet 1 interface uses an RMII Ethernet Physical Layer Transceiver (PHY) (U27), connected to an RJ45 standard Ethernet connector (J17) with integrated magnetics and status indicators. The Ethernet clock is sourced from a precision 25 MHz clock crystal connected directly to the Ethernet PHY.

A digital bus switch (U28) is provided to isolate the Ethernet 1 signals from the rest of the system. To enable Ethernet 1, set DIP switch S6-3 to ON. When Ethernet 1 is enabled, LED12 is illuminated.

Table 15. Ethernet 1 Port Assignments

Ethernet 1 Signal Description	DK-S7G2 Port
IRQ	P002
RESET#	P706
MDC	P403
MDIO	P404
CRS_DV	P705
TXD_EN	P405
TXD0	P700
TXD1	P406
RXD1	P703
RXD0	P702
RX_ER	P704
REF50CK	P701

Table 16. Ethernet 1 Components

Component	Manufacturer	Manufacturer Part Number
Ethernet PHY	Microchip	KSZ8091RBN
RJ-45 Connector	Abracon	ARJC02-111009D
25 MHz Oscillator	TXC	8Y-25.000MEEQ-T

5.4.13 RS232/485 Transceiver

DK-S7G2 includes an Intersil ISL41387 dual-protocol RS-232/485 Transceiver (U29) with loop-back mode and shutdown functions. The shutdown mode disables the receive and transmit outputs of the transceiver, disables the charge pump in RS-232 mode, and places the transceiver in low-current (35 μ A) mode.

In RS-232 mode, the on-board charge pump generates RS-232 compliant ± 5 V Tx output levels. The transceiver supports Rx input levels of ± 25 V and Tx output levels of ± 12 V with data rates of up to 650 kbps.

In RS-485 mode, the charge pump is disabled to save power and minimize noise. The RS-485 receiver supports full fail-safe operation that keeps the Rx output in a high state if the inputs are opened or shorted together. The RS-485 transmitter supports three data rates: up to 20 Mbps, 460 kbps, and 115 kbps. Data rates of 460 kbps and 115 kbps in RS-485 mode are slew-rate limited for problem-free communication.

The transceiver can be configured for either RS-232 or RS-485, and for various data rates using DIP switches 1 through 3 on S5, as shown in the following table.

DIP switch S5-4 (HALF) can be used to disable the receiver output and set up the UART in half-duplex mode by controlling the direction through a GPIO pin.

A digital bus switch (U30) is provided to isolate the RS232/485 signals from the rest of the system. To enable the RS232/485 interface, set DIP switch S7-3 to ON. When RS232/485 interface is enabled, LED19 is illuminated.

Table 17. RS232/485 Configuration using DIP Switch S5

Switch 1 (232)	Switch 2 (SLEW)	Switch 3 (SPB)	Data rate	Mode
OFF	ON	ON	115 kbps	485
OFF	ON	OFF	460 kbps	485
OFF	OFF	X	20 Mbps	485
ON	X	X	460 kbps	232

Table 18. RS232/485 Port Assignments

RS232/485 Signal Description	DK-S7G2 Port
RX	P708
DEN	P914
TX	P709
ON	P915

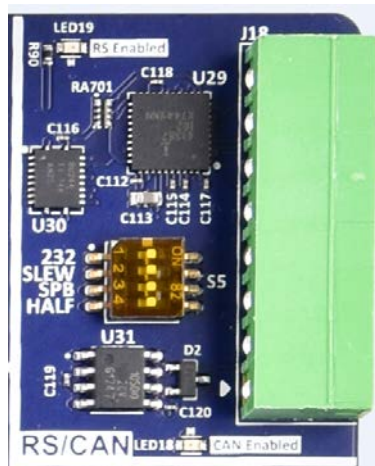


Figure 15. RS232/485 and CAN Interfaces

5.4.14 CAN Transceiver

The Infineon IFX1050GVIO CAN Transceiver (U31) supports transmission rates from 1 kbaud to 1 Mbaud. An On Semiconductor NUP2105 Bus Protector protects the CAN transceiver.

The CAN transceiver is connected to CAN channel 0 on the S7G2 microcontroller and to connector J18.

A digital bus switch (U30) is provided to isolate the CAN signals from the rest of the system. To enable the CAN interface, set DIP switch S7-4 to ON. When the CAN interface is enabled, LED18 is illuminated.

Table 19. CAN Port Assignments

CAN Signal Description	DK-S7G2 Port
TX	P811
RX	P812

5.4.15 QSPI Flash

Included on DK-S7G2 is a Macronix 128 Mb serial flash QSPI memory (MX25L12835FM). The QSPI serial flash device (U15) connects to the QSPI peripheral on the S7G2 MCU and defaults to standard SPI mode initially. The flash memory is enabled for XIP (Execute-in-place) mode directly after power-on.

A digital bus switch (U14) is provided to isolate the QSPI signals from the rest of the system. To enable the QSPI Flash, set DIP switch S9-1 to ON. When the QSPI Flash is enabled, LED17 is illuminated.

Table 20. QSPI Flash Port Assignments

QSPI Signal Description	DK-S7G2 Port
QSPI CS#	P501
QSPI CLK	P500
QSPI DQ0	P502
QSPI DQ1	P503
QSPI DQ2	P504
QSPI DQ3	P505

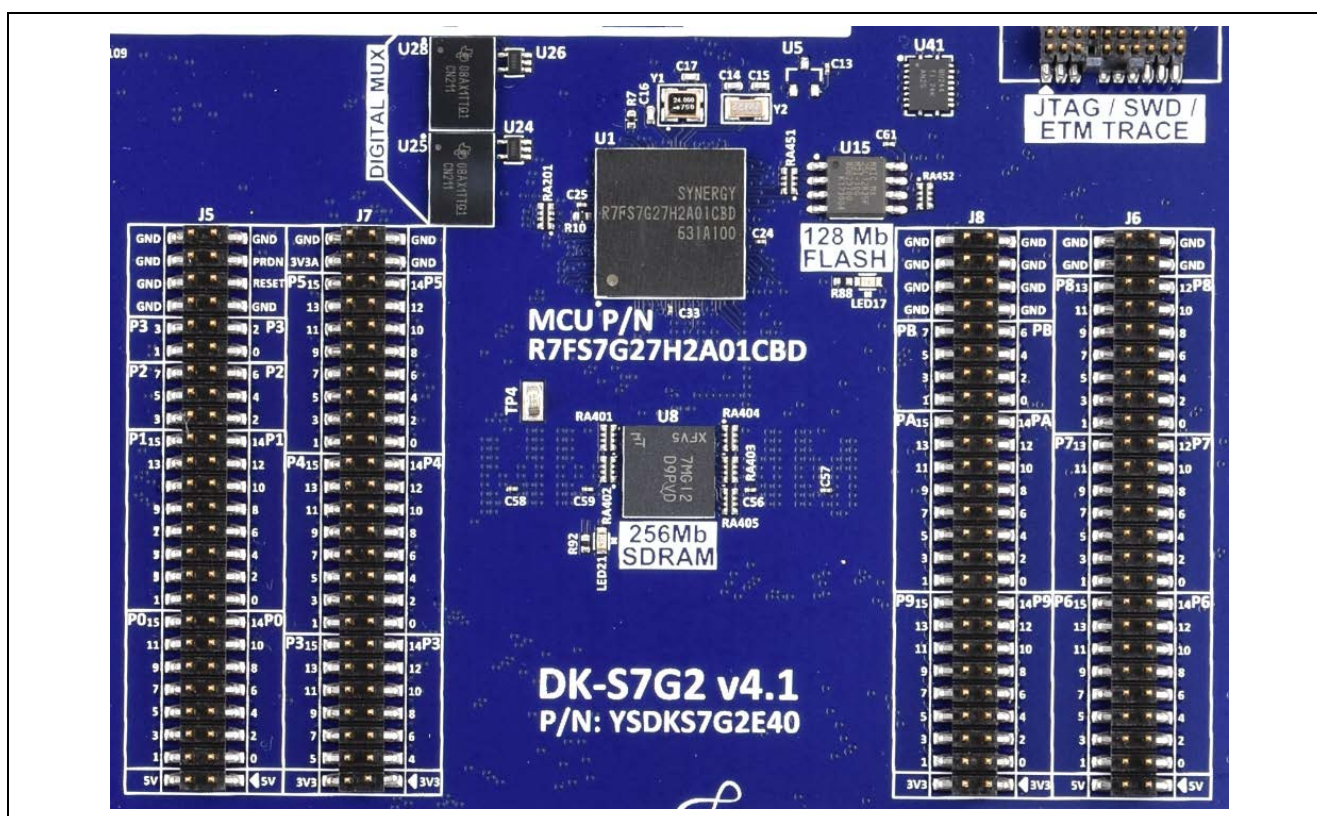


Figure 16. Main MCU, SDRAM, QSPI Flash, and Breakout Pin Headers

5.4.16 SDRAM

Included on DK-S7G2 is a Micron 256 Mb automotive grade SDR SDRAM (U8) in a 4M x 16 x 4 bank configuration (MT48LC16M16A2).

Because the S7G2 MCU ports are highly multiplexed, some of the ports used for SDRAM signals are also used for PMOD C and PMOD D signals. A set of digital bus switches is provided to isolate the SDRAM signals from the rest of the system. To enable the SDRAM, set DIP switch S9-2 to ON. This is done to preserve SDRAM signal integrity. When the SDRAM is enabled, LED21 is illuminated. When the SDRAM is enabled, PMOD C, PMOD D, and the breakout pin headers are not available for the ports used by the SDRAM. To use PMOD C, PMOD D, or access the ports used by the SDRAM at the breakout pin headers, the SDRAM must be disabled.

Table 21. SDRAM Port Assignments

SDRAM Device Signal Description	DK-S7G2 SDRAM Signal Description	DK-S7G2 Port
DQ15	SDRAM DQ15	P801
DQ14	SDRAM DQ14	P800
DQ13	SDRAM DQ13	P603
DQ12	SDRAM DQ12	P604
DQ11	SDRAM DQ11	P605
DQ10	SDRAM DQ10	P614
DQ9	SDRAM DQ9	P613
DQ8	SDRAM DQ8	P612
DQ7	SDRAM DQ7	P107
DQ6	SDRAM DQ6	P106
DQ5	SDRAM DQ5	P105
DQ4	SDRAM DQ4	P104
DQ3	SDRAM DQ3	P103
DQ2	SDRAM DQ2	P102
DQ1	SDRAM DQ1	P101
DQ0	SDRAM DQ0	P100
A12	SDRAM A15	P310
BA1	SDRAM A14	P309
BA0	SDRAM A13	P308
A11	SDRAM A12	P307
A10	SDRAM A11	P306
A9	SDRAM A10	P305
A8	SDRAM A9	P304
A7	SDRAM A8	P303
A6	SDRAM A7	P302
A5	SDRAM A6	P301
A4	SDRAM A5	P111
A3	SDRAM A4	P112
A2	SDRAM A3	P113
A1	SDRAM A2	P114
A0	SDRAM A1	P115
UDQM	SDRAM DQM1	P608
LDQM	SDRAM DQM0	P601
CLK	SDRAM SDCLK	P602
CKE	SDRAM CKE	P609
RAS#	SDRAM RAS#	P311
CAS#	SDRAM CAS#	P312
WE#	SDRAM WE#	P610
CS#	SDRAM SDCS#	P611

5.4.17 SD Card Socket

Included on DK-S7G2 is an SD/MMC card socket (J12) with a four-bit data bus, plus card detect and write protect functions. The SD card socket is connected to channel 0 of the SD/MMC controller on the S7G2 MCU.

A digital bus switch (U19) is provided to isolate the SD card signals from the rest of the system. To enable the SD card socket, set DIP switch S8-3 to ON. When SD Card socket is enabled, LED20 is illuminated.

The SD Card socket conflicts with the e.MMC. To use the SD card, disable the e.MMC by setting S6-4 to OFF.

Table 22. SD Card Port Assignments

SD Card Signal Description	DK-S7G2 Port
CMD	P412
CLK	P413
CD	P903
WP	P414
D0	P411
D1	P410
D2	P206
D3	P205

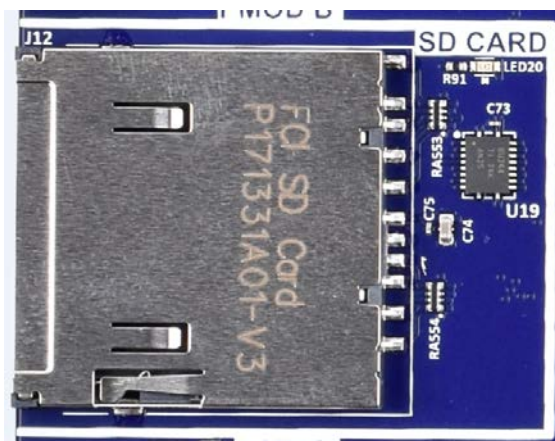


Figure 17. SD Card Socket

5.4.18 e.MMC

Included on DK-S7G2 is a Micron 4 GB e.MMC memory device with an eight-bit data bus (MTFC4GACAJCN-4M IT). The e.MMC memory is connected to channel 0 of the SD/MMC controller on the S7G2 MCU.

Digital bus switches (U17 and U18) are provided to isolate the SD card signals from the rest of the system. To enable the SD card socket, set DIP switch S6-4 to ON. When the e.MMC is enabled, LED10 is illuminated.

Since this is an embedded device, the CD and WP signals are not used by the e.MMC. When the e.MMC is enabled, these two signals are pulled high so the S7G2 MCU SD/MMC peripheral functions correctly.

The e.MMC conflicts with the SD Card socket. To use the e.MMC, disable the SD Card Socket by setting S8-3 to OFF.

Table 23 e.MMC Port Assignments

e.MMC Signal Description	DK-S7G2 Port
CMD	P412
CLK	P413
CD	P903
WP	P414
D0	P411
D1	P410
D2	P206
D3	P205
D4	P204
D5	P203
D6	P202
D7	P313



Figure 18. e.MMC

5.4.19 Camera Interface

The DK-S7G2 Camera Module includes an Omnivision OV7670 image sensor with adjustable lens. The image sensor combines a VGA camera with an image processor and can be controlled through an I²C bus interface connected to the Serial Communications Interface (SCI) peripheral on the S7G2 microcontroller.

The 8-bit data bus supports data formats YUV/YCbCr 4:2:2, RGB565/555, GRB 4:2:2, or Raw RGB Data.

The sensor has an image array operating at up to 30 frames per second in VGA. Image quality, image format, and output data transfer are user programmable. The sensor supports image processing such as exposure control, gamma correction, and adjustment of white balance, color saturation, and hue.

The Camera Module can be installed on J30 of the DK-S7G2.

Digital bus switches (U38 and U39) are provided to isolate the Camera signals from the rest of the system. To enable the Camera Module interface, set DIP switch S8-2 to ON. When the Camera Module interface is enabled, LED9 is illuminated.

The camera module conflicts with Ethernet 1. Ethernet 1 must be disabled for the Camera interface to function correctly. To disable Ethernet 1, set DIP switch S6-3 to OFF.

Table 24. Camera Interface Port Assignments

Camera Interface Signal Description	J30 Pin Number	DK-S7G2 Port
+3.3 V	1	N/A
GND	2	N/A
I2C SCL	3	PA03
I2C SDA	4	PA02
VSYNC	5	P512
HSYNC	6	P704
PIXCLK	7	P705
PCKO	8	P511
PXD7	9	P403
PXD6	10	P404
PXD5	11	P405
PXD4	12	P406
PXD3	13	P700
PXD2	14	P701
PXD1	15	P702
PXD0	16	P703
RESET#	17	PB06
PWDN#	18	PB07



Figure 19. Camera Module

5.4.20 Audio Jack

DK-S7G2 contains an On Semiconductor 135 mW stereo headphone power amplifier (NCP2809BDMR2G). The output signals are generated by the Digital-to-Analog peripheral signals DA0 and DA1 on the S7G2 microcontroller.

The audio interface also uses P902 as a GPIO signal that drives the shutdown signal on the amplifier. Port P015 (DA1) is shared with Ethernet 0. Ethernet 0 must be enabled to use Audio Jack. To enable Ethernet 0, set DIP switch S6-2 to ON.

Note: Ethernet 0 and Audio Jack cannot be used at the same time.

To isolate Audio Jack and prevent interference with Ethernet 0, remove the jumpers from J9. Silkscreen next to J9 shows the related jumper positions for each signal in the audio interface.

Table 25. Audio Jack Port Assignments

Audio Jack Signal Description	DK-S7G2 Port	Jumper J9 Connections
Amp SHDN#	P902	Pins 1-2
OUT-Left	P014 (DA0)	Pins 5-6
OUT-Right	P015 (DA1)	Pins 3-4

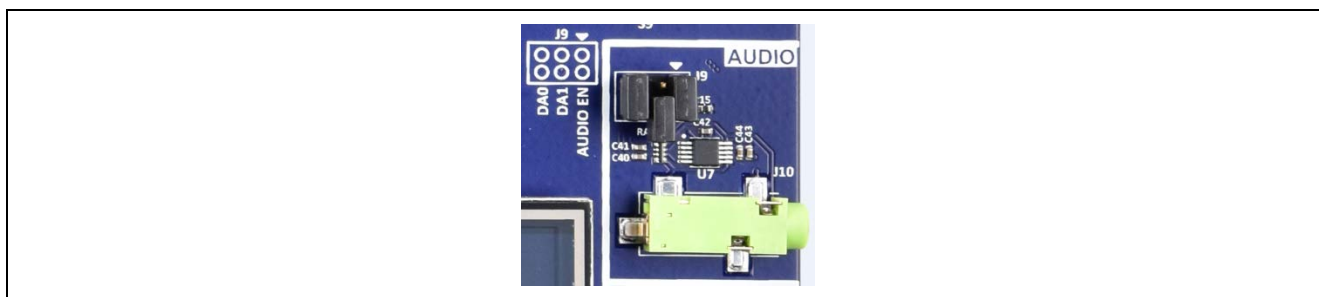


Figure 20. Audio Jack

5.4.21 LCD

DK-S7G2 includes an LXD M7190C 4.3" TFT RGB 480x272 LCD panel with Resistive Touch screen. The LCD interface supports a 16-bit LCD data bus and includes a resistive touch controller and LED backlight driver.

The resistive touch interface uses a Semtech SX8676IWLTRT touch controller, driven by the MCU I²C bus. The resistive touch controller may be isolated from the system I²C signals by removing the jumpers from header J27.

The LED backlight controller is an On Semiconductor CAT4237TD LED driver.

Some LCD modules produce excessive Electromagnetic Interference (EMI), which can cause undesirable performance. To compensate for this potential EMI radiation, DK-S7G2 provides footprints for optional Pi filters on each of the LCD data and control lines. By default, these Pi filters are not installed, but zero-ohm bridge resistors are installed. DK-S7G2 is designed to use Murata NFL21SP506X1C3D filters components, in a 4-pin 0805 surface mount package. Be sure to remove the respective bridge resistor when installing a Pi filter for the desired signal.

A digital bus switch (U34) is provided to isolate the LCD signals from the rest of the system. To enable the on-board LCD, set DIP switch S8-4 to ON. When the on-board LCD is enabled, LED6 is illuminated.

Table 26. LCD Control Signal Port Assignments

LCD Control Signal Description	DK-S7G2 Port
LCD SCL (I2C)	PA03
LCD SDA (I2C)	PA02
TOUCH RESET#	P711
TOUCH IRQ	P001
LCD Backlight Enable	P712

Table 27. LCD Port Assignments

LCD Signal Description	LCD ZIF Connector (J28) Pin	LCD ZIF Connector Pin Name	DK-S7G2 Port	Pi Filter	Bridge Resistor
LEDK	1	LEDK	-	-	-
LEDA	2	LEDA	-	-	-
GND	3	GND	-	-	-
+3.3 V	4	VCC	-	-	-
DATA13	5	R0	P907	FL7	R40
DATA14	6	R1	P908	FL9	R42
DATA15	7	R2	P901	FL11	R44
DATA11	8	R3	P905	FL3	R35
DATA12	9	R4	P906	FL5	R37
DATA13	10	R5	P907	FL7	R40
DATA14	11	R6	P908	FL9	R42
DATA15	12	R7	P901	FL11	R44
DATA9	13	G0	PA08	FL6	R38
DATA10	14	G1	P615	FL8	R41
DATA5	15	G2	PA00	FL13	R46
DATA6	16	G3	PA01	FL15	R48
DATA7	17	G4	PA10	FL17	R50
DATA8	18	G5	PA09	FL4	R36
DATA9	19	G6	PA08	FL6	R38
DATA10	20	G7	P615	FL8	R41
DATA2	21	B0	P802	FL14	R47
DATA3	22	B1	P606	FL16	R49
DATA4	23	B2	P607	FL18	R51
DATA0	24	B3	P804	FL10	R43
DATA1	25	B4	P803	FL12	R45
DATA2	26	B5	P802	FL14	R47
DATA3	27	B6	P606	FL16	R49
DATA4	28	B7	P607	FL18	R51
GND	29	GND	-	-	-
CLK	30	CLK	P900	FL19	R52
ON	31	DISP	P710	FL20	R53
HSYNC	32	HS	P314	FL21	R54
VSYNC	33	VS	P313	FL22	R55
DE	34	DEN	P315	FL23	R57
N.C.	35	N.C.	-	-	-
GND	36	GND	-	-	-
TOUCH XR	37	XR	-	-	-
TOUCH YB	38	YB	-	-	-
TOUCH XL	39	XL	-	-	-
TOUCH YT	40	YT	-	-	-



Figure 21. On-board LCD Module

5.4.22 External LCD Connector

In addition to the on-board LCD, DK-S7G2 provides an expansion connector for the use of an external LCD module. The External LCD interface supports a 16-bit LCD data bus, control signals, and I²C bus to interface with a touch controller. The external LCD interface uses the same MCU ports for the LCD data bus as the on-board LCD.

A digital bus switch (U37) is provided to isolate the LCD signals from the rest of the system. To enable the external LCD, set DIP switch S9-4 to ON. When the external LCD is enabled, LED7 is illuminated.

The connector interface includes an LCD_PRESENT signal (J29 pin 2), which has a weak pull-down on DK-S7G2. The LCD_PRESENT signal is connected to the Board Configuration I²C Bus Expander (U40) and indicates to the MCU that an external LCD is installed. This signal should be pulled high (+3.3 V) by the external LCD module.



Figure 22. External LCD Connector

Table 28. External LCD Connector Port Assignments

LCD Signal Description	External LCD Connector (J29) Pin	DK-S7G2 Port
+3.3V	1	-
LCD Present	2	-
+3.3V	3	-
GND	4	-
GND	5	-
DATA0	6	P804
DATA1	7	P803
DATA2	8	P802
DATA3	9	P606
DATA4	10	P607
DATA5	11	PA00
GND	12	-
DATA6	13	PA01
DATA7	14	PA10
DATA8	15	PA09
DATA9	16	PA08
DATA10	17	P615
DATA11	18	P905
DATA12	19	P906
DATA13	20	P907
DATA14	21	P908
DATA15	22	P901
TOUCH RESET#	23	P711
NC	24	-
GND	25	-
DE	26	P315
HSYNC	27	P314
VSYNC	28	P313
GND	29	-
CLK	30	P900
GND	31	-
+5V	32	-
+5V	33	-
+5V	34	-
ON	35	P710
I2C SDA	36	PA02
I2C SCL	37	PA03
IRQ	38	P001
Backlight Enable	39	P712
LCD RESET#	40	P713

5.4.23 User Potentiometer

DK-S7G2 includes a 10 kΩ single-turn potentiometer (R16) connected to the Analog-to-Digital Converter (ADC) peripheral on the S7G2 MCU. This device is connected to P000 using the AN000 function assignment.

To isolate the User Potentiometer from P000, remove the jumper from J11.



Figure 23. User Potentiometer

5.4.24 Kit Data Serial EEPROM

DK-S7G2 includes a 64 Kb I²C serial EEPROM (U43), which stores basic information about the DK-S7G2. This device is programmed at the factory and is write protected. This device may be accessed either through the MCU or through the breakout pin headers to retrieve the basic kit information. The 7-bit I²C address is 0x50 for this device.



Figure 24. Kit Data Serial EEPROM

5.5 Breakout Pin Headers

The DK-S7G2 pin headers, J5, J6, J7 and J8, provide access to all Main MCU interface signals, and to voltages for all Main MCU power ports as seen in Figure 16. Each pin is labeled with the voltage or port connected to that pin.

5.6 Configuration

5.6.1 Function select DIP switches

Most pins of the Synergy S7G2 microcontroller support multiple functions and can therefore be connected to more than one device or connector on the DK-S7G2 board. To make it easy and safe to connect important functions, especially those with wide data bus connections, the DK-S7G2 provides banks of DIP switches S6, S7, S8, and S9.

Each DIP switch controls a high-speed buffer which, when the switch is in the ON position, connects the signal lines between the microcontroller and the on-board device or connector. When the switch is in the OFF position, the microcontroller pins are isolated from the respective connector or device and can be used for another board function.

When the DIP switches are in the OFF position, software can dynamically enable the respective peripherals at system initialization through an I/O expander. The I/O expander is controlled through software through an I²C port connected to the SCI channel 7 on the S7G2 microcontroller and performs the following functions:

- Sense the position of the DIP switch.
- Generate the enable signal for the buffer.
- Control an LED.

Through the I/O expander's I²C port, software can read the position of the DIP switch and, if the DIP switch is open, enable the buffers to connect the device to the microcontroller pins.

The selection DIP switches enable peripheral functions as shown in the following table.

Table 29. Selection DIP Switch Functions

Location	Default Setting	Function	Notes
S6-1	OFF	Boot Mode (MD) Select	OFF = Normal Boot mode ON = Serial Boot mode
S6-2	OFF	Ethernet 0 Enable	
S6-3	OFF	Ethernet 1 Enable	
S6-4	OFF	e.MMC Enable	
S7-1	OFF	PMOD A Enable	
S7-2	ON	JTAG Enable	
S7-3	OFF	Serial Port (RS232/485) Enable	
S7-4	OFF	CAN Enable	
S8-1	OFF	PMOD B Enable	
S8-2	OFF	Camera Module Enable	
S8-3	OFF	SD Card Enable	
S8-4	ON	On-board LCD Enable	
S9-1	OFF	QSPI Flash Enable	
S9-2	OFF	SDRAM Enable	
S9-3	OFF	User Push-buttons Enable	
S9-4	OFF	External LCD Enable	

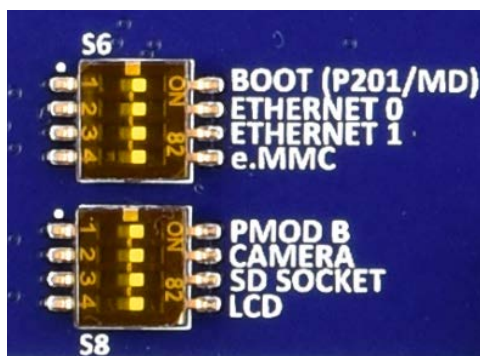


Figure 25. Function Select DIP Switches S6 and S8



Figure 26. Function Select DIP Switches S7 and S9

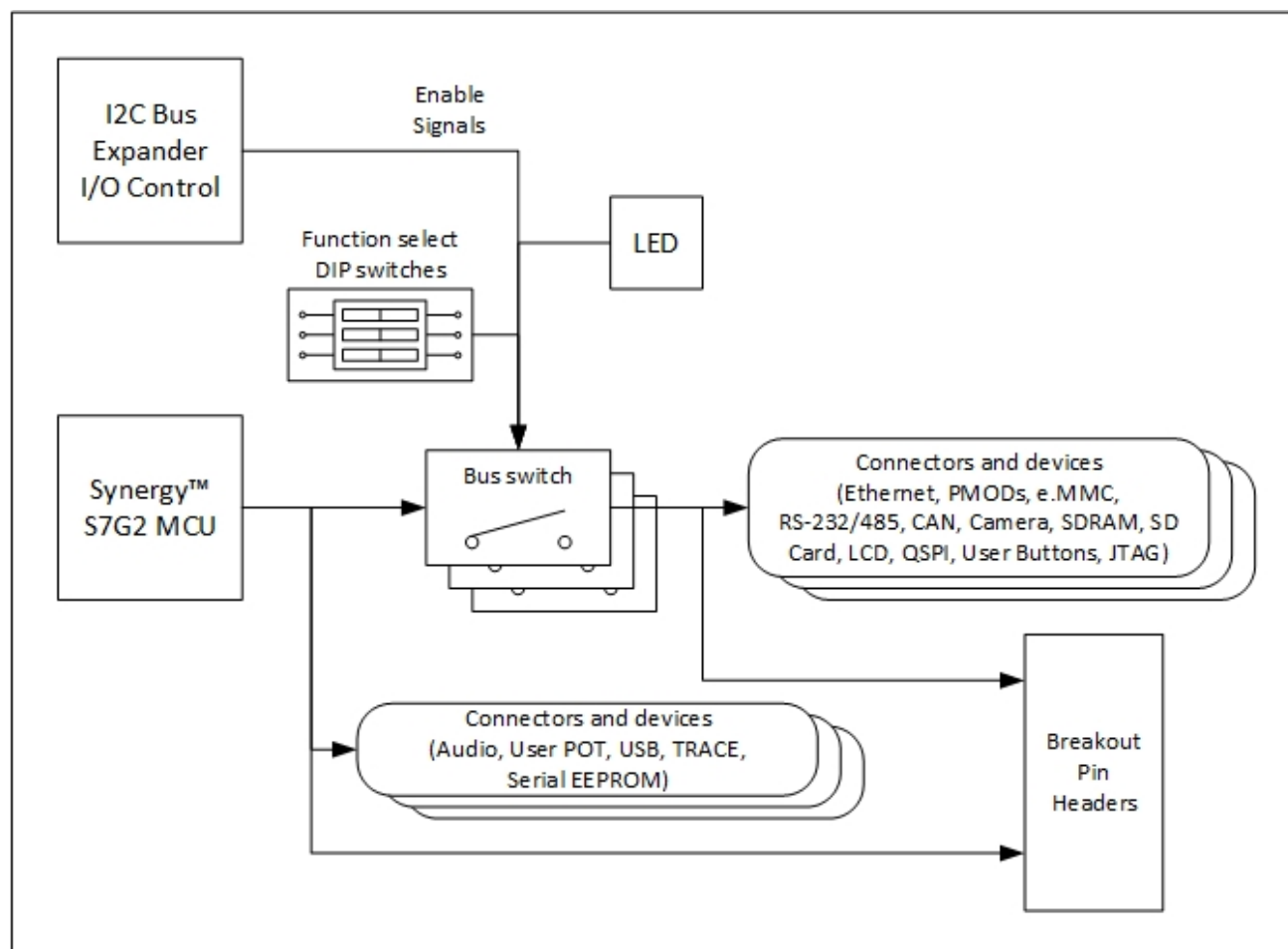


Figure 27. Function Selection

5.6.2 Ethernet 0 Multiplexing

Ethernet 0 is multiplexed with Audio Jack, SD Card, e.MMC, and Breakout Pin Headers.

To enable Ethernet 0, set S6-2 to ON. The selection DIP switches for the SD Card and e.MMC do not matter when Ethernet 0 is enabled. With Ethernet 0 enabled, the other multiplexed functions are not available.

To disable Ethernet 0 and enable the other multiplexed functions, set S6-2 to OFF. To enable the SD Card, set S8-3 to ON. To enable the e.MMC, set S6-4 to ON. With Ethernet 0 disabled, Audio Jack is automatically enabled, and the multiplexed ports are available at the Breakout Pin Headers.

Note: SD Card and e.MMC use the same MCU ports. SD Card and e.MMC cannot be used at the same time.

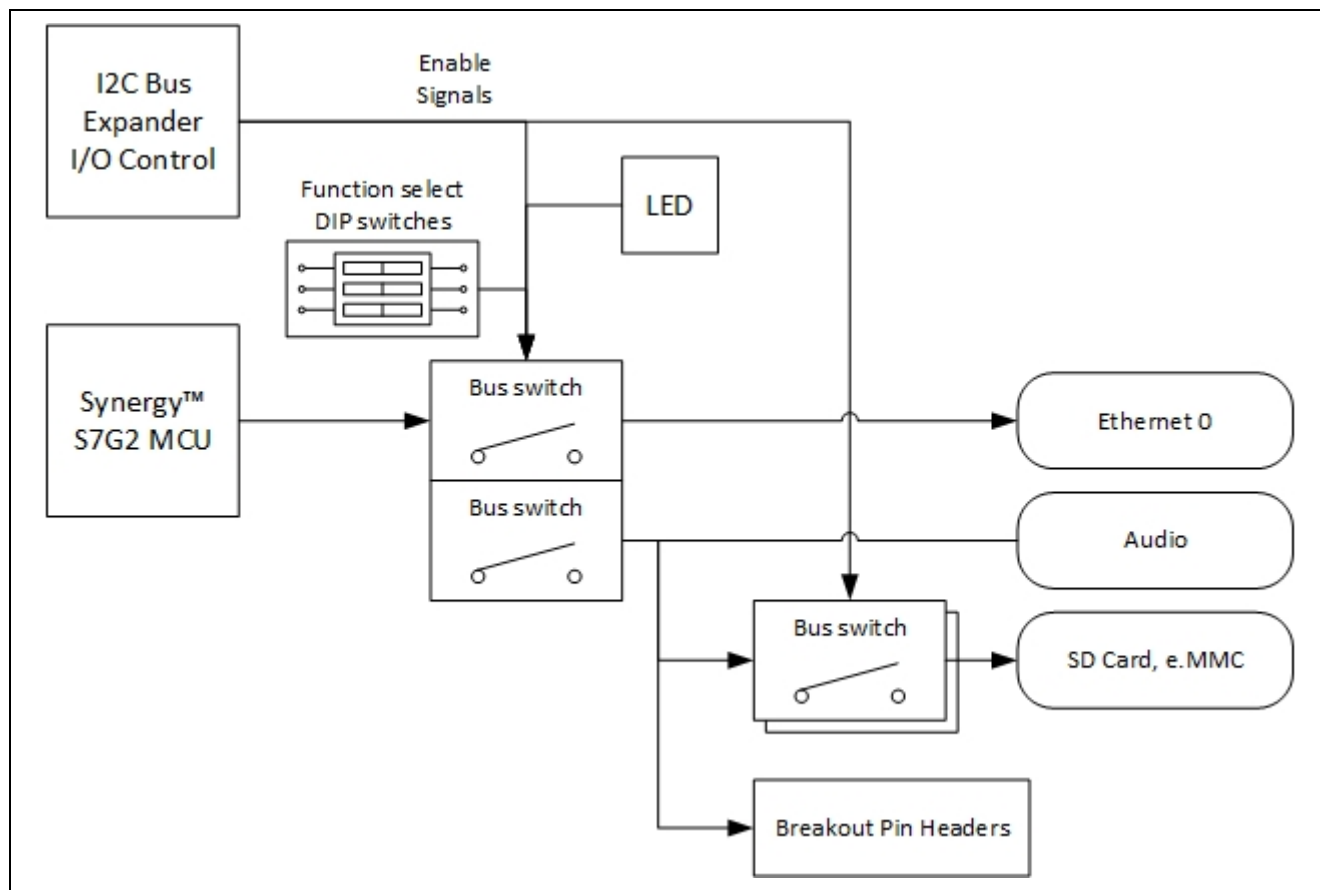


Figure 28. Ethernet 0 Multiplexing

5.6.3 Ethernet 1 Multiplexing

Ethernet 1 is multiplexed with the Camera Module and some ports on the Breakout Pin Headers.

To enable Ethernet 1, set S6-3 to ON and S8-2 to OFF. This also enables the multiplexed ports that are routed to the Breakout Pin Headers.

To enable the Camera Module, Ethernet 1 must be enabled. Set S6-3 to ON and S8-2 to ON. To avoid signal conflicts, do not use Ethernet 1 and the Camera Module at the same time.

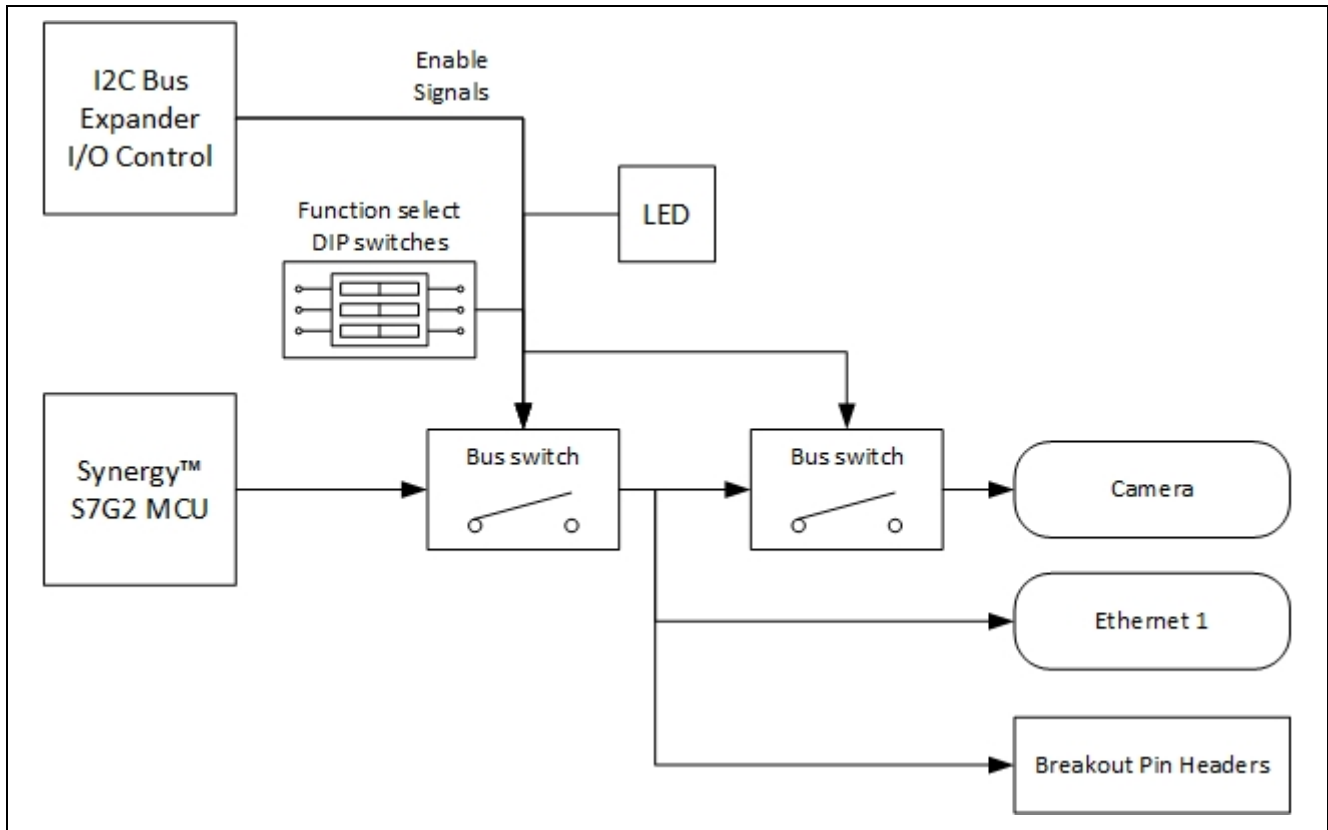


Figure 29. Ethernet 1 Multiplexing

5.6.4 LCD Multiplexing

Ports used for the on-board LCD are shared with the external LCD, and some LCD ports are multiplexed with the e.MMC. These shared and multiplexed signals are always available at the Breakout Pin Headers.

To enable the on-board LCD, set S8-4 to ON, S9-4 to OFF, and S6-4 to OFF.

To enable the external LCD, set S8-4 to OFF, S9-4 to ON, and S6-4 to OFF.

To enable the e.MMC, set S8-4 to OFF, S9-4 to OFF, and S6-4 to ON.

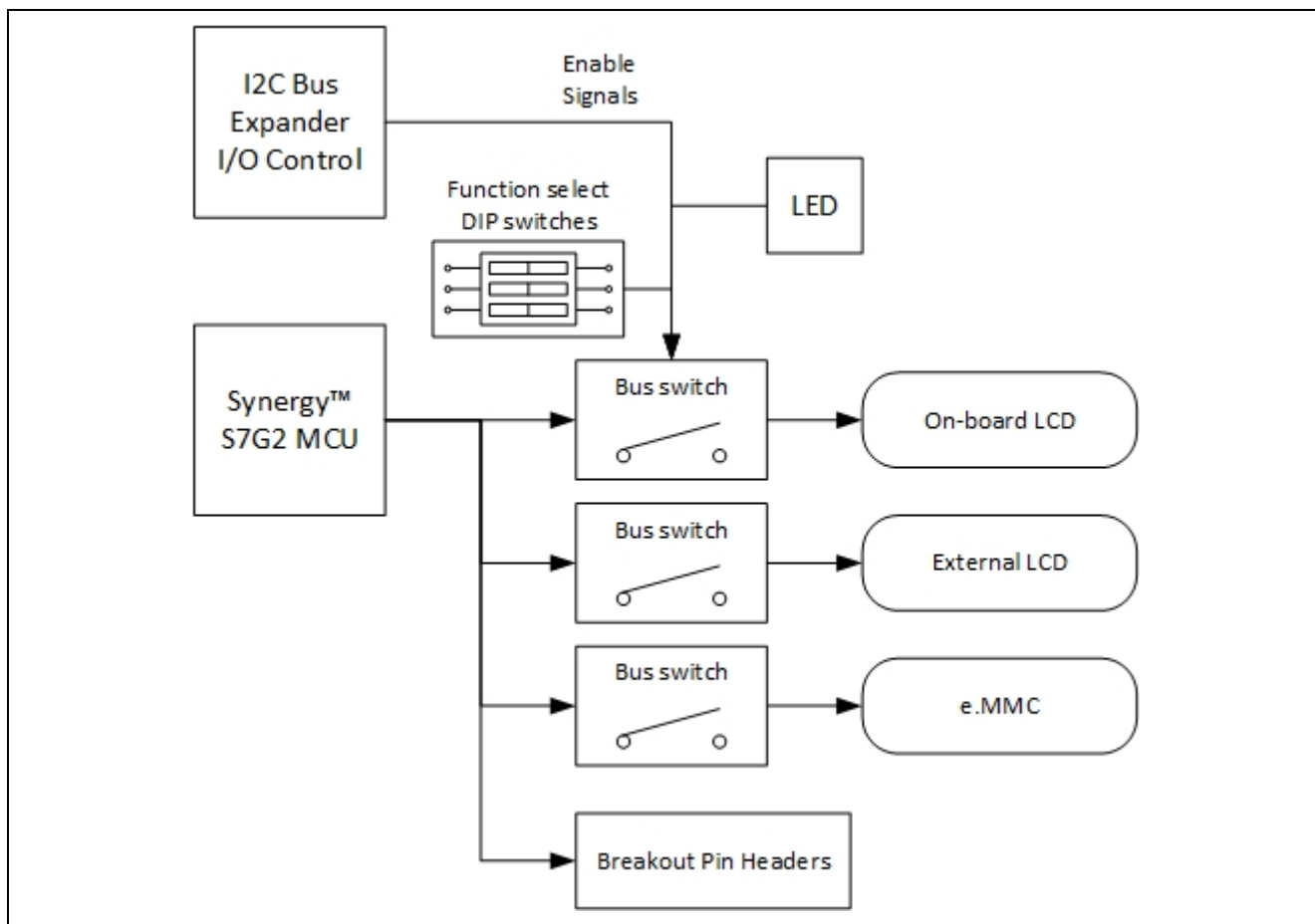


Figure 30. LCD Multiplexing

5.6.5 SDRAM Multiplexing

Ports used for the SDRAM are multiplexed with PMOD C, PMOD D, and some ports on the Breakout Pin Headers.

To enable the SDRAM and disable the other multiplexed functions, set S9-2 to ON.

To enable PMOD C, PMOD D, and the multiplexed ports on the Breakout Pin Headers, first disable the SDRAM. To disable the SDRAM, set S9-2 to OFF. PMOD C, PMOD D, and the multiplexed ports on the Breakout Pin Headers will be available.

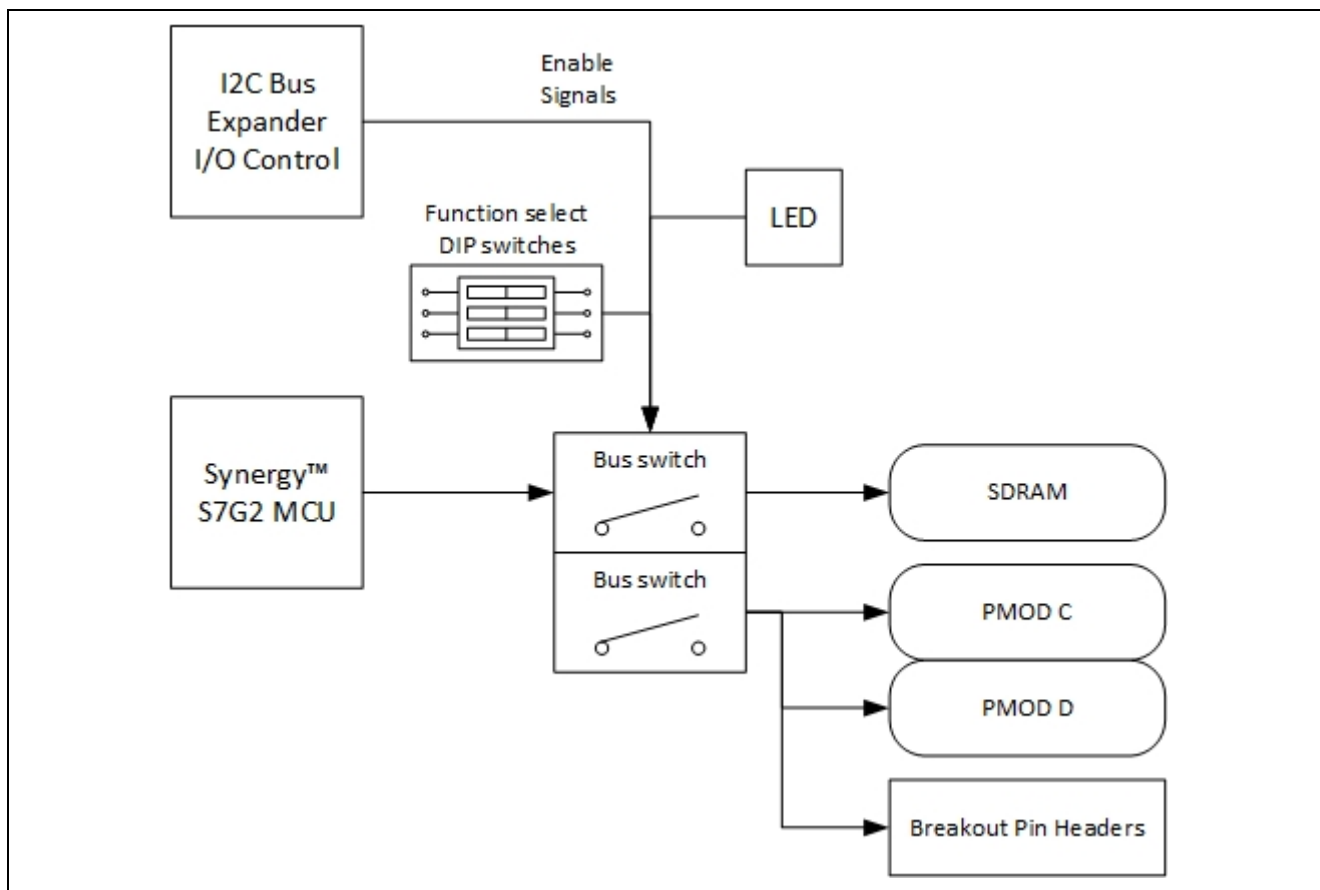


Figure 31. SDRAM Multiplexing

6. Electrical Schematics

DK-S7G2			
Table of Contents			
1	Title Page		
2	Power Supplies		
3	MCU Main Signals		
4	MCU Clocks, RESET Control, USB Signals		
5	MCU Power Supply		
6	MCU Breakout Pins		
7	LEDs, Push Buttons		
8	Audio Amplifier, User Pot		
9	SDRAM		
10	SDRAM Bus Transfer Switches		
11	QSPI		
12	eMMC 8-Bit		
13	SD Card		
14	USB Host and Device Interfaces		
15	Ethernet Interface #0 (ETH0)		
16	Ethernet Interface #1 (ETH1)		
17	RS232/485, CAN Interfaces		
18	PMODA Interfaces		
19	PMODB-C-D Interfaces		
20	RGB TFT LCD with Resistive Touch		
21	External LCD Interface		
22	Camera/PDC Interfaces		
23	Board Configuration Selection, I2C LEDs		
24	JTAG, JLink On Board with S124 LQFP64		
25	Board Data Serial EEPROM		

REVISION HISTORY			
Revision	Date	Description	
1.0	10/16/14	Initial Design	
2.0	12/30/14	Chg 3.3V Buck to ES01107, shuffled parts between pages, renumbered parts, moved USB_OC P/U res to 3.3V fm 5V, add res div network to USBF_VBUS. Chg digital sw part no, add switches for several I/Os isolation.	
2.1	01/28/15	PA, 2, PA, 3, PA, 4 use/same chips, add Enet RS1# cap	
2.2	03/05/15	Add pwr OVP ckt, add cur mess jps and res for +3V3_MCU and +3V3ANA_MCU, add battery/decoupling jumper for MCU VBAT, p/d res for USBF_VBUS. Add TP for ETH1_IRQ#	
3.0	07/24/15	Chg SDRAM switches, now switching all SDRAM ports, several ports are now designated E_P#_# being switched by SDRAM bus switches, E_P#_8 is one and requires board changes	
3.1	04/28/16	BOM changes to address EOL parts.	
3.2	03/07/17	PCB almost completely re-rotated, PCB was 8-layer now 10-layer with fill top/bot, USB CM filters, ext oscillators ckt to crystal and MCU oscillator, unused resistor array elements grounded, more resistors in line with Enet PHY ports, Enet now integrated magnetics BL45, PMOD in-line resistors, added power input filter, outer layer traces minimized, USB traces buried and nom 90-ohm diff, SDRAM and Enet switches moved closer to MCU	
4.0	04/05/2018	Kit changed from 2 board (Main and Breakout) to 1 board, LCD installed on board for EMI reasons, Analog proto region and C-MAX RT1E features removed. Renumbered reference designators for single board design. Corrected four pin assignments on SDRAM multiplexer switches. Updated port designators to ensure proper use of SDRAM multiplexing (NOTHING is connected prior to MUX switches). Ethernet signals are now disconnected from other circuitry when Ethernet is in use. Changed Audio Amplifier power from Vcc to +5V. Replaced SX8651 with SX8676	
4.1	06/14/2018	Updated silkscreen for usability, added Renesas part numbers, and added Renesas website references. Changed U16 eMMC NAND Flash to Micron MTFC64GACUW-4M. Corrected layout of eMMC to remove ground short, per updated manufacturer data. Changed QSPI Flash to Macronix MX25L12835F.	

DK-S7G2

Title Page

Version: 4.1

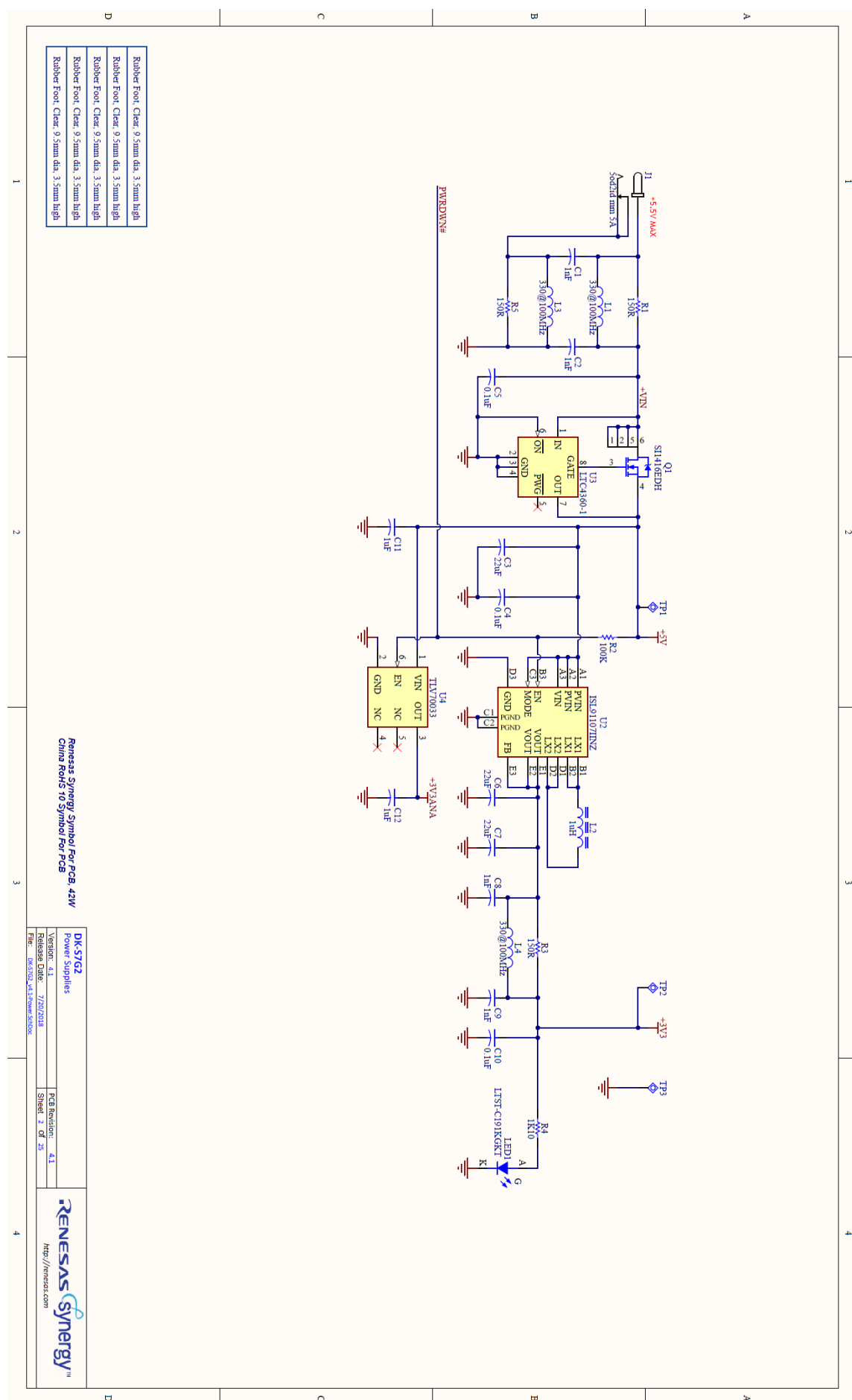
Release Date: 7/20/2018

File: DK-S7G2_v4.1_Images_Layout

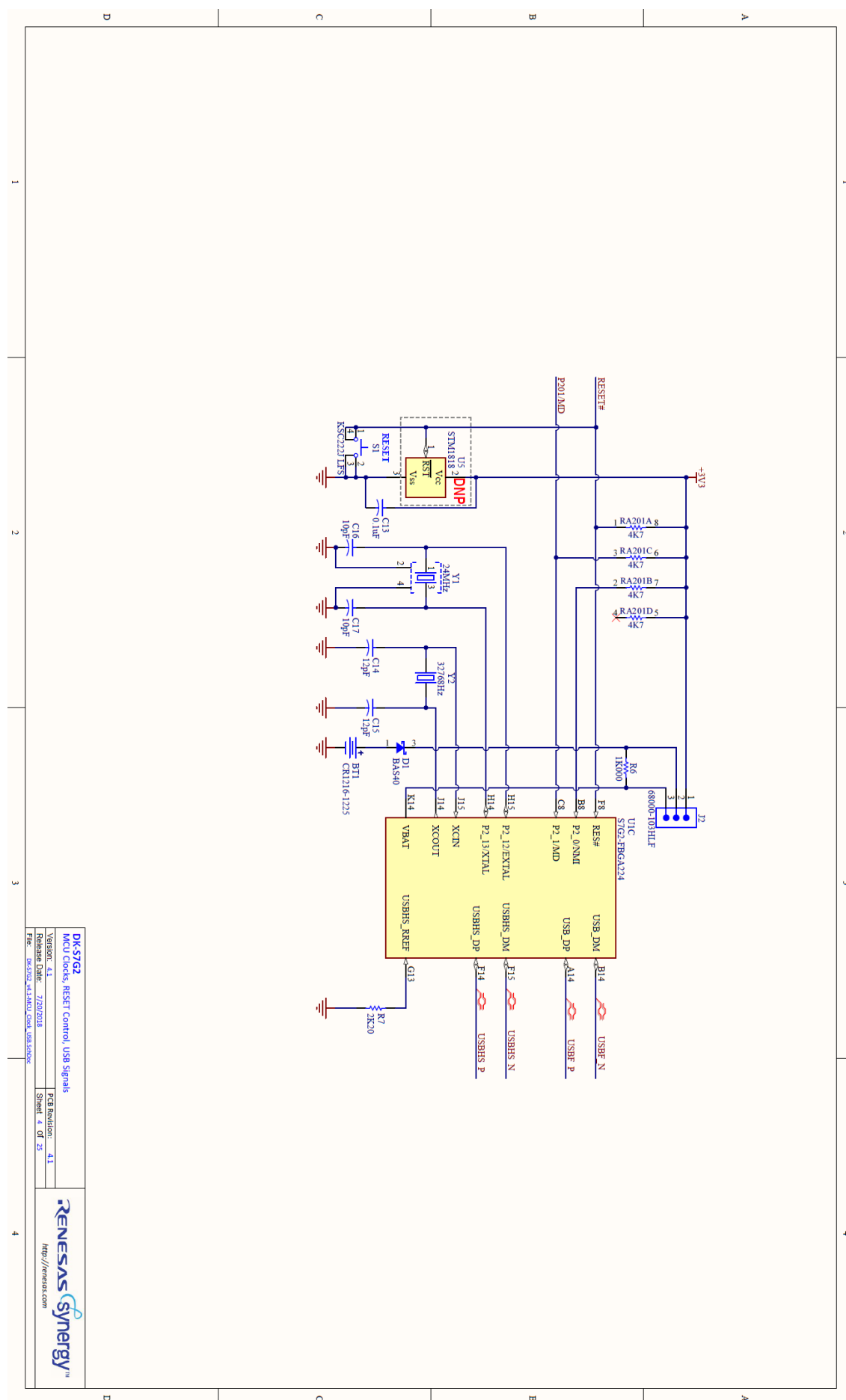
PCB Revision: 4.1

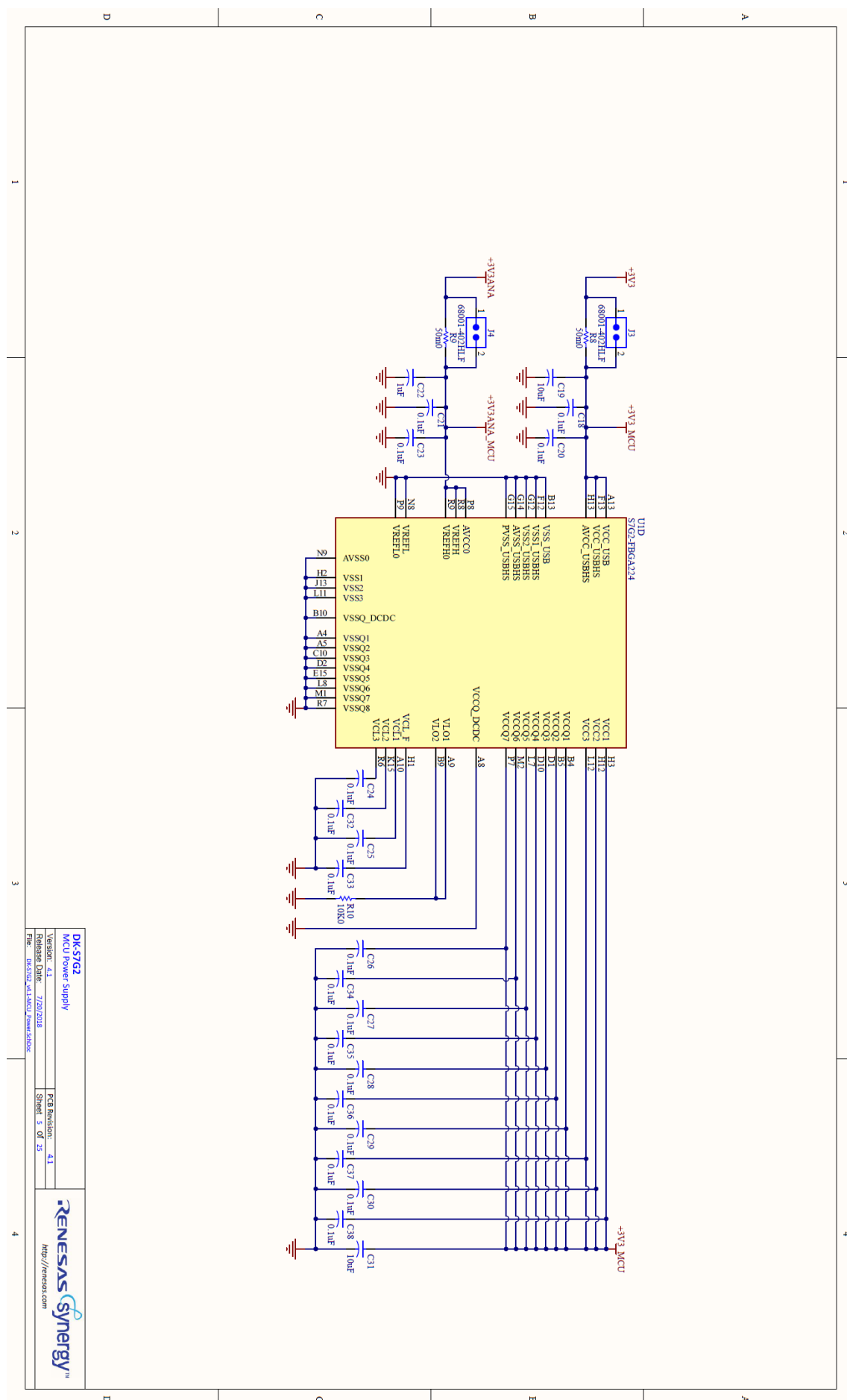
Sheet: 1 of 20

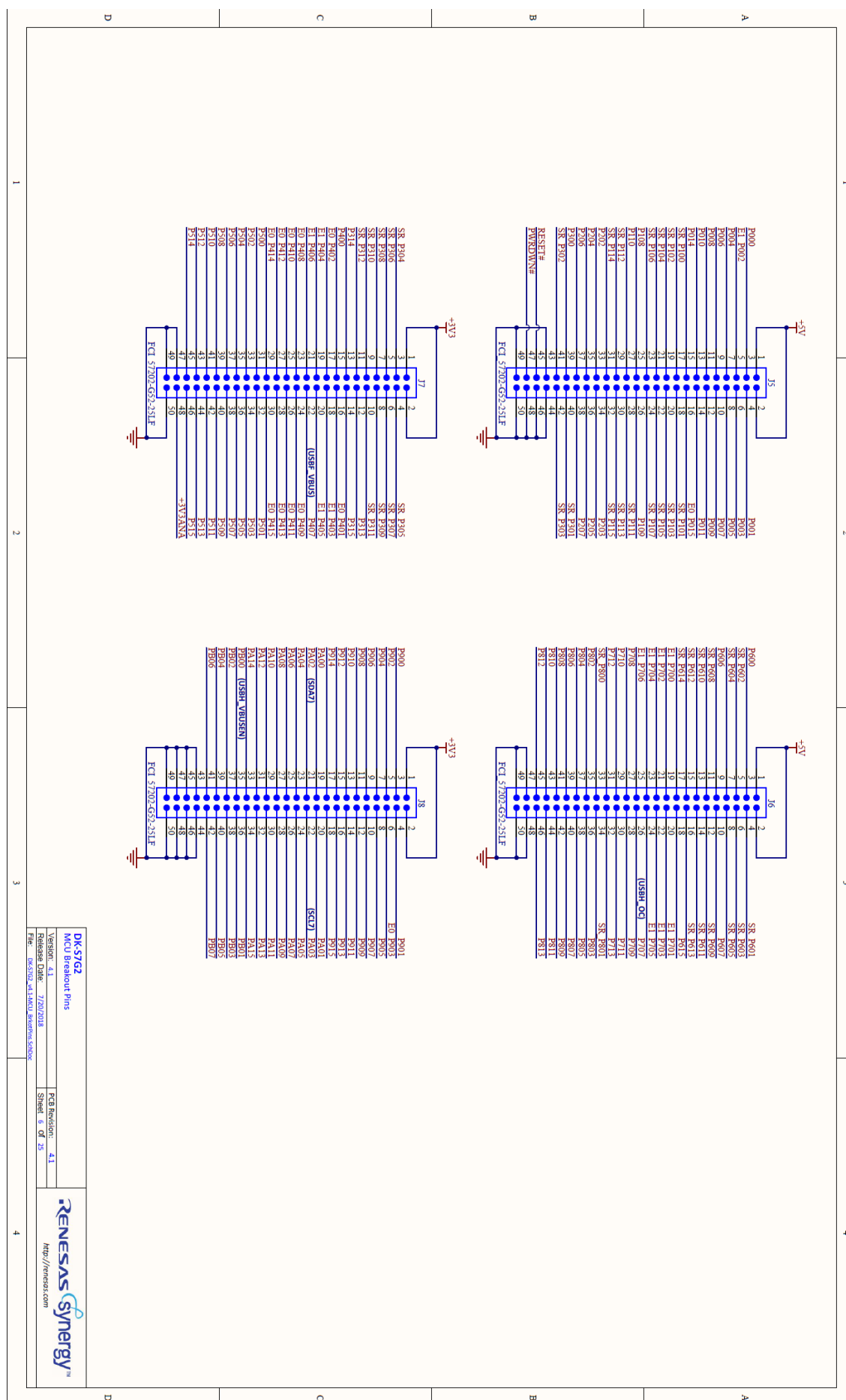

http://reneras.com

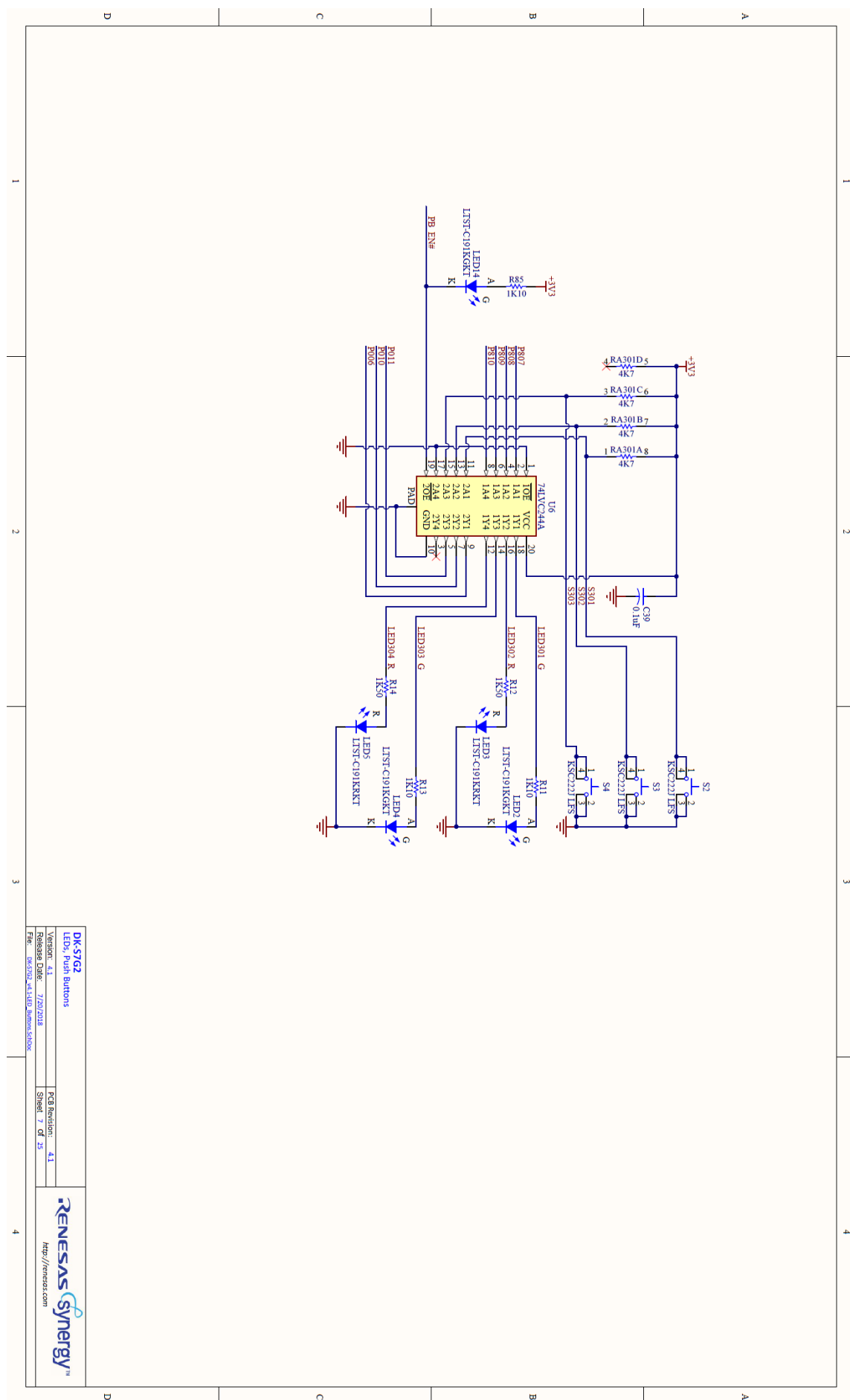


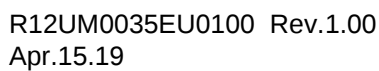
--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

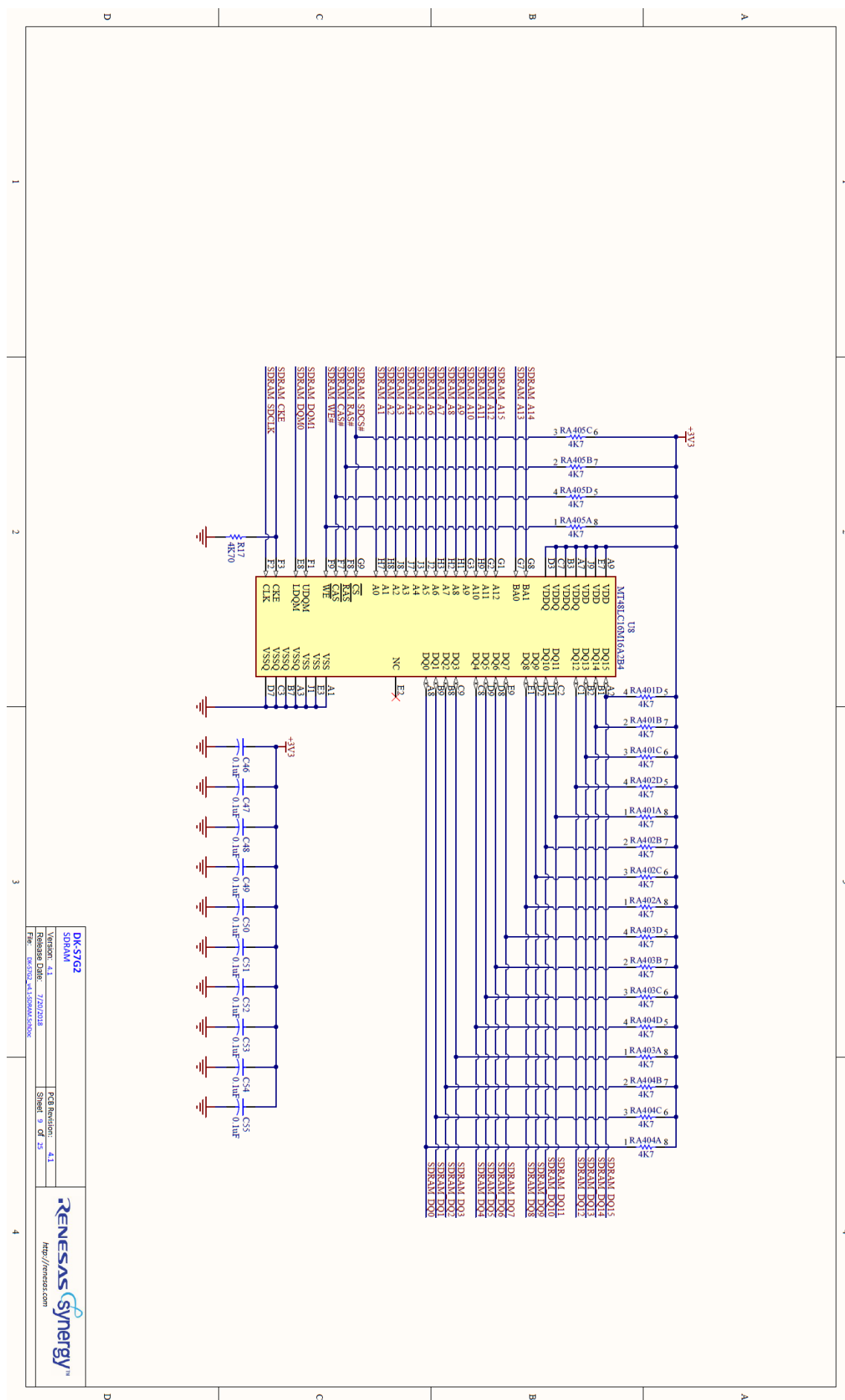


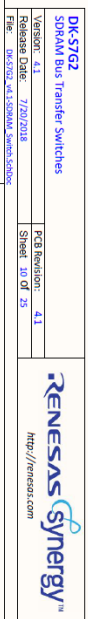


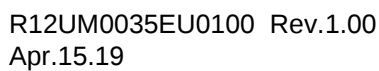


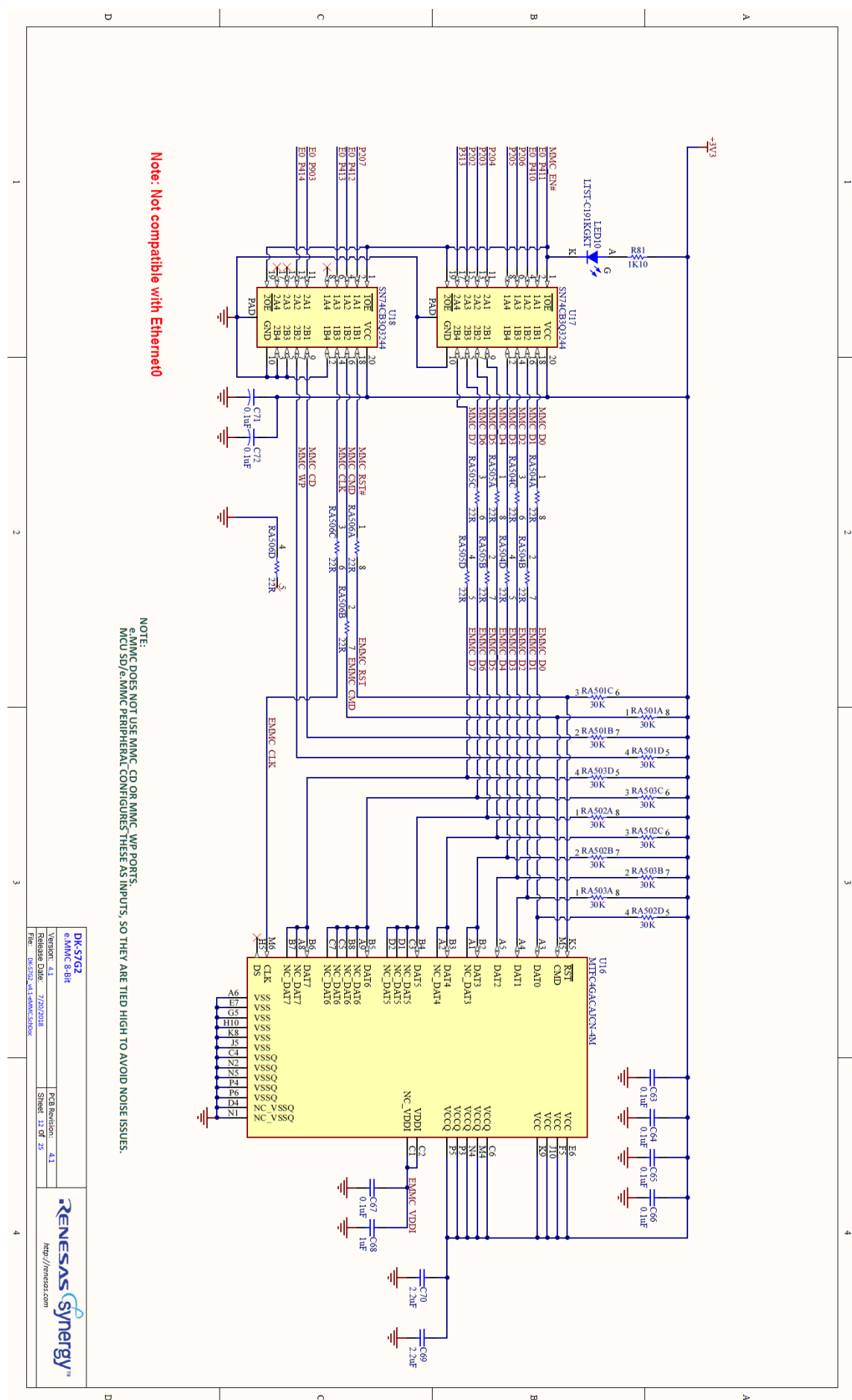


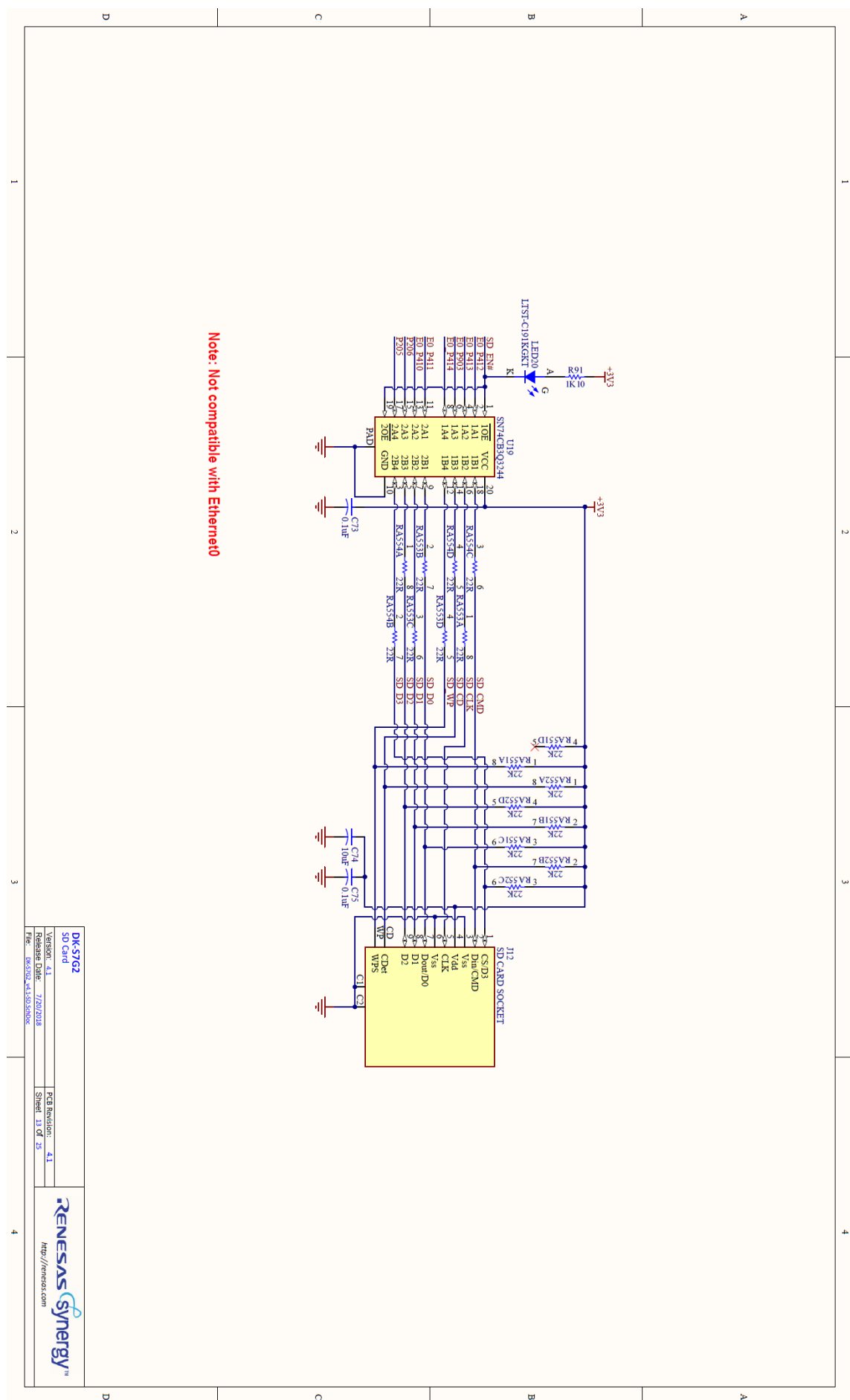


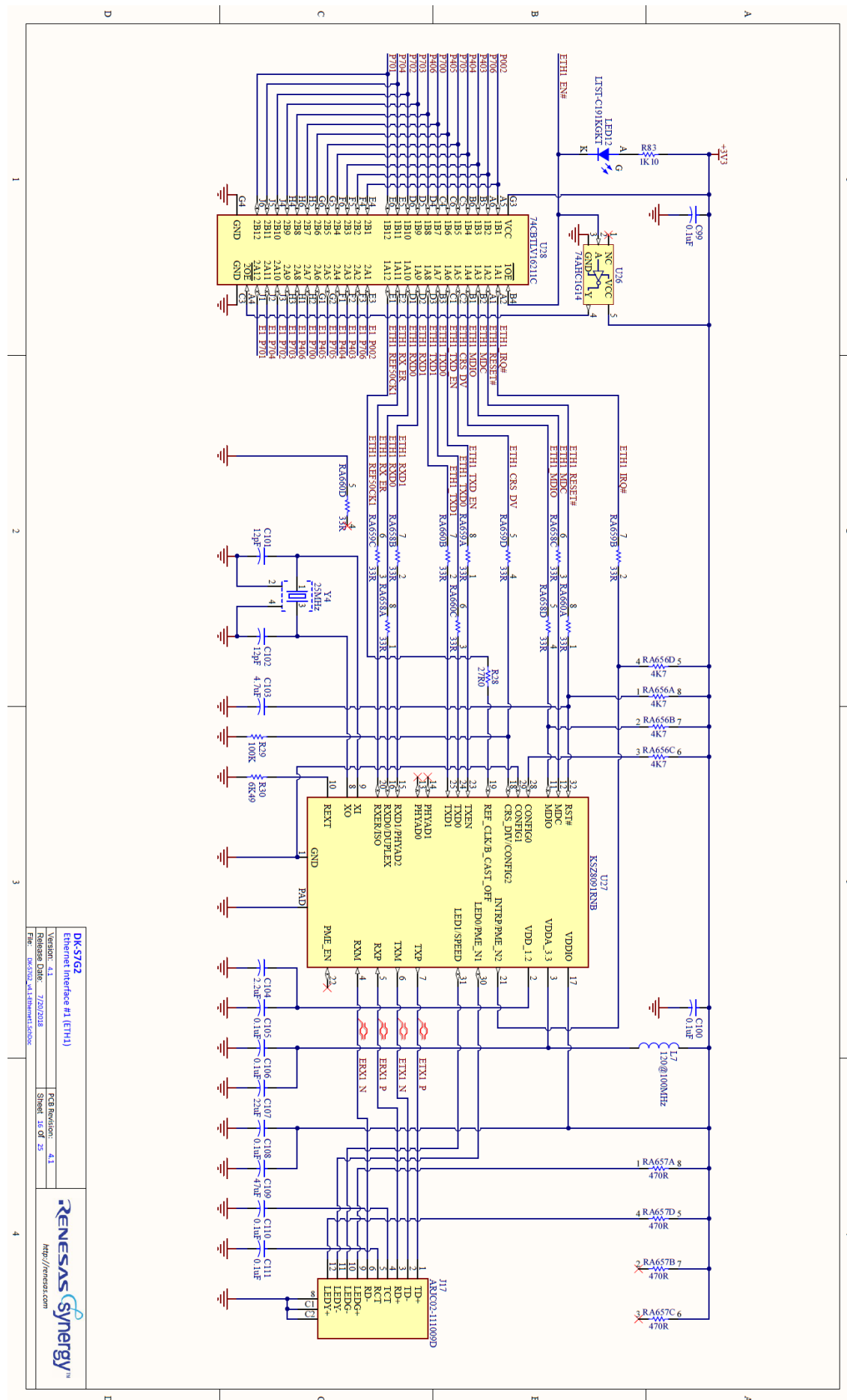


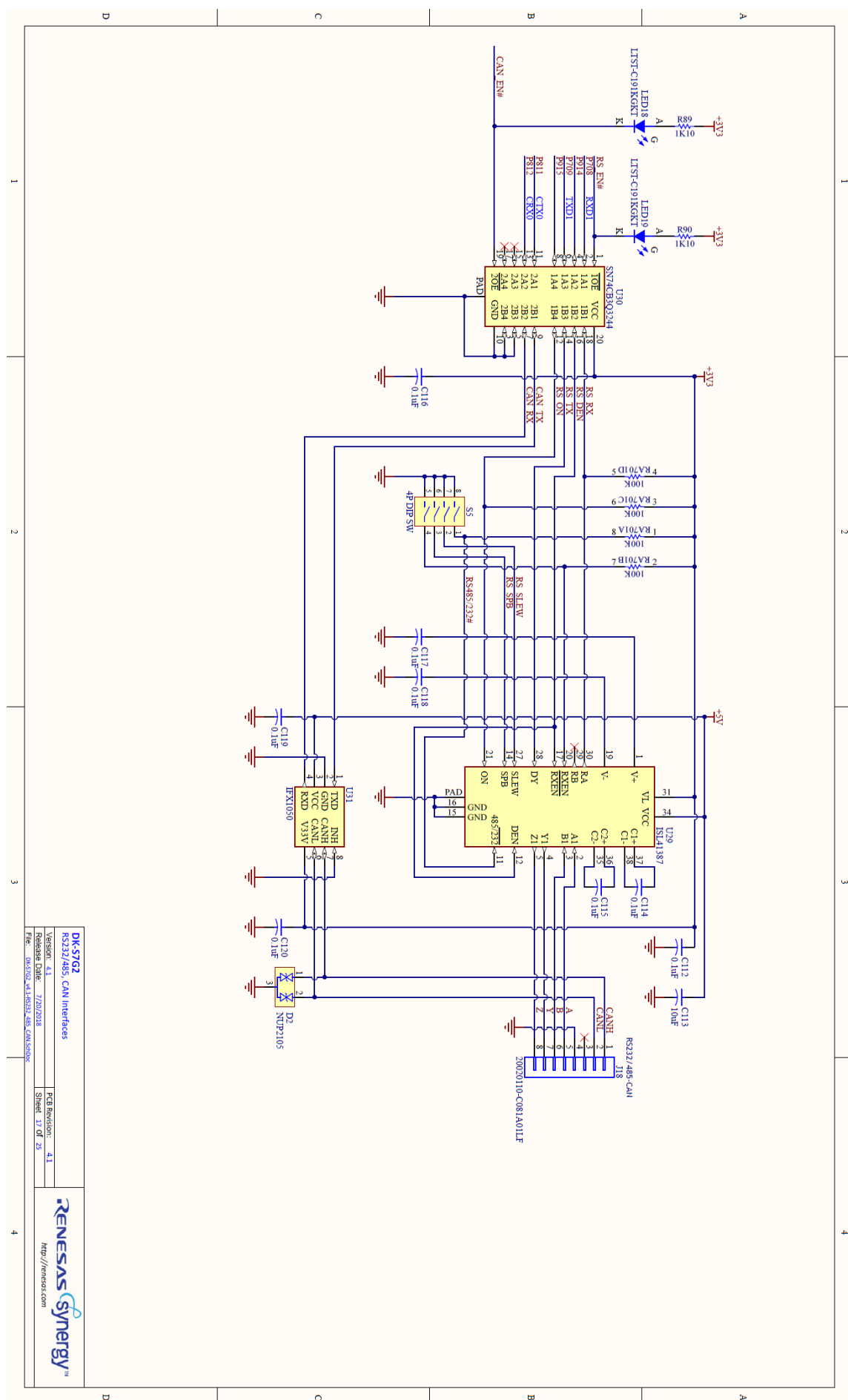


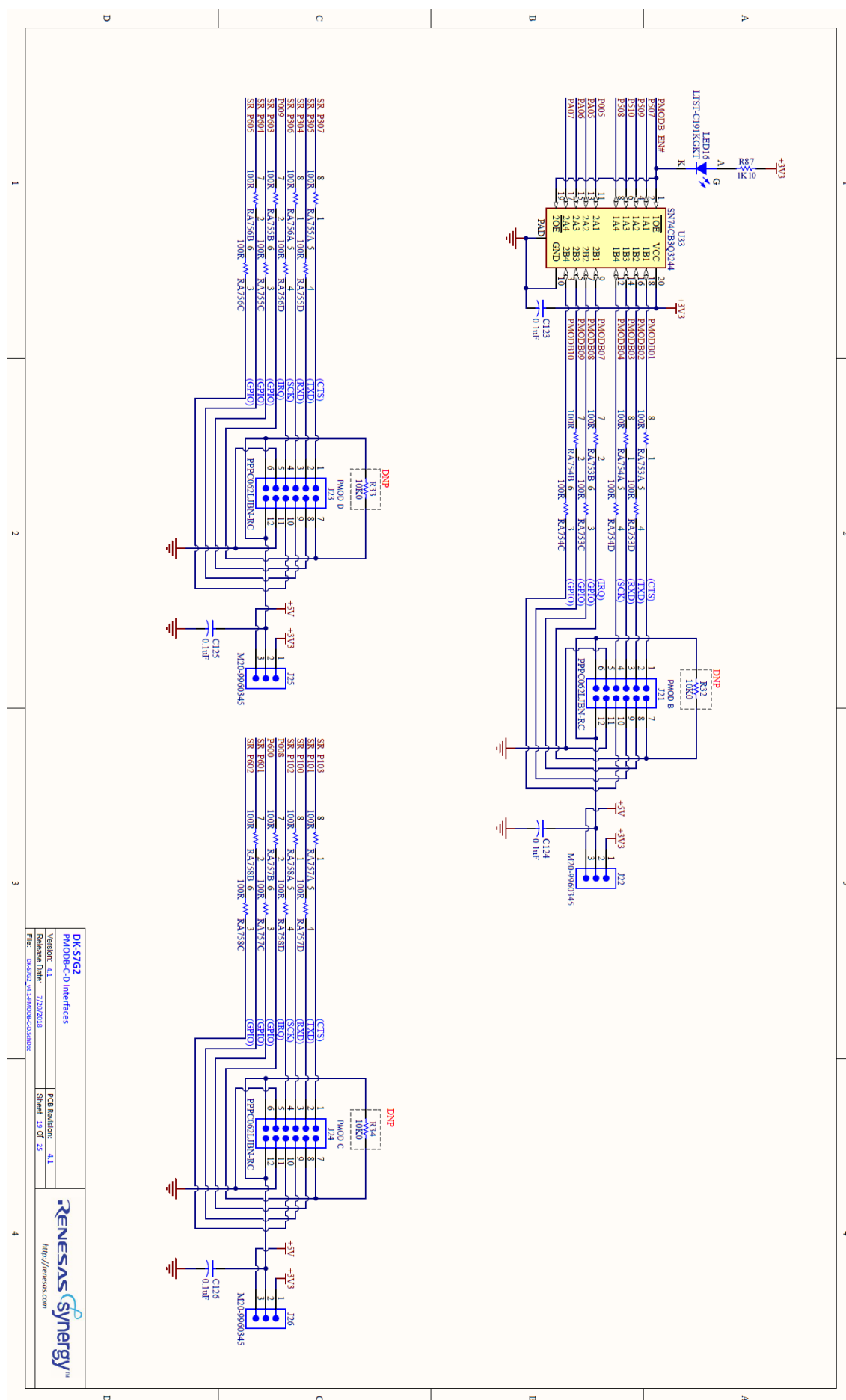


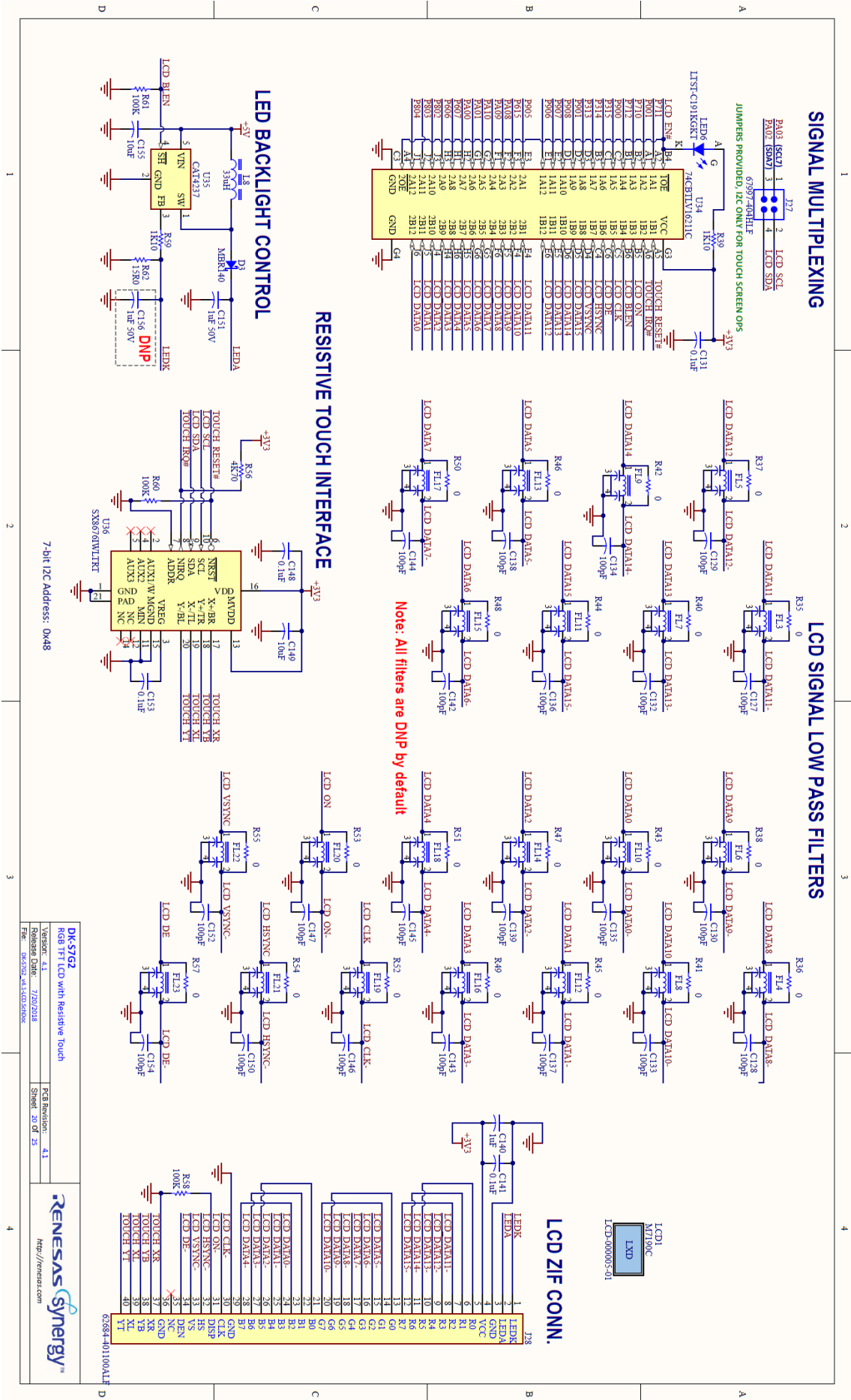


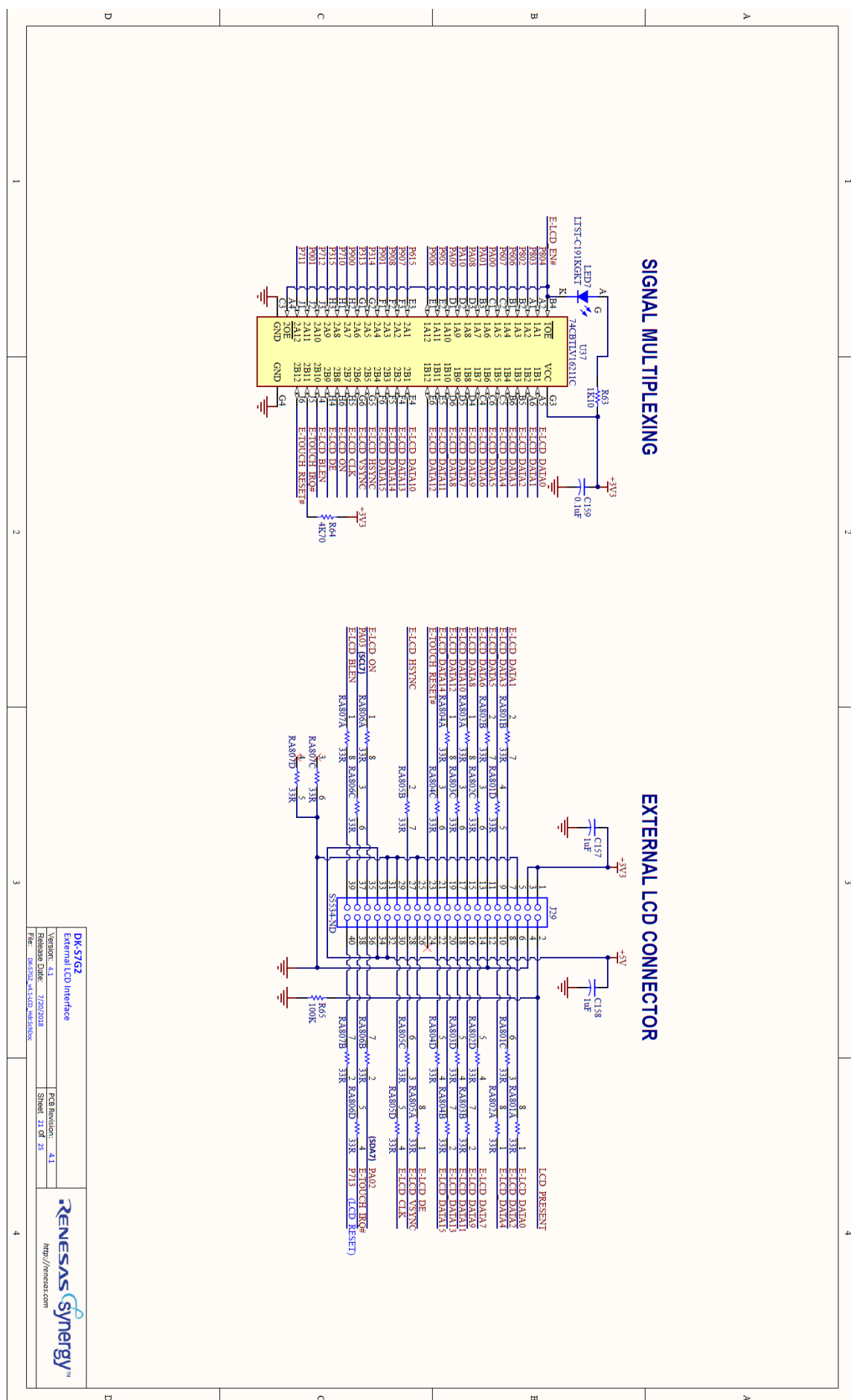


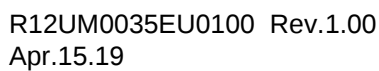


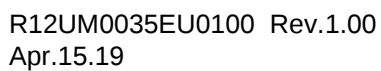




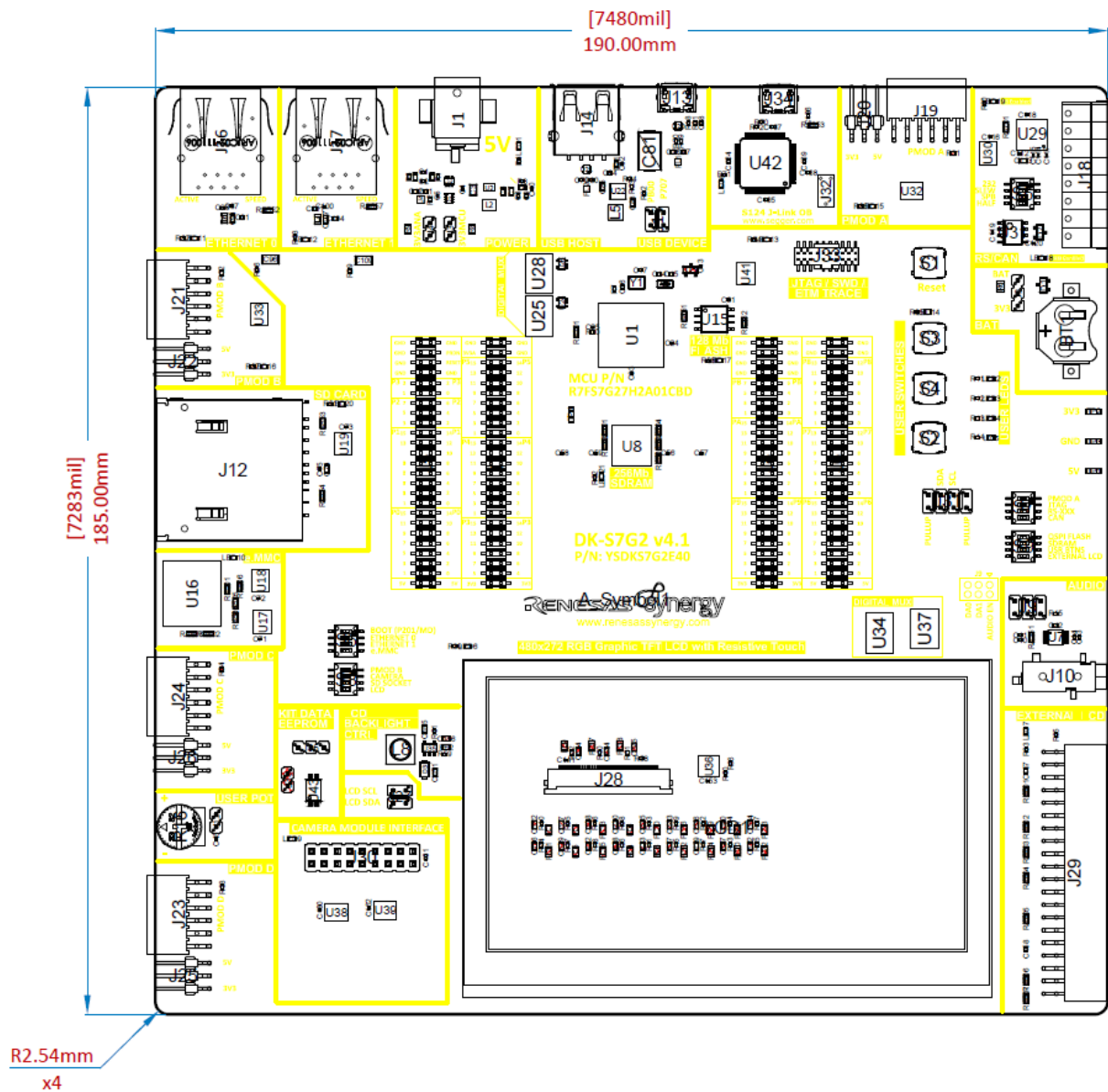








7. Mechanical Drawing



8. Certifications

FCC Compliance

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Japanese VCCI Normative Annex 1 and Normative Annex 1-1, Class B ITE

This is a Class B product based on the standard of the VCCI Council. If this is used near a radio or television receiver in a domestic environment, it may cause radio interference. Install and use the equipment according to the instruction manual.

China SJ/T 113642014, 10 year environmental protection use period.

Chinese National Standard 13438, C6357 compliance, Class B limits

Australia/New Zealand AS/NZS CISPR 32:2015, Class B

EU RoHS

EU EMI/EMC compliance

Website and Support

Visit the following vanity URLs to learn about key elements of the Synergy Platform, download components and related documentation, and get support.

Synergy Software	www.renesas.com/synergy/software
Synergy Software Package	www.renesas.com/synergy/ssp
Software add-ons	www.renesas.com/synergy/addons
Software glossary	www.renesas.com/synergy/softwareglossary
Development tools	www.renesas.com/synergy/tools
Synergy Hardware	www.renesas.com/synergy/hardware
Microcontrollers	www.renesas.com/synergy/mcus
MCU glossary	www.renesas.com/synergy/mcuglossary
Parametric search	www.renesas.com/synergy/parametric
Kits	www.renesas.com/synergy/kits
Synergy Solutions Gallery	www.renesas.com/synergy/solutionsgallery
Partner projects	www.renesas.com/synergy/partnerprojects
Application projects	www.renesas.com/synergy/applicationprojects
Self-service support resources:	
Documentation	www.renesas.com/synergy/docs
Knowledgebase	www.renesas.com/synergy/knowledgebase
Forums	www.renesas.com/synergy/forum
Training	www.renesas.com/synergy/training
Videos	www.renesas.com/synergy/videos
Chat and web ticket	www.renesas.com/synergy/resourcelibrary

Revision History

Rev.	Date	Description	
		Page	Summary
1.00	Apr.15.19	-	First release document

Development Kit S7G2 (DK-S7G2) User's Manual

Publication Date: Apr.15.19

Published by: Renesas Electronics Corporation

Renesas Synergy™ Platform Development Kit S7G2 (DK-S7G2)