User's Manual

Development Kit S128 (DK-S128)

User's Manual

Renesas Synergy™ Platform

Synergy Tools & Kits

Kits: DK-S128 v2.0

Renesas Electronics
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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 S128 (DK-S128) v2.0

Contents

1. Overview

The Development Kit S128 (DK-S128) is primarily intended for software and hardware developers to develop firmware, and to experiment, and evaluate the extensive I/O features of the S1 MCU Series on the DK-S128 prior to development of their own customized hardware.

- Renesas Synergy™ S128 Microcontroller Group
  - MCU part number R7FS128783A01CFM
  - LQFP64 Package
  - ARM® Cortex®-M0+ Core
  - ARM®v6-M architecture
  - 24 KB on-chip SRAM
  - 256 KB on-chip code flash memory
  - 4 KB on-chip data flash memory
  - Maximum operating frequency: 32 MHz
  - ARM® Memory Protection Unit (MPU) with 8 regions
  - Debug and Trace: DWT, BPU, Core Sight™ MTB-M0+
  - Core Sight™ Debug Port: SW-DP
- Connectivity
  - USB 2.0 Full-Speed Module (USBFS)
  - SPI and I2C interface, 8-pin header
  - Seeed Grove I2C interface
  - CAN transceiver
  - Configurable RS232/RS485 port on an industrial-style 3.5 mm screw terminal plug connector
  - Digital Addressable Lighting Interface (DALI)
  - PMOD 12-pin multi-type expanded interface (firmware configured)
- Power
  - Main power input of 5 V to a barrel jack or USB Device input of 5 V
  - High efficiency 5 V to 3.3 V system power DC-DC converter
  - Low noise 5 V to 3.3 V power regulator for MCU analog functions
  - Lithium coin cell holder for low-power operations testing
  - Several jumper-configurable headers to allow selection of regulated or battery power source, and monitoring of currents and voltages
- Analog
  - Stereo audio output with headphone jack, and single microphone input
  - Operational Amplifier (OPAMP) x 4
  - Ambient Light and Temperature sensor
  - User-adjustable manual thumbwheel potentiometer
- Human Machine Interface
  - Two capacitive touch buttons and one capacitive touch-slider
- User I/O
  - Three user-configurable LEDs (red, yellow, and green)
  - Two user-configurable momentary button switches
- General Purpose I/O Ports
  - Up to 53 input/output pins
- MCU boot configuration jumper
- MCU reset push-button switch

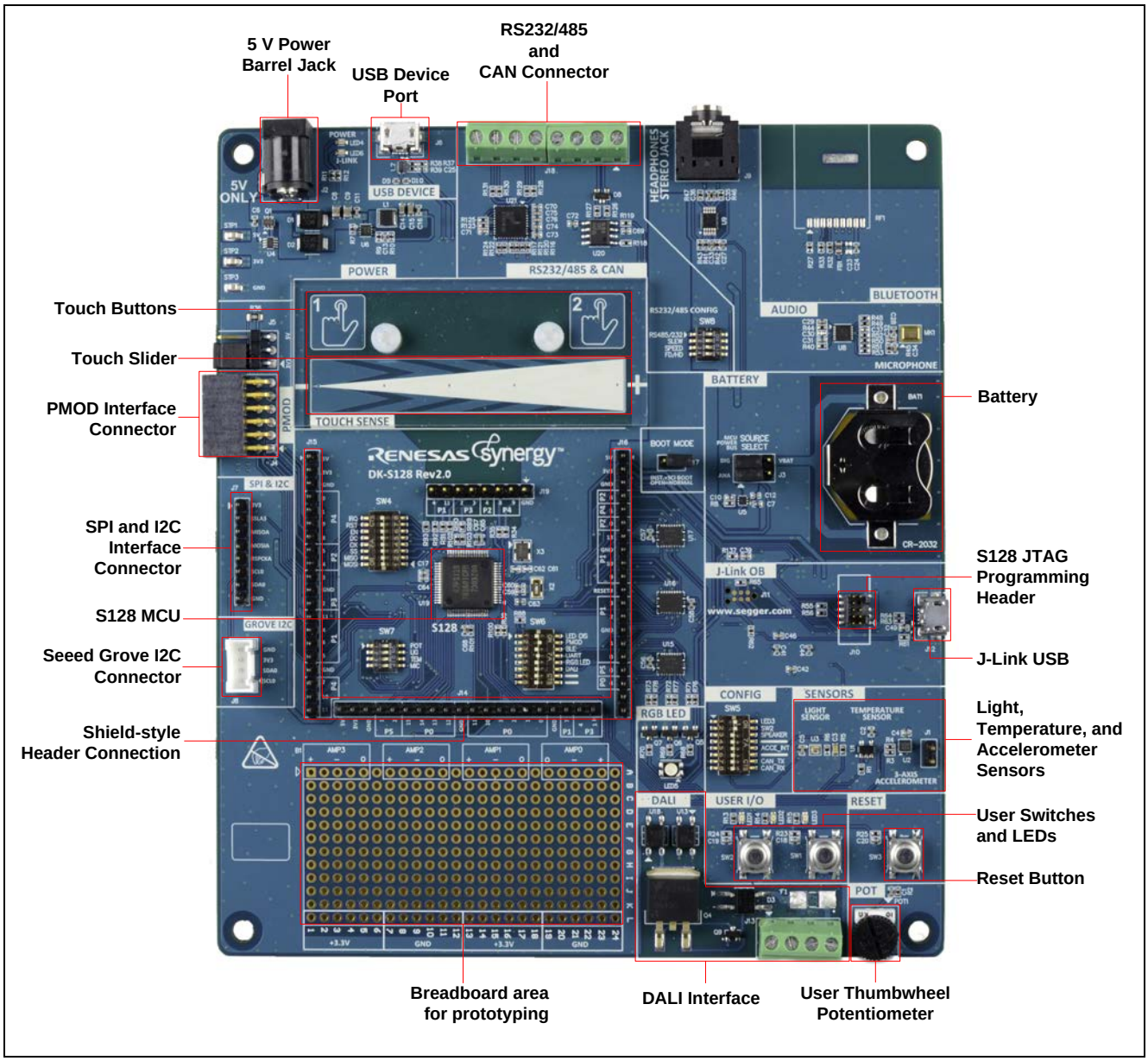


Figure 1. DK-S128 Top Side

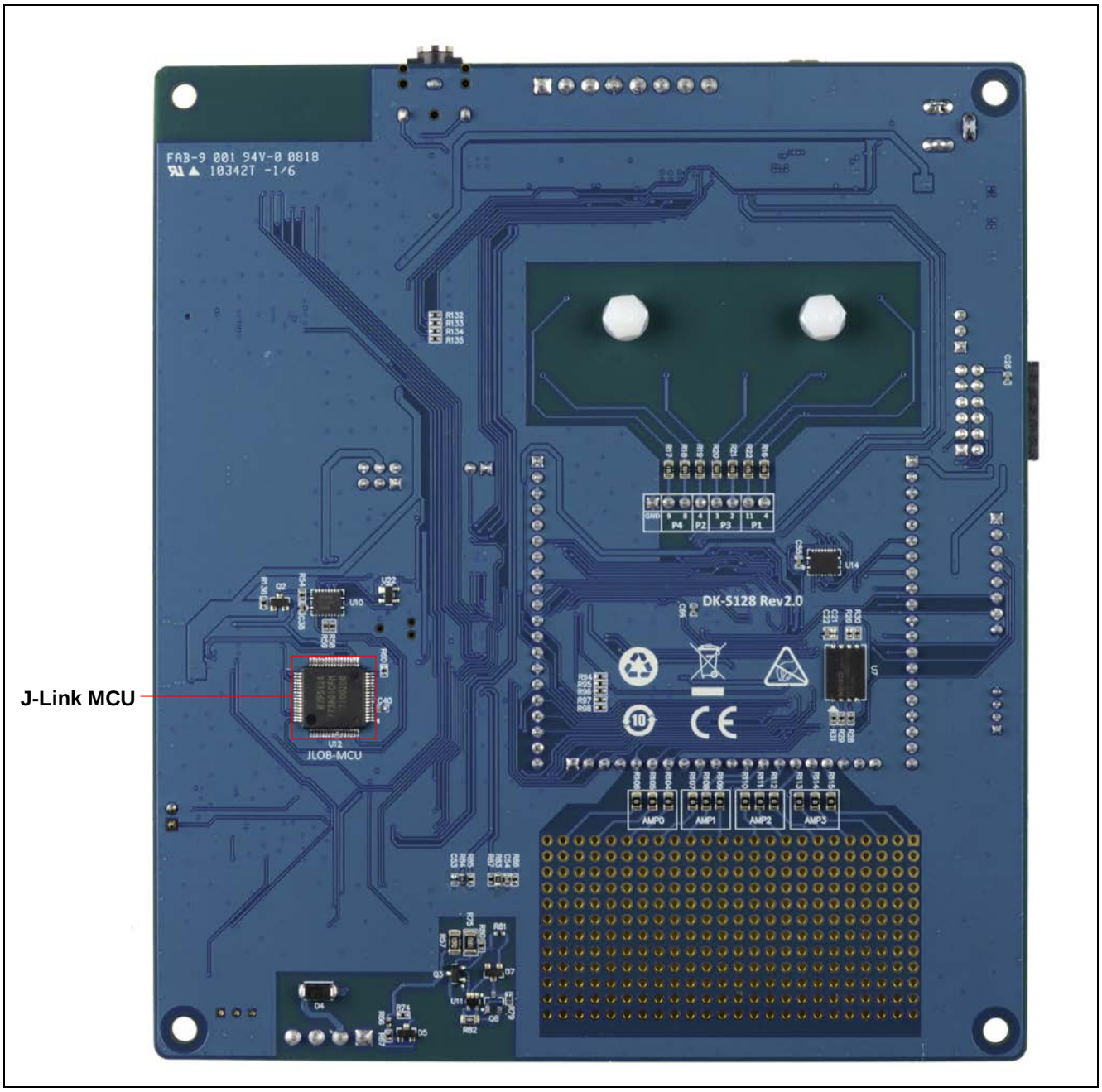


Figure 2. DK-S128 Bottom Side

2. Kit Contents

The following components are included in the Development Kit S128 (DK-S128):

- 1x DK-S128 main board with installed acrylic overlay for the touch buttons and touch slider, with installed bumper feet
- 1x three-foot USB cable Type-A connector to Micro-B connector
- 5x shunt-jumpers for 0.1” headers on the DK-S128 - 1 each for J1, J5, J7 and 2 for J3
- 1x RSK PMOD display board

3. Getting Started with Embedded Application Development on DK-S128

To develop and execute embedded applications on the DK-S128 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:

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

B. **e² studio Platform Installer** installs Synergy Software Package and e² studio for Synergy IDE with IAR complier and J-Link USB drivers.
Download from www.renesas.com/synergy/e2studio.

Note: The DK-S128 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-S128, they are not required to run the Out-of-Box (OoB) Demonstration Application that the DK-S128 comes pre-programmed with. Refer to the *DK-S128 Quick Start Guide* for more details.

Step 3: Explore Existing Application Projects for the DK-S128

Renesas provides several application projects to demonstrate different capabilities of the S128 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-S128 are listed at www.renesas.com/synergy/dk-s128.

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-S128 board.

4. DK-S128 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-S128.

Table 1. Default Jumper Settings

Location	Circuit Group	Default Open/Closed	Function
J1	Accelerometer Interrupt	Jumper on pins 1-2	Connect the accelerometer to the main MCU
J3	MCU Power Bus Source	Jumper on pins 1-3 Jumper on pins 2-4	Connects output from U5 to the MCU Connects the main +3.3 V to the MCU +3.3 V
J17	Boot Mode	Open	Sets the board to boot normally
J5	PMOD Power	Jumper on pins 1-2	Sets the PMOD power to +3.3 V

The following table describes the default settings for each DIP Switch on the DK-S128.

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

Table 2. Default DIP Switch Settings

Location	Circuit Group	Default Open/Closed	Function
SW5-1	Config	ON	Enables LED3
SW5-2	Config	ON	Enables user push-button SW2
SW5-3	Config	OFF	Enables the headphone jack output
SW5-4	Config	OFF	Not connected
SW5-5	Config	OFF	Enables the accelerometer interrupt
SW5-6	Config	OFF	Not connected
SW5-7	Config	OFF	Enables the CAN Transmit signal
SW5-8	Config	OFF	Enables the CAN Receive signal
SW6-1	Config	OFF	Disables LED1
SW6-2	Config	ON	Enables the PMOD interface
SW6-3	Config	OFF	Enables SPI flash and the SPI header
SW6-4	Config	ON	Enables the UART interface
SW6-5	Config	OFF	Enables the RGB LED (LED5)
SW6-6	Config	OFF	Enables the DALI interface
SW6-7	Config	OFF	Not connected
SW6-8	Config	OFF	Not connected
SW8-1	Serial Port Config	ON	Configures the RS232/485 serial port
SW8-2	Serial Port Config	OFF	Configures the RS232/485 serial port
SW8-3	Serial Port Config	OFF	Configures the RS232/485 serial port
SW8-4	Serial Port Config	OFF	Configures the RS232/485 serial port
SW4-1	PMOD	ON	Isolates the PMOD MOSI signal
SW4-2	PMOD	ON	Isolates the PMOD MISO signal
SW4-3	PMOD	ON	Isolates the PMOD SS signal
SW4-4	PMOD	ON	Isolates the PMOD CK signal
SW4-5	PMOD	ON	Isolates the PMOD DC signal
SW4-6	PMOD	ON	Isolates the PMOD EN signal
SW4-7	PMOD	ON	Isolates the PMOD RST signal
SW4-8	PMOD	ON	Isolates the PMOD IRQ signal
SW7-1	Analog	ON	Enable the user Potentiometer
SW7-2	Analog	ON	Enable the light sensor
SW7-3	Analog	ON	Enable the temperature sensor
SW7-4	Analog	ON	Enable the SEMS microphone

5. Hardware Layout

5.1 System Block Diagram

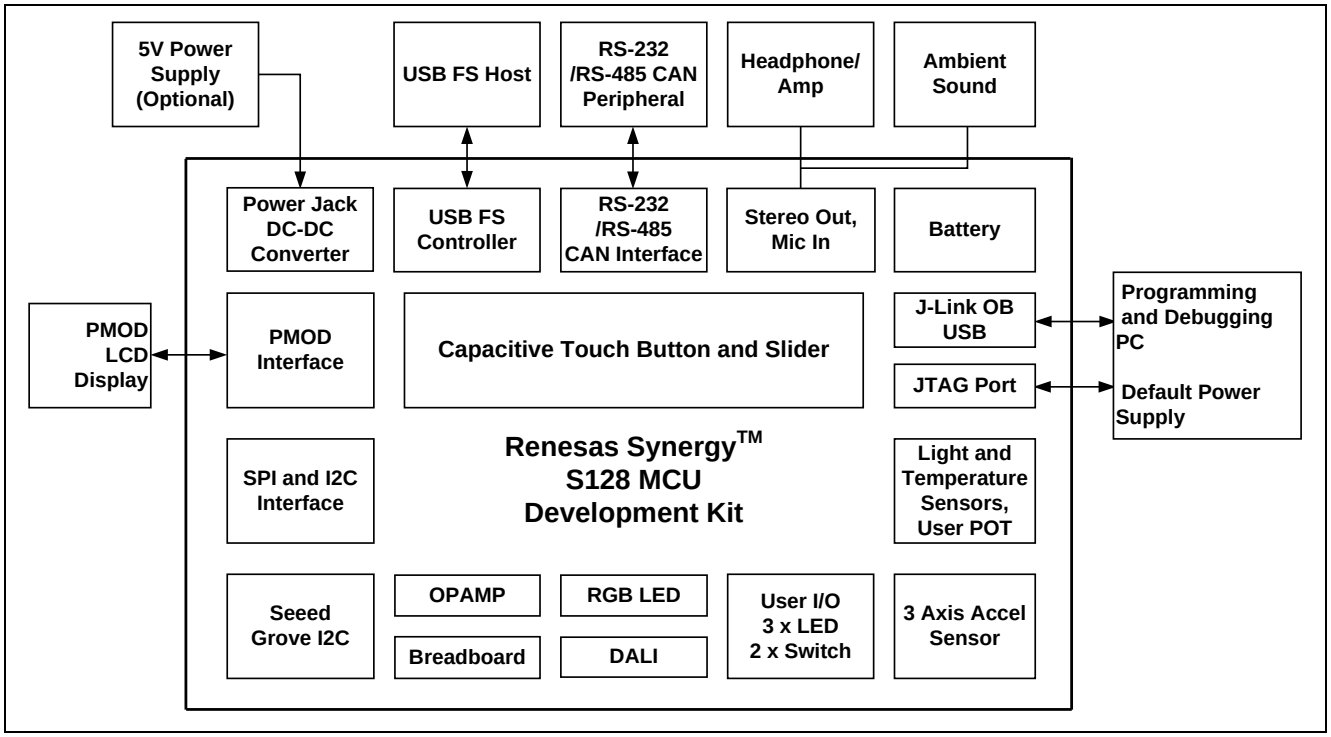


Figure 3. DK-S128 Block Diagram

5.2 Power Requirements

This section covers information related to power supplies for DK-S128. It includes information on input power supply sources, power up behavior, battery supply configuration, and how to measure current consumption for the S128 MCU and other key components.

5.2.1 Power Supply Options

This section provides details on various input power supply options available on the DK-S128.

5.2.1.1 5 V Power Barrel Jack

This connector is one way of powering the DK-S128 board. It is rated for 2 A and accepts a 5.5 mm plug. The connector has the following dimensions: 5.5 mm OD x 2.1 mm ID, with ≥ 9.5 mm insertion barrel power plug, center is positive polarity.

Figure 4. 5 V Power Barrel Jack

There is limited voltage protection on the 5 V direct power input. Using a reverse-polarity barrel plug power source may permanently damage the unit.

5.2.1.2 J-Link USB Micro-B

J-Link USB Micro-B connector J12, located near the battery holder, can be used to power the DK-S128 board. For this feature, a “Power Only” USB cable must be used to ensure there are no data conflicts with the J-Link signals.

See section 5.4.4 for more information about the use of this USB Micro-B connector for the J-Link feature.

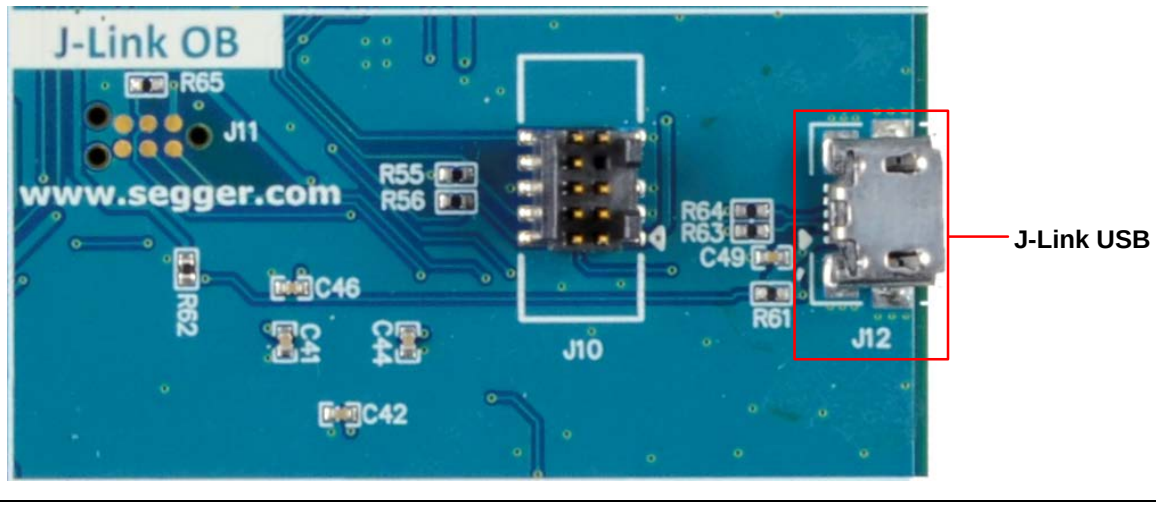


Figure 5. J-Link USB Micro-B Power Connection

5.2.1.3 CR2032 Lithium Coin Cell

A CR2032 lithium coin cell battery can be installed in BAT1 holder near the right edge of the circuit board.

When power to the S128 MCU is supplied from the lithium coin cell and J-Link circuitry operation is required for debugging, connection of the JLOB USB interface powers the J-Link circuitry. This also has a side-effect of powering some other circuitry on the DK-S128 main board that would otherwise remain un-powered for battery operation.

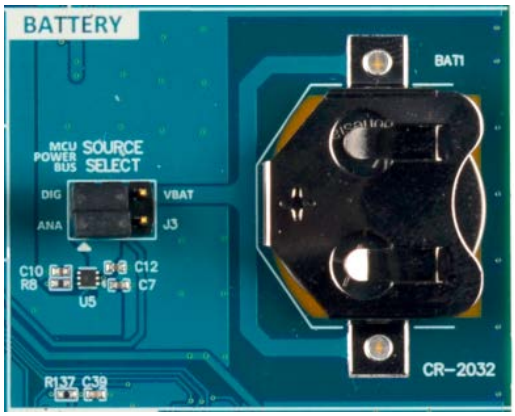


Figure 6. CR2032 Lithium Coin Cell

5.2.1.4 External Power Supply

Installation of a 5V power source can be done using the Expansion Headers J14, J15 and J16. The positive (+5 V) of the external power supply can be connected at J14-20, J15-1, or J16-1. The negative (Ground) of the external power supply can be connected at J14-18, J15-3 or J16-3. See section 6 for more details on the Expansion Headers.

There is no over voltage protection on the 5 V direct power input on the Expansion Headers. Use extreme caution when connecting an external power supply to the Expansion Headers.

5.2.2 Power-up Behavior

The DK-S128 is delivered preloaded with a demonstration program. The demonstration program shows several features of the DK-S128 and has source code available as a programming example for developers. See the *DK-S128 Quick Start Guide* for details of use and expected board behavior when running the demonstration program.

When powered from J-Link USB or the barrel jack (the 3.3 V Main Power Subsystem is currently powered), the green LED4 adjacent to the barrel jack is lit, and the red LED6 is flashing. The red LED6 is controlled by the J-Link microcontroller in accordance with J-Link specifications. The red LED6 stops flashing when the connection between the J-Link MCU and J-Link software on the PC is established.

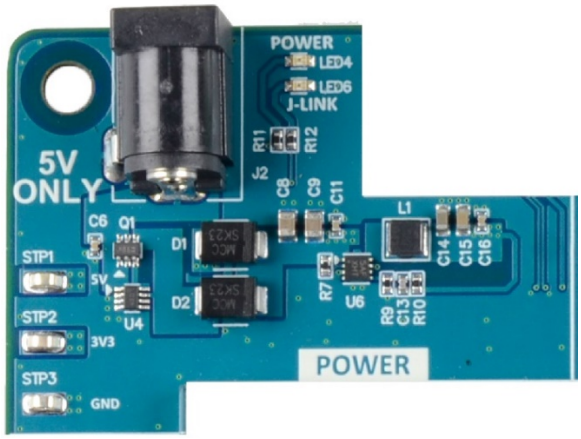


Figure 7. Input Power Section

5.2.3 Battery Supply Configuration

A lithium button cell battery may be used to provide power to the board. See section 5.2.1.3, CR2032 Lithium Coin Cell for information on the battery.

Specific jumpers must be configured to use the button cell battery. See section 4.1, Jumpers and DIP Switch Settings for information on the jumper settings.

5.2.4 Power Rails on the Board

5.2.4.1 +5 V Main Voltage Rail

Dual low-drop Schottky diodes merge the two power inputs (barrel connector input and J-Link USB supply) such that whichever is available and is higher is delivered downstream as the power rail +5 V to power supplies for the circuitry on the DK-S128.

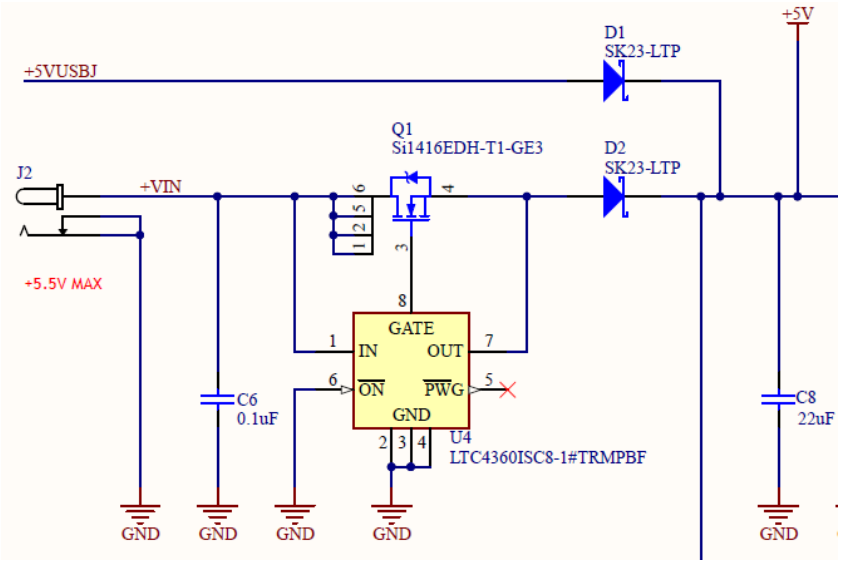
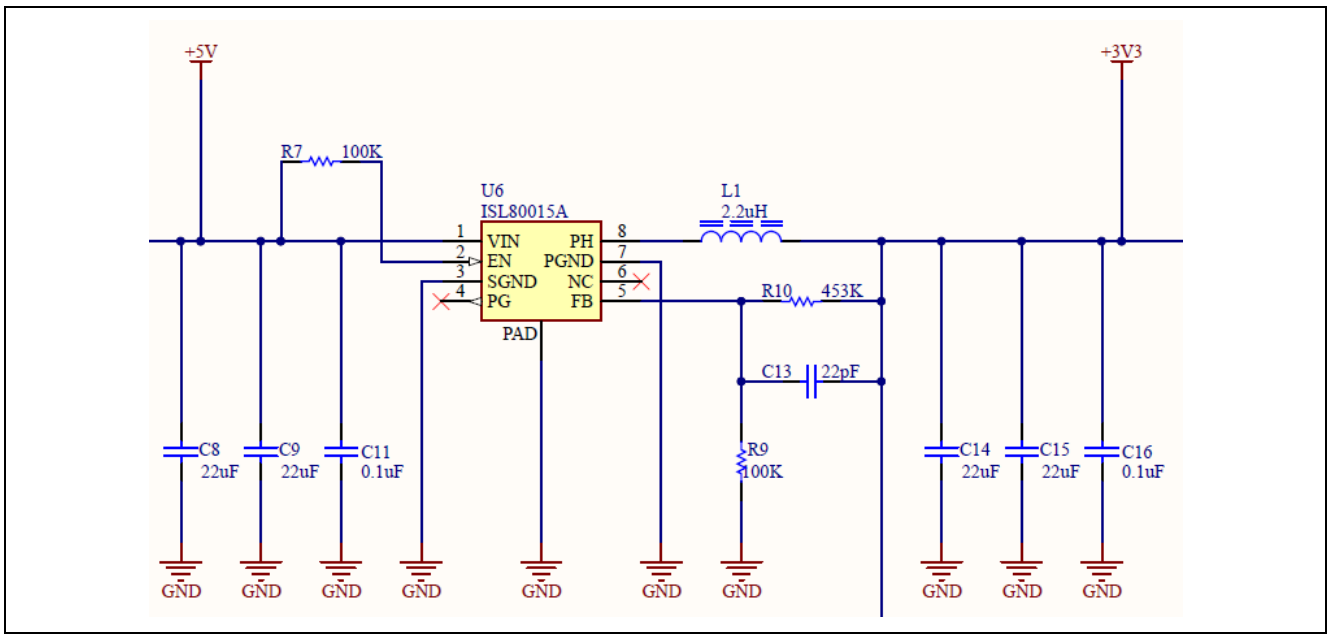


Figure 8. Main Input Power Schematic

5.2.4.2 Main Power Subsystem

Almost all the circuits on the board require 3.3 V, including MCU, memory, and logic. The +5 V main voltage rail power is delivered to the ISL80015 buck-boost switcher. This switcher, using a tiny inductor, creates 3.3 V at up to 1.5 A, and can operate with a +5 V rail voltage between 2.7 V and 5.5 V. Note that some subsystems on the DK-S128, such as USB may not function correctly with lower input voltages on the +5 V rail.



5.2.5 Measuring Current Consumption

5.2.5.1 Microcontroller Current

Power supply current to the MCU may be monitored by connecting ammeter leads of a multimeter in place of one of three jumpers on the main board. Jumper J3 can be used to monitor main MCU current (to VCC) plus USB MCU current (to VCC_USB and VCC_USB_LDO). Jumper J3 at lower center and lower left pins can be used to monitor MCU analog current (to AVCC).

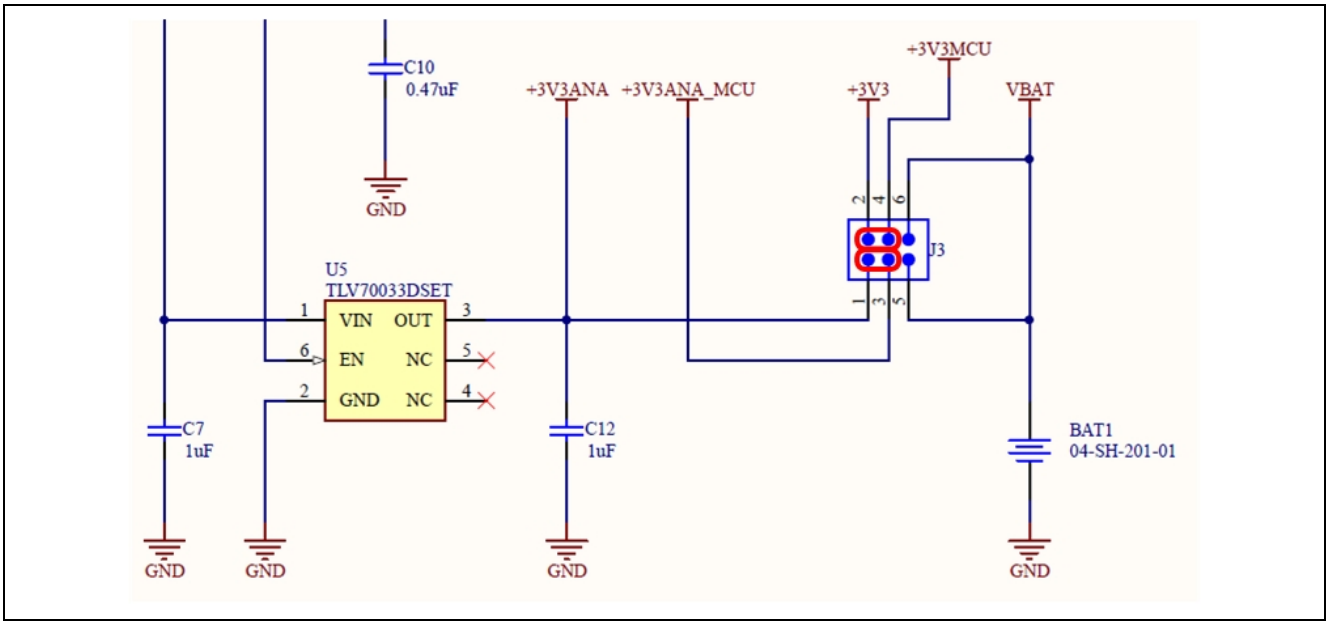


Figure 9. MCU Current Measurement

5.2.5.2 Battery Current

Battery current can be measured replacing the appropriate jumper with ammeter leads of a multimeter (or shunt resistor and voltmeter). This can be performed by using J3 upper pins to measure the MCU digital supply current, using J3 lower center and lower right pins to measure the MCU analog supply.

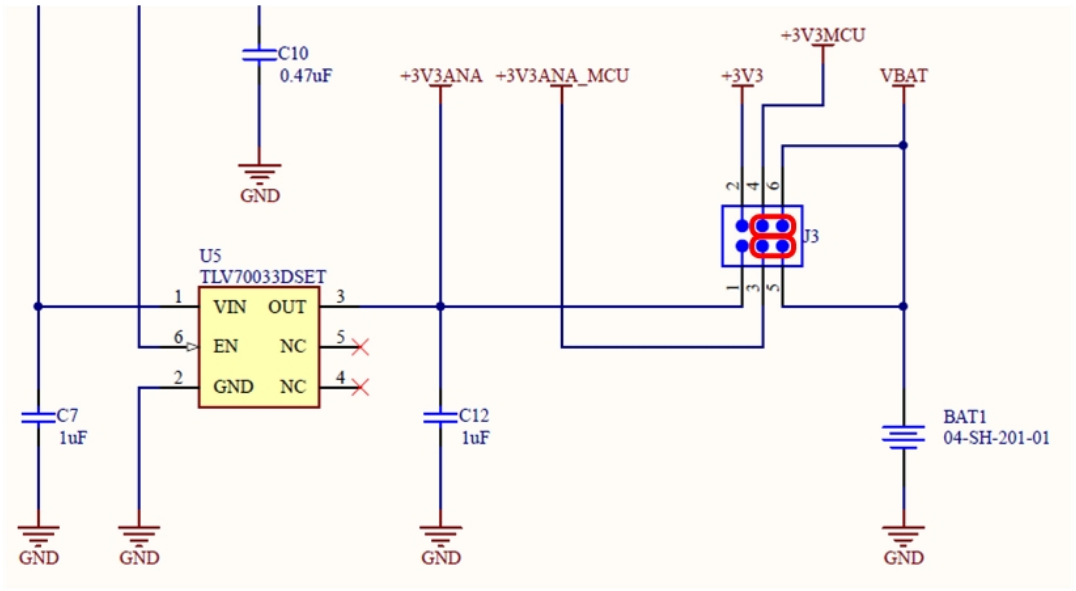


Figure 10. Battery Current Measurement

5.3 Main Components

- Main MCU
  - Renesas Synergy™ S128 MCU, part number R7FS128783A01CFM#AA0 (U19)
    - Main MCU
- Intersil ISL41387 (U21)
  - Configurable RS232 or RS485 half-duplex or full-duplex serial interface
  - RS232 configurable to 650 kbps, separate receive and transmit connections
  - RS485 configurable to 20 Mbps, or slew rate limited for low noise at 115 kbps or 460 kbps
- Infineon IFX1050G (U20)
  - CAN Transceiver
    - Supports transmission rates from 1 kbps to 1 Mbps
- Maxim MAX9814 (U8) with MEMS microphone (MK1)
  - AGC and low noise microphone 2 V bias
  - Selectable output gain for maximum total gain 40 dB, 50 dB, or 60 dB
  - The Maxim MAX9814 microphone preamplifier (U8) with a supplied MEMS microphone (MK1) on the board, provides an amplified audio signal relative to omnidirectional sound levels near the circuit board. All gain, shutdown, AGC, and other settings are hard-wired on the board.
  - A low-pass filter with a corner frequency of 3.4 kHz on the output of MK1 prevents the introduction of high frequency signals to the MCU ADC, as MK1 is capable of ultrasonic performance. The audio signal output by the MAX9814 is provided to the S128 at P0_2/AN002 ADC input.
- On Semiconductor NCP2809 (U9) with stereo headphone jack (J9)
  - 135 mW/channel into 16 Ω stereo load
  - Internal gain of 0 dB, PSRR 85 dB
- Analog Devices TMP35 (U1)
  - Analog output, 2C accuracy, 0.5C linearity
  - The Analog Devices TMP35 (U1) provides a voltage output proportional to circuit board temperature at the sensor, provided to the S128 MCU at P0_1/AN001 ADC input. The voltage to the MCU ADC will be V_{adc} = T x 0.01V, where T is temperature in degrees Celsius in the range 10°C to 125°C and V_{adc} is the voltage delivered to the MCU ADC.

- Analog Devices APDS-9005-020 (U3)
  - The Avago ADPS-9005 (U3) provides a current output proportional to ambient light at the sensor, sampled through a 1 kΩ resistor, then provided to the S128 MCU at P0_0/AN000 ADC input.
  - Normal light ranges will provide the MCU ADC 40 mV at 100 Lux (dim office lighting), 0.4 V at 1k Lux (sunlight, overcast), and will saturate around 2.3 V at or above 6k Lux (sunlight in a shaded area).
- S124 MCU (U12) with J-Link USB port (J12)
  - Programmed to provide J-Link interface, allowing USB programming and debug of S128 MCU
  - Powered from the +3.3 V internal +5 V derived bus, allowing separation from battery supply
- Bosch BMA250E (U2)
  - SPI or I²C interface, programmable ranges from +/- 2 g to +/- 16 g, programmable low pass filters
  - Motion triggered interrupt output
  - The Bosch BMA250E (U2) is an SPI or I²C (used on DK-S128) interface 3-axis accelerometer with ranges from +/- 2 g to +/-16 g selectable, low pass filtering selectable, with a sample FIFO, extremely low power operating, and has several modes to further reduce power.
  - This chip provides two separate power busses, VDD for analog and internal sampling processes, and VDDIO for serial interface support, both of which are connected to the +3.3 V Bus. This device has an I2C address of 0011000b (address byte 0x30 to OR with write bit).
- Micron N25Q256A (U7)
  - SPI Flash device, supports 108 MHz SPI clock, DK-S128 supports 16 MHz clock
  - 32 MB organized for 4 KB sub-sector, 64 KB sector, and full-chip erase operations
  - 100,000 erase cycle rating

5.4 Connectivity and Settings

5.4.1 USB Device

This USB Micro-B connection jack connects the S128 MCU to an external USB Host, FS capable, but does not accept power from the host. Host power voltage is checked to detect connection.

Figure 11. USB Device Connector (J6)

Table 3. USB Device Connector (J6)

USB Device Connector		S128 Microcontroller	
Pin	**Description**	**Logical Pin(s)**	**Function Name(s)**
1	VBUS, +5VDC, two 10 K resistors connected in parallel	P4_7	P4_7/USB_VBUS
2	Data-	USB_DM	USB_DM
3	Data+	USB_DP	USB_DP
4	USB ID, jack internal switch, cable inserted	-	(Not connected)
5	Ground	VSS	(Circuit Ground)

5.4.2 RS232/485 and CAN

The RS232/485 and CAN connector header connects the ISL41387 RS232/485 transceiver and the IFX1050 CAN transceiver to the mating screw-terminal-block adapter supplied with the DK-S128.

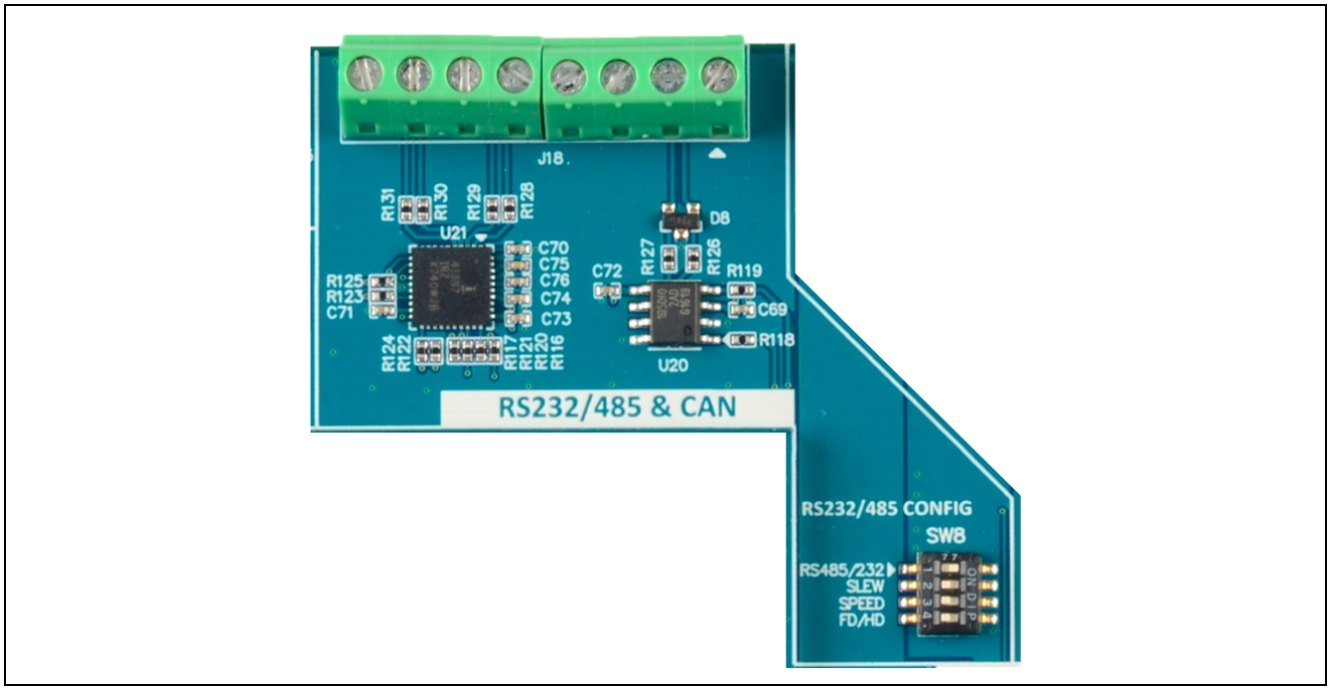


Figure 12. RS232/485 and CAN Interface

The S128 MCU interfaces with the ISL41387 RS232/485 transceiver as shown in the following table.

Table 4. RS232/485 Transceiver

ISL41387 RS232/485 Transceiver		**S128 Microcontroller**	
Pin	**Description**	**Logical Pin(s)**	**Function Name(s)**
RA	Receive Channel A	P4_10	UART_RX
RB	(NOT CONNECTED)	No Connect	Not Applicable
RXEN	Receive Enable, logically compared to RXEN# (Controlled by SW8 FD/HD switch)	No Connect	Not Applicable
RXEN#, DEN	Not Receive Enable, Transmit Enable	P1_3	UART_DEN
DY	Transmitted Data Input	P4_11	UART_TX
SLEW	RS485 slew limit setting (Controlled by SW8 SLEW switch)	No Connect	Not Applicable
SPB	RS485 speed control setting (Controlled by SW8 SPEED switch)	No Connect	Not Applicable
ON	In RS232 mode only, pin HIGH enables charge pumps for supply voltage boost	P1_2	UART_ON
485/Not232	RS232/485 mode selection (Controlled by SW8 RS485/232 switch)	No Connect	Not Applicable

Note: The RS232/485 feature shares MCU signals with the RSPI feature. Only one of these features may be used at a time. See Table 2. Default DIP Switch Settings for feature enable settings.

The S128 MCU interfaces with the IFX1050 CAN transceiver as shown in the following table.

Table 5. RS232/485 and CAN Connector (J18)

RS232/485 and CAN Connector		Transceiver	
Pin	**Description**	**Logical Pin(s)**	**Function Name(s)**
1	CANH, CAN high	CAN_H	IFX1050, High line I/O
2	CANL, CAN low	CAN_L	IFX1050, Low line I/O
3	Not Connected	No Connect	Not Applicable
4	Ground	GND	(Circuit ground, both transceivers)
5	A, RS232 channel 1 input, RS485 inverting input	A1	ISL41387 receive A
6	B, RS232 channel 2 input, RS485 non-inverting input	B1	ISL41387 receive B
7	Y, RS232 channel 1 output, RS485 inverting output	Y1	ISL41387 transmit Y
8	Z, RS232 channel 2 output, RS485 non-inverting output	Z1	ISL41387 transmit Z

5.4.3 Stereo Headphone Jack

This 3.5 mm stereo output jack is provided with left output to the tip conductive region, right output to the middle conductive region, and output return to the cable-end conductive region of a miniature stereo phone plug. The input signal supplied to the headphone amplifier is from a single DAC on the S128 MCU, so only monaural sound is possible.

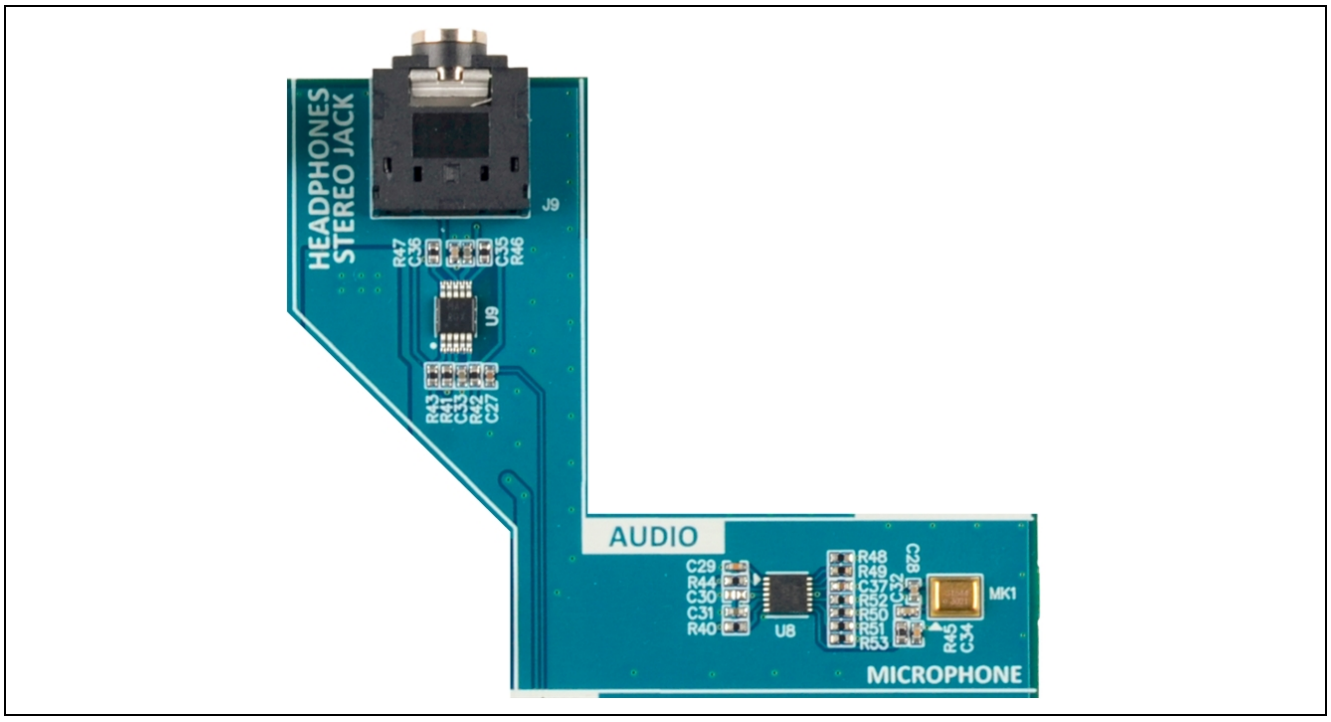


Figure 13. Stereo Headphone Jack and Microphone

Table 6. Stereo Headphone Jack (J9)

Stereo Headphone Connector		Stereo Headphone Amplifier	
Pin	**Description**	**Logical Pin(s)**	**Function Name(s)**
1	Common headphone return, sleeve	SPK_OUTI	Return for both left and right channels, and cable shield
2	Left headphone signal, plug tip	SPK_OUTL	Left output channel signal
3	Right headphone signal, plug middle ring	SPK_OUTR	Right output channel signal

Table 7. Stereo Headphone Amplifier (U9)

Stereo Headphone Amplifier		S128 Microcontroller	
Pin	**Description**	**Logical Pin(s)**	**Function Name(s)**
9	VM	VSS	(Circuit Ground)
5	IN_L, Left headphone input signal	P0_4	SPK_INL
1	IN_R, Right headphone signal	P0_4	SPK_INR

Note: The Stereo Headphone feature shares MCU signals with the SW2 feature. Only one of these features may be used at a time. See Table 2. Default DIP Switch Settings for feature enable settings for SW5.

5.4.4 J-Link USB and Power

This USB Micro-B connection jack connects the J-Link MCU to an external USB Host, FS capable, and accepts power from the host, allowing re-programming and debug of the S128 MCU firmware.

See section 5.2.1.2, J-Link USB Micro-B for more information on using the J-Link USB Micro-B connector to supply power to the board.

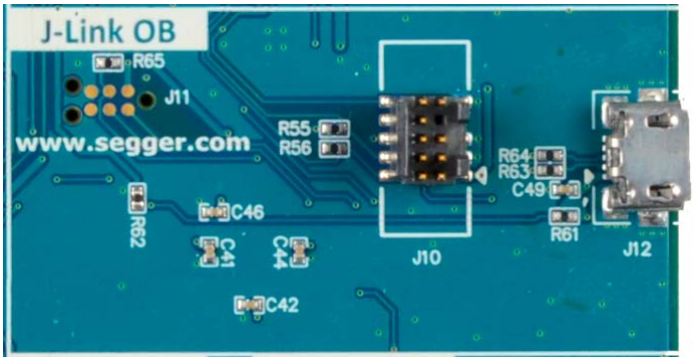


Figure 14. J-Link OB USB Programming and Debug

Table 8. J-Link OB USB Connector (J12)

J-Link USB Connector		JLOB Microcontroller	
Pin	**Description**	**Logical Pin(s)**	**Function Name(s)**
1	VBUS, +5VDC, connected to +5VUSBJ	-	(Not connected)
2	Data-	USB_DM	USB_DM
3	Data+	USB_DP	USB_DP
4	USB ID, jack internal switch, cable inserted	-	(Not connected)
5	Ground	VSS	(Circuit Ground)

5.4.5 S128 Programming and Debug

This 0.05” pitch 2 x 5 pin polarized header (J10) has pin 7 removed to allow use with a pin-7-plugged debug connector. The S128 Programming and Debug connector allows programming and debug of the S128 MCU using Serial Wire interface only. See Figure 14. J-Link OB USB Programming and Debug.

Table 9. S128 Programming and Debug Connector (J10)

S128 Programming and Debug Connector		S128 Microcontroller	
Pin	**Description**	**Logical Pin(s)**	**Function Name(s)**
1	ARM VCC, connected to +3V3 bus	+3V3MCU	MCU VCC
2	ARM SWDIO, Serial Wire Debug Data I/O	P1_8	P1_8/SWDIO
3	ARM GND	VSS	(Circuit Ground)
4	ARM SWCLK, Serial Wire Debug Clock	P3_0	P3_0/SWCLK
5	ARM GND	VSS	(Circuit Ground)
6	ARM SWO, Serial Wire Trace Output (optional)	-	(Not connected)

S128 Programming and Debug Connector		S128 Microcontroller	
Pin	**Description**	**Logical Pin(s)**	**Function Name(s)**
7	(pin removed)	N/A	N/A
8	Not Used	-	(Not connected)
9	GND	VSS	(Circuit Ground)
10	ARM RESET#, Pin low resets target CPU	RESET_L	RESET_L

5.4.6 J-Link JTAG Programming and Debug

This Tag-Connect 14-pin connection pattern, without retainer clip holes, is provided to allow JTAG programming interface to the Renesas S124 J-Link On-Board MCU. A Tag-Connect 14-pin adapter cable will properly mate with this pattern during programming. A friction clip may be needed to hold the cable's spring-pin-connector to the board. See Figure 14. J-Link OB USB Programming and Debug.

This connection is for factory use only. All J-Link On-Board MCU programming should be completed using the J-Link USB Micro-B connector. Information about the J-Link OB connector is provided only for reference.

5.4.7 Grove I2C Interface

This 4-pin specialty connector is provided for ready connection to Seeed Grove I2C I/O modules for ready demonstration of various interface capabilities.

Figure 15. Grove I2C Interface (J8)

Table 10. Grove I2C Connector (J8)

Grove I2C Connector		S128 Microcontroller	
Pin	**Description**	**Logical Pin(s)**	**Function Name(s)**
1	I2C serial clock	P4_0	P4_0/SCL0
2	I2C serial data	P4_1	P4_1/SDA0
3	+3.3V bus	-	+3.3 V
4	Circuit ground	GND or VSS	(Circuit Ground)

Note: Although P4_0 and P4_1 can be re-configured for non-I2C use, doing so also affects the accelerometer and the SPI and I2C connector interfaces. See section 5.4.8, SPI and I2C Interface.

5.4.8 SPI and I2C Interface

The SPI and I2C interface connector is an 8-pin 0.1” pitch single-column header with pin connections labelled on the PCB overlay.

Figure 16. SPI and I2C Interface (J7)

Table 11. SPI and I2C Connector (J7)

SPI and I2C Connector		S128 Microcontroller	
Pin	**Description**	**Logical Pin(s)**	**Function Name(s)**
1	+3V3 power bus	-	(config. may connect to VCC)
2	SPI communications chip select	P1_6	P1_6/SPI_SS3
3	SPI Master-In Slave-Out	P4_10	P4_10/SPI_MISO/UART_RX
4	SPI Master-Out Slave-In	P4_11	P4_11/SPI_MOSI/UART_TX
5	SPI serial clock	P1_2	P1_2/SPI_CK/UART_ON
6	I2C serial clock	P4_0	P4_0/SCL0
7	I2C serial data	P4_1	P4_1/SDA0
8	Circuit ground	VSS	(Circuit Ground)

Note: P4_0 and P4_1 can be re-configured for non-I²C use; however, doing so also affects the accelerometer and the Grove I2C interface. For the Grove I2C interface, see section 5.4.7, Grove I2C Interface.

5.4.9 PMOD Interface

The PMOD interface connector is a two-column six-row (12-pin) 0.1” pitch connector with selectable power between +5 V and +3.3 V (with jumper disconnect.) The interface is configurable to several alternate PMOD standard interface configurations.

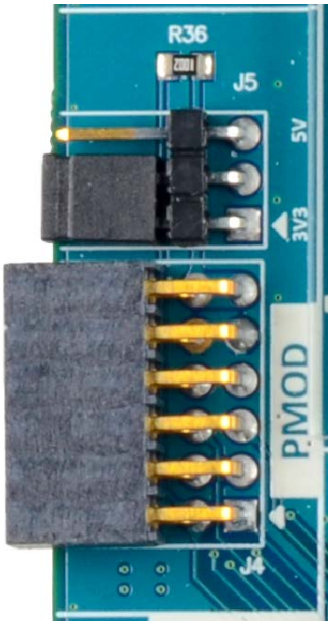


Figure 17. PMOD Interface

A PMOD Type 1 General Purpose Input Output (GPIO) interface is achieved by connecting the daughter-card to the 6 pins closest to the PCB. Daughter card pin 1 on the same end as J4 pin 1 (square pad on J4 soldered pins) will properly insert daughter pin 1 to J4-6.

Table 12. PMOD Connector (J4), Type 1 Configuration

PMOD Connector, Type 2A (GPIO)		**S128 Microcontroller**	
Pin	**Description**	**Logical Pin(s)**	**Function Name(s)**
1	(not connected)		
2	(not connected)		
3	(not connected)		
4	(not connected)		
5	(not connected)		
6	(not connected)		
7	PMOD input/output 1 (IO1)	P1_4	(discrete firmware controlled input/output)
8	PMOD input/output 2 (IO2)	P1_11	(discrete firmware controlled input/output)
9	PMOD input/output 3 (IO3)	P3_3	(discrete firmware controlled input/output)
10	PMOD input/output 4 (IO4)	P3_2	(discrete firmware controlled input/output)
11	GND	VSS	(Circuit Ground)
12	PMOD VCC, PMODA_PWR, configurable for +5V or +3.3V	-	(depends on configuration)

A PMOD Type 2A expanded Serial Peripheral Interface (SPI) is achieved by plugging the daughter card pin 1 into J4 pin 1. Firmware must properly configure all applicable pins.

Table 13. PMOD Connector (J4), Type 2A Configuration

PMOD Connector, Type 2A (expanded SPI)		S128 Microcontroller	
Pin	**Description**	**Logical Pin(s)**	**Function Name(s)**
1	PMOD slave select (SS) signal	P2_5	P2_5/CTS9 (to /SS9A)
2	PMOD master out slave in (MOSI) signal	P4_9	P4_9/TXD9 (to /MOSI9A)
3	PMOD master in slave out (MISO) signal	P4_8	P4_8/RXD9 (to /MISO9A)
4	PMOD serial clock (SCK) signal	P2_4	P2_4/SCK9A
5	GND	VSS	(Circuit Ground)
6	PMOD VCC, PMODA_PWR, configurable for +5V or +3.3V	-	(depends on configuration)
7	PMOD interrupt (INT) signal	P1_4	P1_4/IRQ1
8	PMOD RESET command	P1_11	(discrete firmware controlled output)
9	PMOD unspecified signal	P3_3	(discrete firmware controlled)
10	PMOD unspecified signal	P3_2	(discrete firmware controlled)
11	GND	VSS	(Circuit Ground)
12	PMOD VCC, PMODA_PWR, configurable for +5V or +3.3V	-	(depends on configuration)

A PMOD Type 4A expanded Universal Asynchronous Receiver Transmitter (UART) is achieved by plugging the daughter card pin 1 into J4 pin 1. Firmware must properly configure all applicable pins.

Always check the jumper position prior to inserting a PMOD. Applying 5 V to a 3.3V PMOD may damage the PMOD and potentially the DKS128: the power to this port is not fuse protected.

The PMOD MCU pins are not 5 V tolerant. Even though some PMODs require 5 V to be powered (using the 5 V position of the jumper), do not connect 5 V or higher signals to the MCU connected signals on this port directly. For example, if a full level RS232 port is desired, one might choose the Digilent PMOD RS232X, which plugs into J4 and translates these voltages.

Table 14. PMOD Connector (J4), Type 4A Configuration

PMOD Connector, Type 4A (expanded UART)		S128 Microcontroller	
Pin	**Description**	**Logical Pin(s)**	**Function Name(s)**
1	PMOD clear to send (CTS) signal	P2_5	P2_5/CTS9A
2	PMOD transmit data (TXD) signal	P4_9	P4_9/TXD9A
3	PMOD received data (RXD) signal	P4_8	P4_8/RXD9A
4	PMOD request to send (RTS) signal	P2_4	P2_4/SCK9A (to discrete firmware controlled output, RTS)
5	GND	VSS	(Circuit Ground)
6	PMOD VCC, PMODA_PWR, configurable for +5V or +3.3V	-	(depends on configuration)
7	PMOD interrupt (INT) signal	P1_4	P1_4/IRQ1
8	PMOD RESET command	P1_11	(discrete firmware controlled output)
9	PMOD unspecified signal	P3_4	(discrete firmware controlled)
10	PMOD unspecified signal	P4_3	(discrete firmware controlled)
11	GND	VSS	(Circuit Ground)
12	PMOD VCC, PMODA_PWR, configurable for +5V or +3.3V	-	(depends on configuration)

Note: The PMOD feature shares MCU signals with the Capacitive Touch feature. Only one of these features may be used at a time. See Table 2. Default DIP Switch Settings for PMOD and Capacitive Touch feature enable settings.

5.4.10 Human-Machine Interface

5.4.10.1 User Touch Buttons

Two capacitive touch buttons located in the upper left region of the main board are provided for user programmable control.

Figure 18. Capacitive Touch Buttons and Slider

Table 15. User Touch Buttons

User Touch Button		S128 Microcontroller	
Designator	**Description**	**Logical Pin(s)**	**Function Name(s)**
TS1	User capacitive touch button 1 (left most)	P1_4	P1_4/TS13
TS2	User capacitive touch button 2 (right most)	P4_9	P4_9/TS5

Note: The Capacitive Touch feature shares MCU signals with the PMOD feature. Only one of these features may be used at a time. When operating the DK-S128 capacitive touch components, set all SW4 switches to off position and PMOD switch on SW6 to off position. These settings adjust the parasitic capacitance on the touch components to the proper range for sensing. See Table 1. Default Jumper Settings for additional information. .

5.4.10.2 User Touch Slider

One capacitive 5-segment touch slider is provided for user programmable control. See Figure 18. Capacitive Touch Buttons and Slider.

Table 16. User Touch Slider

User Touch Slider		S128 Microcontroller	
Designator	**Description**	**Logical Pin(s)**	**Function Name(s)**
TSL1-1	User capacitive slider segment 5 (leftmost)	P4_8	P4_8/TS4
TSL1-2	User capacitive slider segment 4 (left-center)	P2_4	P2_4/TS0
TSL1-3	User capacitive slider segment 3 (center)	P3_3	P3_3/TS2
TSL1-4	User capacitive slider segment 2 (right-center)	P3_2	P3_2/TS8
TSL1-5	User capacitive slider segment 1 (rightmost)	P1_11	P1_11/TS12
-	Capacitive Sensor Ground Reference	P1_12	P1_12/TSCAP

Note: The Capacitive Touch feature shares MCU signals with the PMOD feature. Only one of these features may be used at a time. When operating the DK-S128 capacitive touch components, set all SW4 switches to off position and the PMOD switch on SW6 to off position. These settings adjust the parasitic capacitance on the touch components to the proper range for sensing. See Table 2. Default DIP Switch Settings for additional information.

5.4.10.3 User Push-Button Switches

Near the bottom right corner of the main board in the User I/O (Input/Output) region are two momentary push-button switches, SW1 and SW2, provided for programmable control.

Figure 19. User I/O

Table 17. User Push-Button Switches

User Push-Button Switches		S128 Microcontroller	
Designator	**Description**	**Logical Pin(s)**	**Function Name(s)**
SW1	Push-Button Switch 1 (right most), LOW when pressed	P2_6	P2_6/IRQ0
SW2	Push-Button Switch 2 (left most), LOW when pressed	P0_4	P0_4/IRQ3

Note: The interface for SW1 is shared with the interrupt for the accelerometer. The interface for SW2 is shared with the speaker DAC signal.

5.4.10.4 User LEDs

The User LEDs are located immediately above the user push-button switches. They are one red, one yellow, and one green LEDs, provided for user programmable control. See Figure 19. User I/O.

Table 18. User LEDs

User LED		S128 Microcontroller	
Designator	**Description**	**Logical Pin(s)**	**Function Name(s)**
LED1	LED 1 (leftmost, red), power from MCU	P4_3	P4_3/LED1
LED2	LED 2 (center, yellow), power from MCU	P2_1	P2_1/LED2
LED3	LED 3 (rightmost, green), power from MCU	P1_13	P1_13/LED3

Note: The interface for LED2 is shared with the Boot Mode Select. See Table 1. Default Jumper Settings, J17, for further information.

5.4.10.5 User Potentiometer

Immediately to the right of the user push-button switches is one 10 kΩ thumbwheel potentiometer with its voltage tap terminal fed to the MCU's ADC.

Figure 20. User Potentiometer

Table 19. User Potentiometer

User Potentiometer		S128 Microcontroller	
Designator	**Description**	**Logical Pin(s)**	**Function Name(s)**
POT1	10 kΩ thumbwheel potentiometer	P5_0	P5_0/AN013

5.4.10.6 Reset Push-Button Switch

A momentary switch located near the center of the lower edge of the main board, SW3, causes an S128 MCU reset when pressed.

Figure 21. Reset Push-button Switch

Table 20. Reset Switch

Reset Switch		S128 Microcontroller	
Designator	**Description**	**Logical Pin(s)**	**Function Name(s)**
SW3	Push-Button Switch, LOW when pressed	RESET#	RESET#

5.4.11 DALI Interface

A DALI Interface Connector (J13) is located near the lower right section of the board.

Digital Addressable Lighting Interface (DALI) is an international standard (IEC 62386) that defines a standard for electronic control gear and electronic control devices.

The S128 MCU contains a hardware DALI 2.0 peripheral. The DK-S128 includes additional hardware to interface with the DALI peripheral, and may be used as either a DALI master or a DALI slave. Starting with DK-S128 version 2.0, the additional hardware on the kit is designed to meet the requirements of version 2.0 of the DALI specification. Earlier versions of DK-S128 were designed to meet the requirements of version 1.0 of the DALI specification.

The DALI specification defines signal voltage levels that are much higher than the rest of the DK-S128. Circuitry on the DK-S128 provides the electrical interface needed to interface the DALI signal levels with the low voltage signal levels of the S128 MCU. Details of the electrical circuits can be found on page 6 of the electrical schematic. See section 8, Certifications.

Signals on the DALI bus are higher voltage than other signals on the DK-S128 and may pose a risk of electric shock. Use caution when working with these signals. Follow all DALI guidelines to ensure user safety.

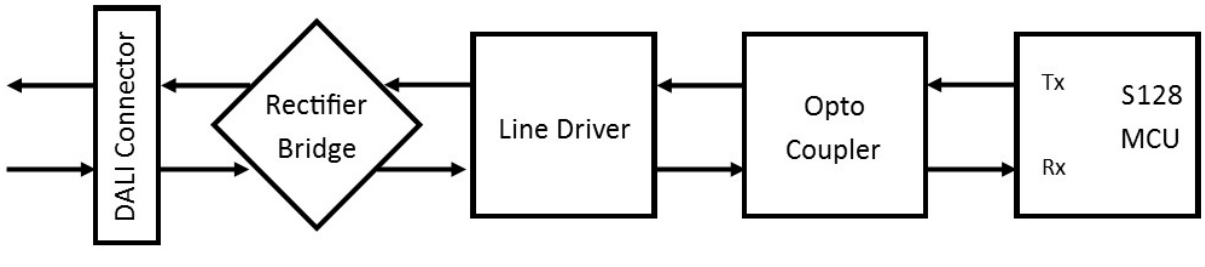


Figure 22. DALI Interface Circuit Block Diagram

Table 21. DALI Bus Connector Signals

DALI Bus Connector		
Pin	**Signal**	**Description**
1	DA-1	Two terminal points are electrically connected for each signal to allow easy daisy chaining of the DALI systems. The DALI specification indicates that the bus lines are interchangeable.
2		
3	DA-2	
4		

Table 22. DALI Bus MCU Signals

DALI TX/RX	S128 Microcontroller	
Description	**Logical Pin(s)**	**Function Name(s)**
DALI - TX	P1_1	P1_1/DALI_TX
DALI - RX	P1_0	P1_0/DALI_RX

5.4.12 PWM RGB LED

An RGB LED is located right above the DALI circuitry. With DALI being used for lighting protocol, the RGB LED allows visual feedback typically required with DALI system development.

Note that each element of the RGB LED is connected to a PWM-capable GPIO of the S128, which can provide dimming capabilities. This allows for simulations of real-world lighting controls.

Figure 23. RGB LED

Table 23. RGB LED (LED5)

User LED		S128 Microcontroller	
Designator	**Description**	**Logical Pin(s)**	**Function Name(s)**
LED5 - R	LED5 – RED Element	P1_7	P1_7/LED_R
LED5 - G	LED5 – GREEN Element	P3_1	P3_1/LED_G
LED5 - B	LED5 – BLUE Element	P3_4	P3_4/LED_B

5.4.13 OP AMP

The S128 provides four internal Operational Amplifier (OPAMP) blocks. These blocks and pins are brought out to the board as open-ended, which means they are not connected to any peripherals by default. The connection to MCU OPAMP is located near the lower left section of the board.

Each connection to the OPAMP block is grouped into three connections: positive input, negative input, and the output pin.

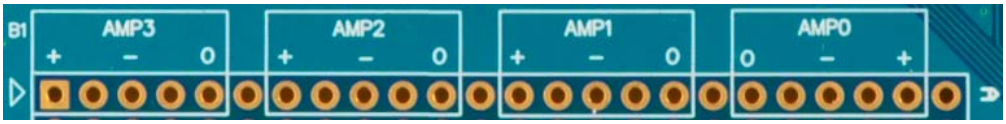


Figure 24. OPAMP Pin Access

Table 24. OPAMP MCU Pin Mapping

OPAMP Block		S128 Microcontroller	
Designator	**Description**	**Logical Pin(s)**	**Function Name(s)**
AMP0 +	AMP0 +, positive input	P0_0	P0_0/OP0+
AMP0 -	AMP0 -, negative input	P0_1	P0_1/ OP0-
AMP0 O	AMP0 O, output	P0_2	P0_2/ OP0O
AMP1 +	AMP1 +, positive input	P0_13	P0_13/ OP1+
AMP1 -	AMP1 -, negative input	P0_12	P0_12/ OP1-
AMP1 O	AMP1 O, output	P0_10	P0_10/ OP1O
AMP2 +	AMP2 +, positive input	P0_15	P0_15/ OP2+
AMP2 -	AMP2 -, negative input	P0_14	P0_14/ OP2-
AMP2 O	AMP2 O, output	P0_11	P0_11/ OP2O
AMP3 +	AMP3 +, positive input	P5_1	P5_1/ OP3+
AMP3 -	AMP3 -, negative input	P5_2	P5_2/ OP3-
AMP3 O	AMP3 O, output	P0_3	P0_3/ OP3O

5.4.14 Breadboard Area

The DK-S128 board has been provided with a breadboard area for quick circuit prototyping development. While normally intended for OPAMP circuit development, this breadboard area can be used for any other circuit prototyping. 3.3 V power supply and ground connection points are provided for easy access in the bottom area of the breadboard.

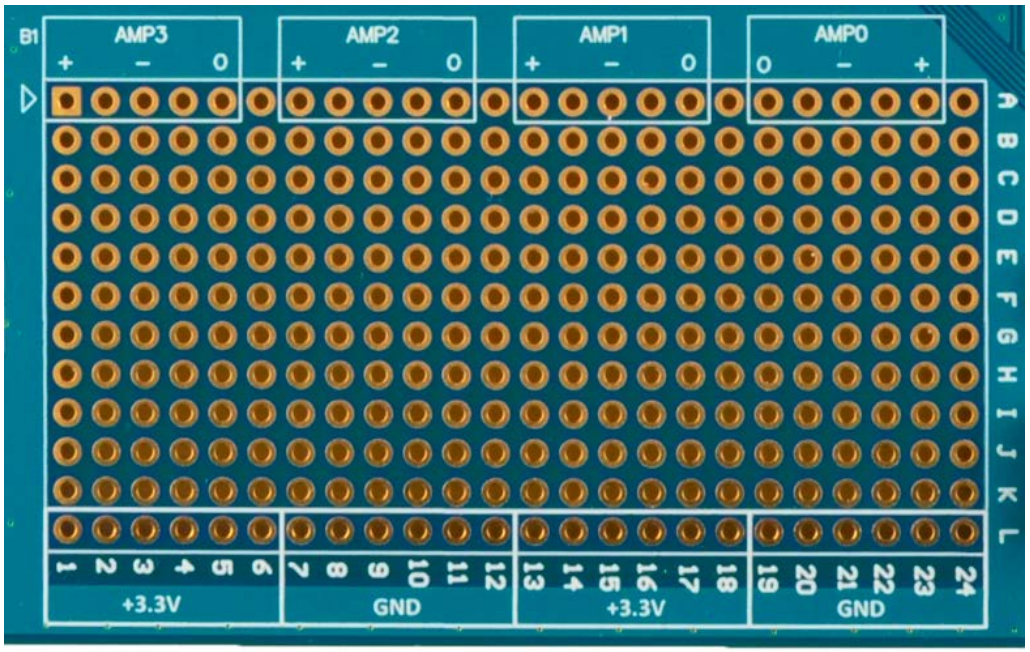


Figure 25. Breadboard Area

5.5 Breakout Pin Headers

The “shield”-style header connection consists of four 0.1” pitch 20-pin and 8-pin headers with their top-most and bottom-most pins aligned horizontally and parallel to each other with 57.4 mm separation center-to-center. These connectors are located on either side of the S128 MCU. 5 V and 3.3 V power buses, as well as ground are accessible on the pins of these connectors, as are many of the S128 MCU port pins.

The S128 MCU port pins that are load-sensitive (such as pins used for capacitive sensing), or interface high-speed data and require impedance control (such as USB) are not made accessible here.

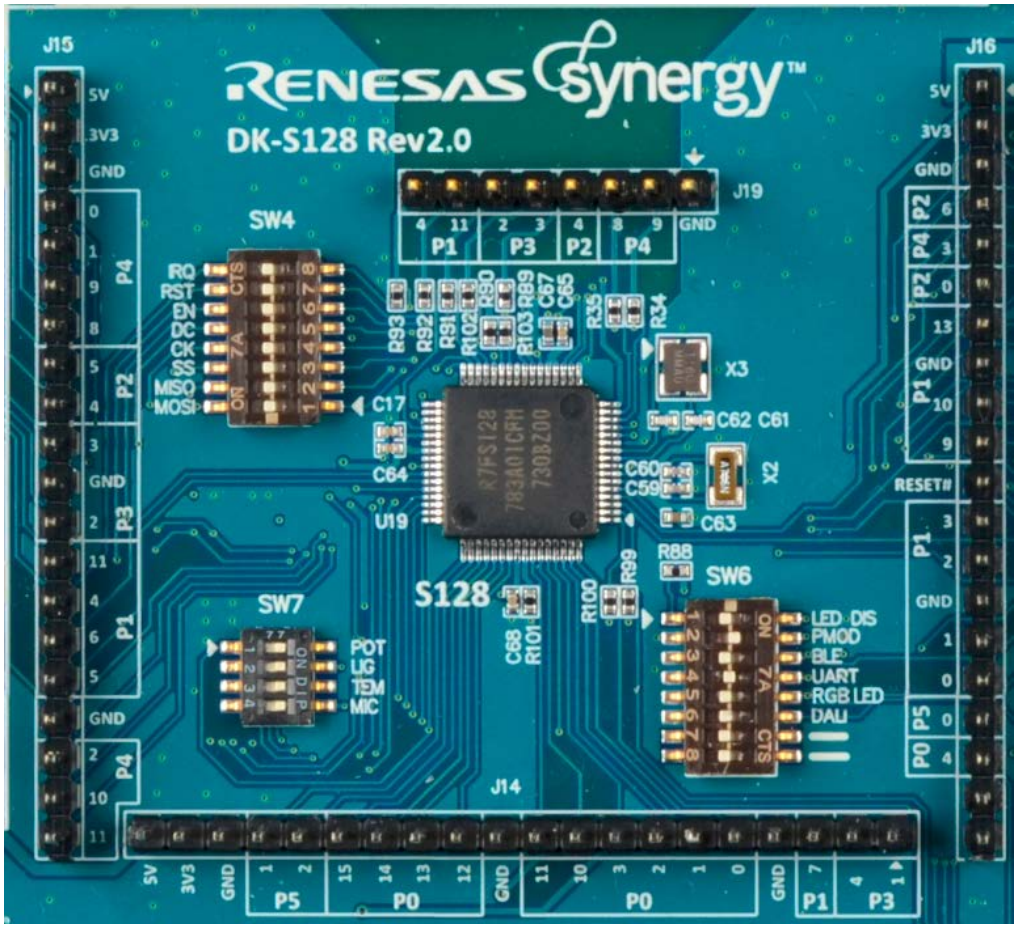


Figure 26. MCU Breakout Pin Headers

Table 25. Breakout Pin Header J14

Shield-Style Header Connectors		S128 Microcontroller	
Pin	**Description**	**Logical Pin(s)**	**Function Name(s)**
J14-1	PWM 3 Interface	P3_1	P3_1/PWM3
J14-2	PWM 2 Interface	P3_4	P3_1/PWM2
J14-3	PWM 1 Interface	P1_7	P1_7/PWM1
J14-4	Ground	-	GND
J14-5	OP AMP 0, Positive Input	P0_0	P0_0/OP0+
J14-6	OP AMP 0, Negative Input	P0_1	P0_1/OP0-
J14-7	OP AMP 0, Output	P0_2	P0_2/OP0O
J14-8	OP AMP 3, Output	P0_3	P0_3/OP3O
J14-9	OP AMP 1, Output	P0_10	P0_10/OP1O
J14-10	OP AMP 2, Output	P0_11	P0_11/OP2O
J14-11	Ground	-	GND
J14-12	OP AMP 1, Negative Input	P0_12	P0_12/OP1-
J14-13	OP AMP 1, Positive Input	P0_13	P0_13/OP1+
J14-14	OP AMP 2, Negative Input	P0_14	P0_14/OP2-
J14-15	OP AMP 2, Positive Input	P0_15	P0_15/OP2+
J14-16	OP AMP 3, Negative Input	P5_2	P5_2/OP3-
J14-17	OP AMP 3, Positive Input	P5_1	P5_1/OP3+
J14-18	Ground	-	GND
J14-19	connected to +3V3 bus	VCC	MCU power
J14-20	connected to +5V bus	-	(Not connected)

Table 26. Breakout Pin Header J15

Shield-Style Header Connectors		S128 Microcontroller	
Pin	**Description**	**Logical Pin(s)**	**Function Name(s)**
J15-1	connected to +5V bus	-	(Not connected)
J15-2	connected to +3V3 bus	VCC	MCU power
J15-3	Ground	-	GND
J15-4	I2C communication clock	P4_0	P4_0/SCL0
J15-5	I2C communication data	P4_1	P4_1/SDA0
J15-6	PMOD interface or capacitive touch sensing	-	PMOD_MOSI
J15-7	PMOD interface or capacitive touch sensing	-	PMOD_MISO
J15-8	PMOD interface	-	PMOD_SS_L
J15-9	PMOD interface or capacitive touch sensing	-	PMOD_CK
J15-10	PMOD interface or capacitive touch sensing	-	PMOD_DC
J15-11	Ground	-	GND
J15-12	Switch setting	-	P3_2/PMOD_EN/TS8
J15-13	PMOD interface or capacitive touch sensing		PMOD_RST_L
J15-14	PMOD interface or capacitive touch sensing		PMOD_IRQ_L
J15-15	SPI interface chip select	P1_6	P1_6/SPI_SS3
J15-16	SPI interface chip select	P1_5	P1_5/SPI_SS2
J15-17	Ground	-	GND
J15-18	BLE IRQ on IRQ4	P4_2	P4_2/IRQ4-BLE_IRQ_L
J15-19	SPI and UART interface	P4_10	P4_10/SPI_MISO/UART_RX
J15-20	SPI and UART interface	P4_11	P4_11/SPI_MOSI/UART_TX

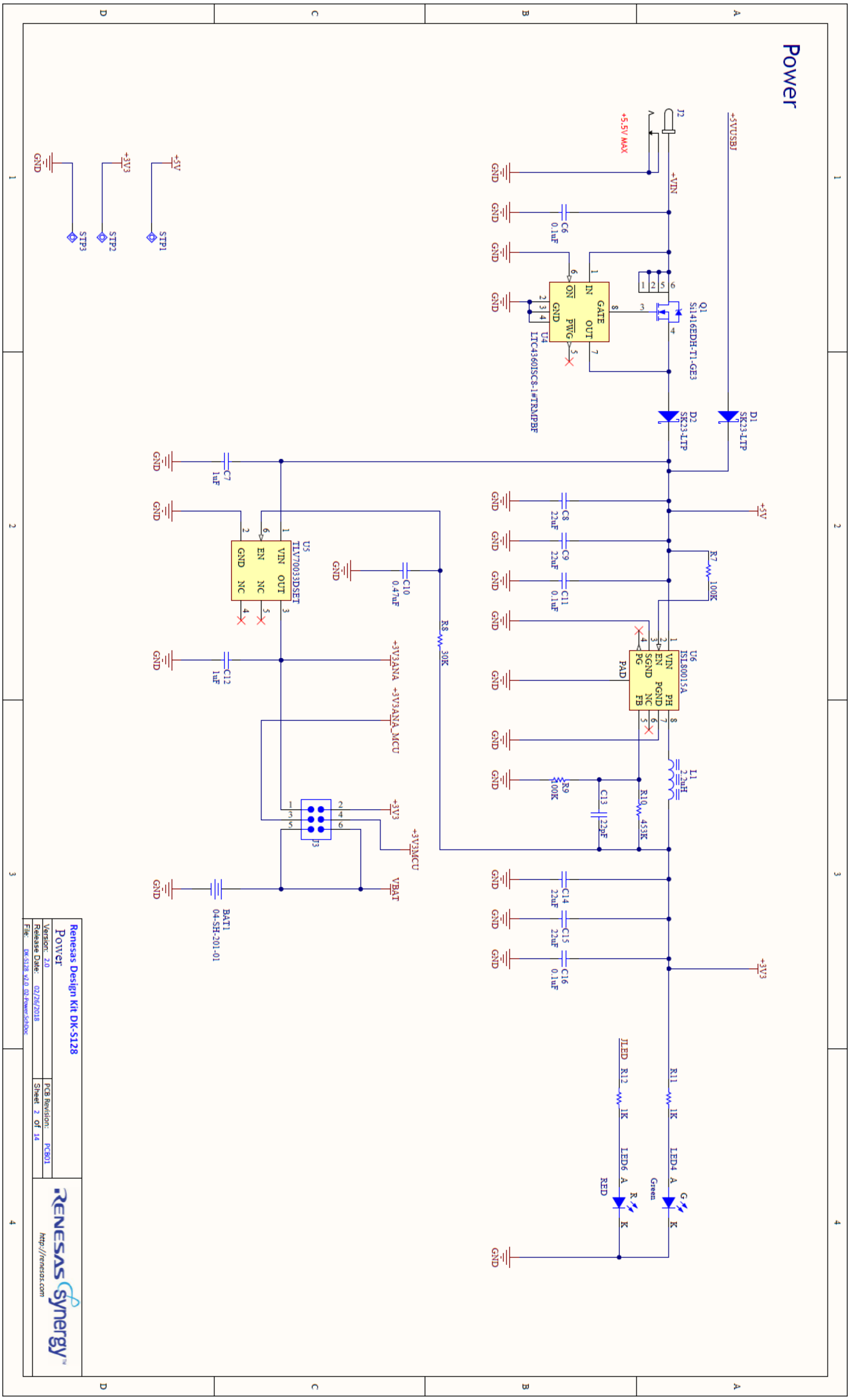
Table 27. Breakout Pin Header J16

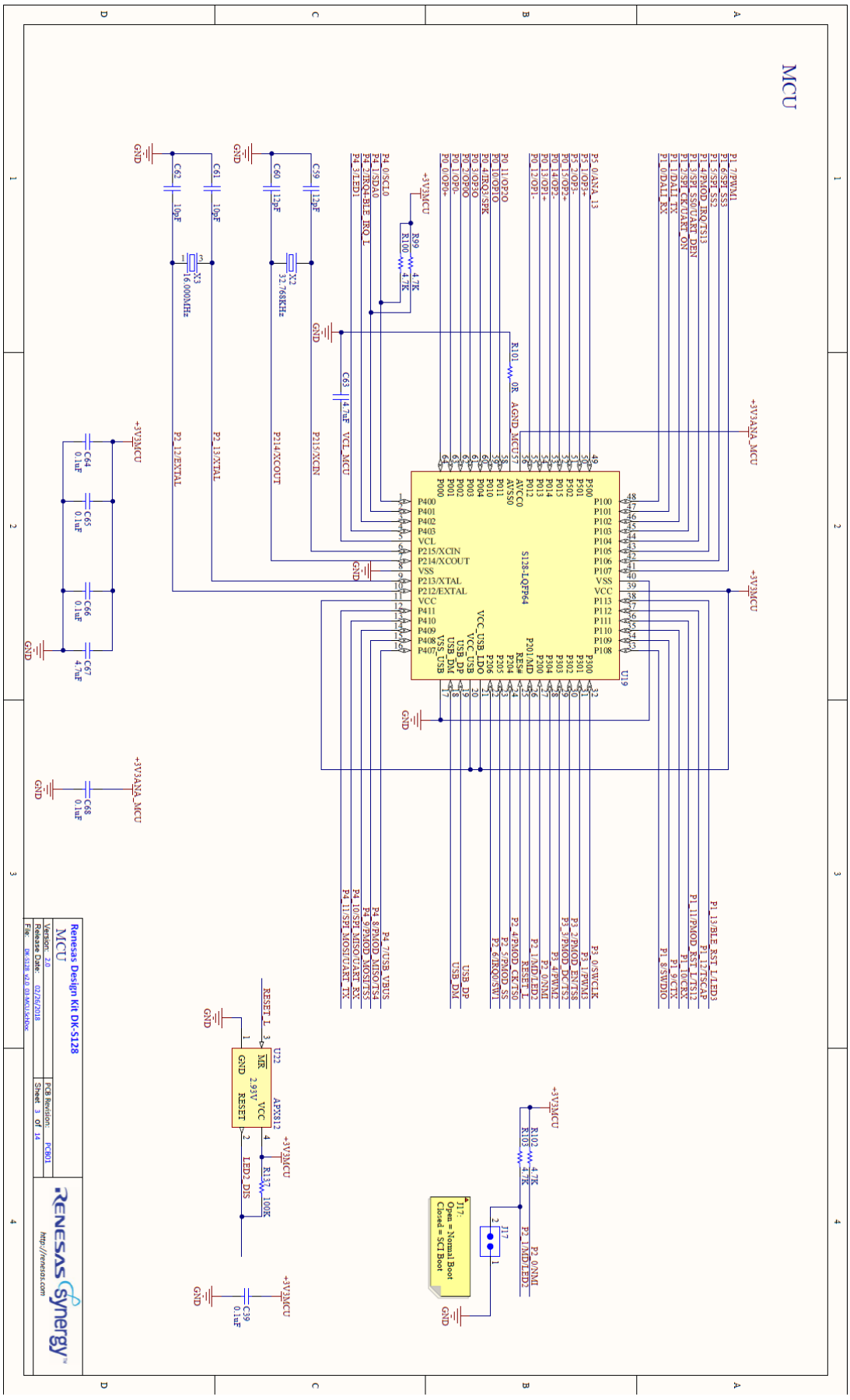
Shield-Style Header Connectors		S128 Microcontroller	
Pin	**Description**	**Logical Pin(s)**	**Function Name(s)**
J16-1	connected to +5V bus	-	(Not connected)
J16-2	connected to +3V3 bus	VCC	MCU power
J16-3	Ground	-	GND
J16-4	IRQ0	P2_6	P2_6/IRQ0/SW1
J16-5	GPIO for LED1	P4_3	P4_3/LED1
J16-6	None-maskable interrupt	P2_0	P2_0/NMI
J16-7	BLE reset or GPIO for LED3	P1_13	P1_13/BLE_RST_L/LED3
J16-8	Ground	-	GND
J16-9	CAN receive	P1_10	P1_10/CRX
J16-10	CAN transmit	P1_9	P1_9/CTX
J16-11	MCU Reset	RES#	RESET_L
J16-12	SPI chip select or UART interface	P1_3	P1_3/SPI_SS0/UART_DEN
J16-13	SPI clock or UART interface	P1_2	P1_2/SPI_CK/UART_ON
J16-14	Ground	-	GND
J16-15	DALI interface data transmit	P1_1	P1_1/DALI_TX
J16-16	DALI interface data receive	P1_0	P1_0/DALI_RX
J16-17	Potentiometer	P5_0	P5_0/ANA_13
J16-18	IRQ3	P0_4	P0_4/IRQ3/SPK
J16-19	Not connected	-	Not connected
J16-20	Not connected	-	Not connected

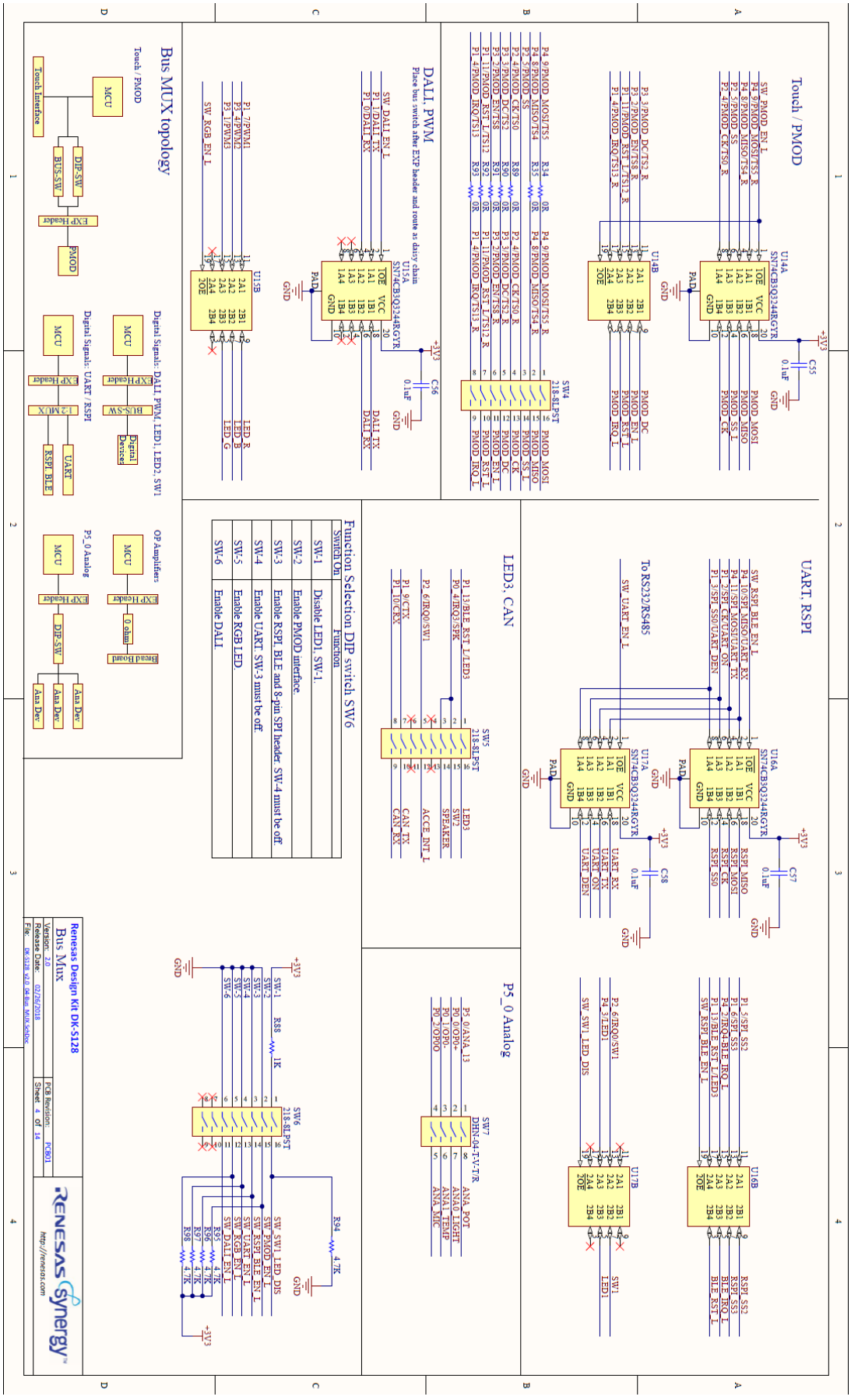
Table 28. Breakout Pin Header J19

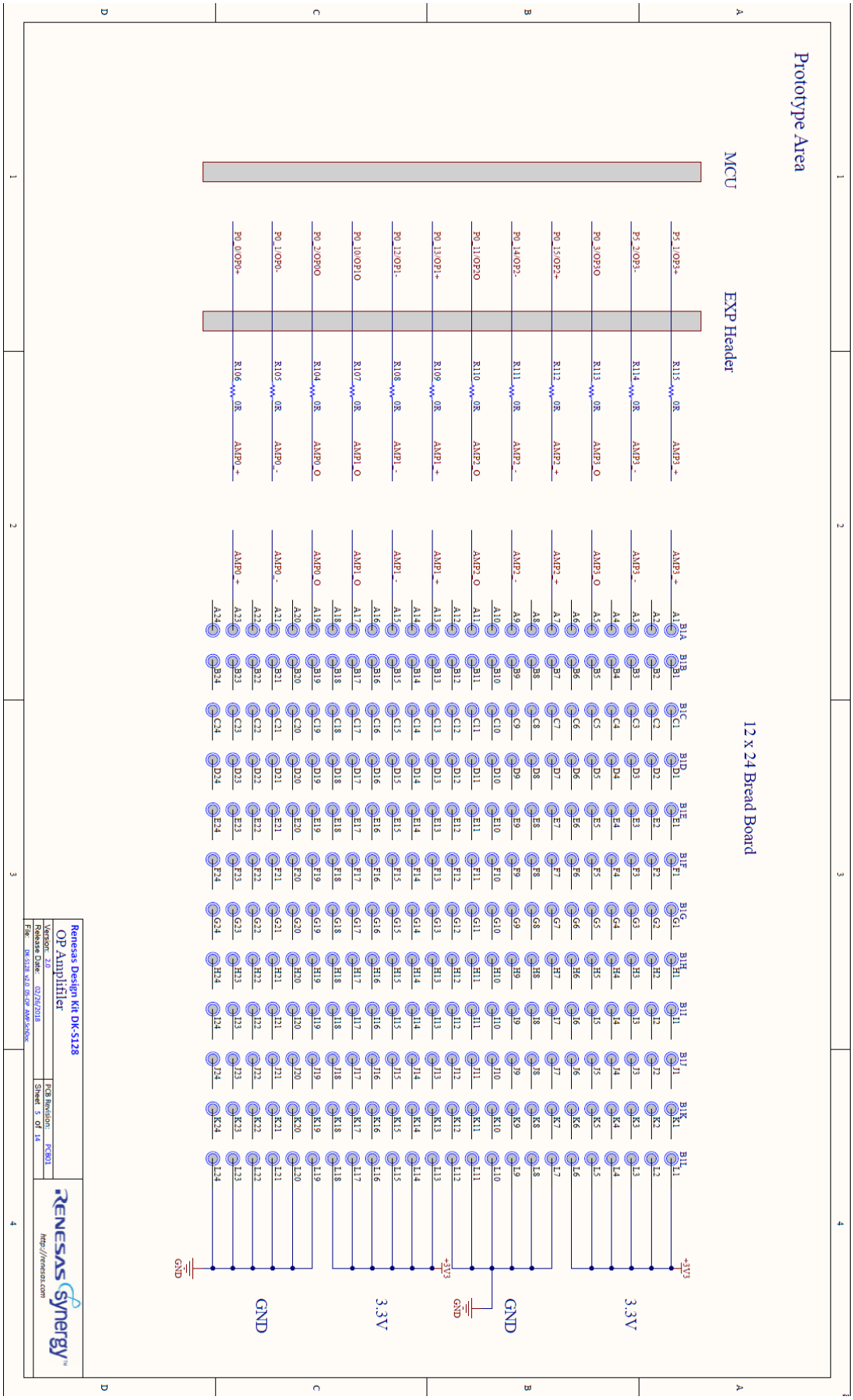
Shield-Style Header Connectors		S128 Microcontroller	
Pin	**Description**	**Logical Pin(s)**	**Function Name(s)**
J19-1	Ground	-	GND
J19-2	Cap Touch TS5	P4_9	P4_9/PMOD_MOSI/TS5
J19-3	Cap Touch TS4	P4_8	P4_8/ PMOD_MISO/TS4
J19-4	Cap Touch TS0	P2_4	P2_4/ PMOD_CK/TS0
J19-5	Cap Touch TS2	P3_3	P3_3/ PMOD_DC/TS2
J19-6	Cap Touch TS8	P3_2	P3_2/ PMOD_EN/TS8
J19-7	Cap Touch TS12	P1_11	P1_11/ PMOD_RST_L/TS12
J19-8	Cap Touch TS13	P1_4	P1_4/ PMOD_IRQ/TS13

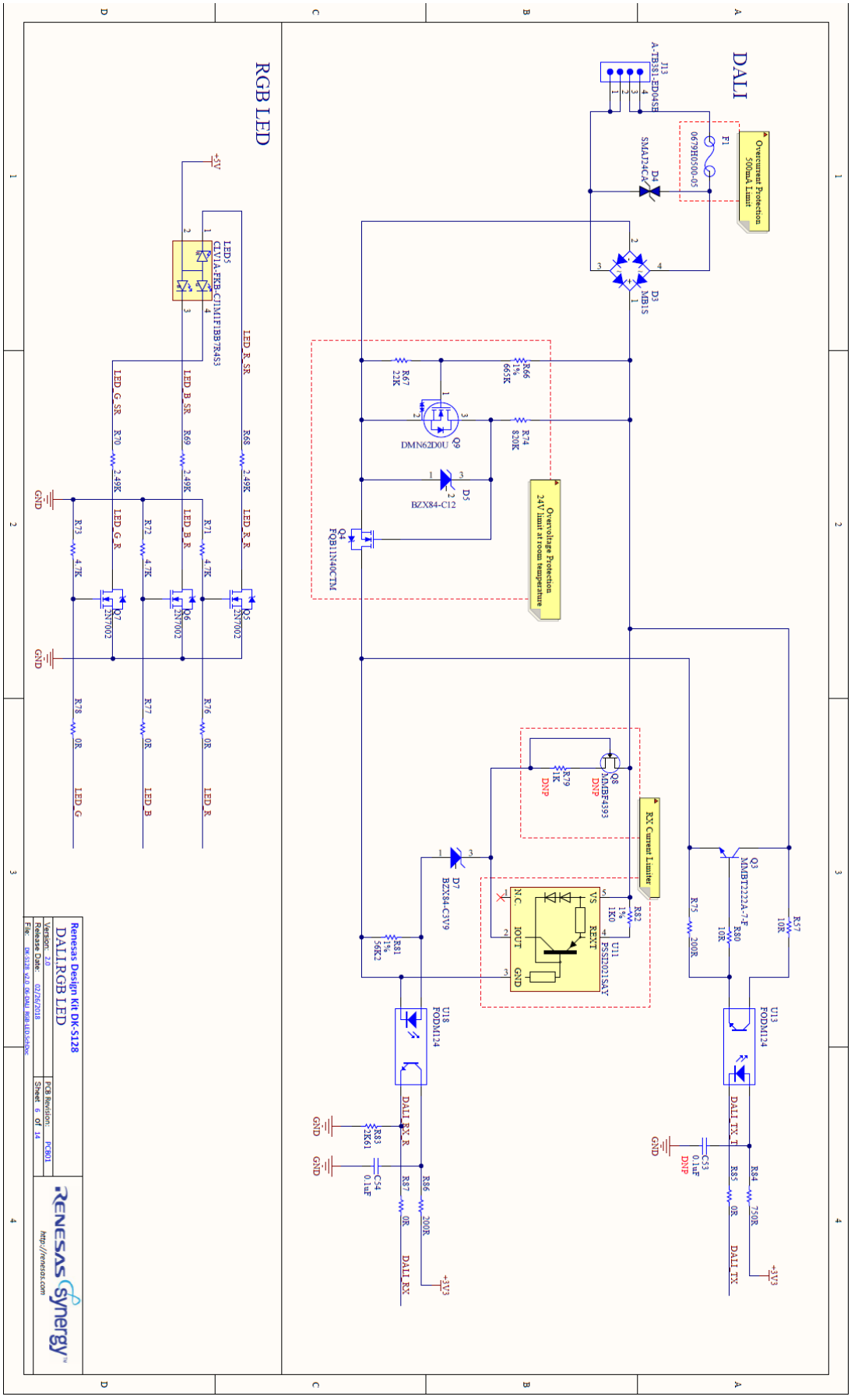
6. Electrical Schematics

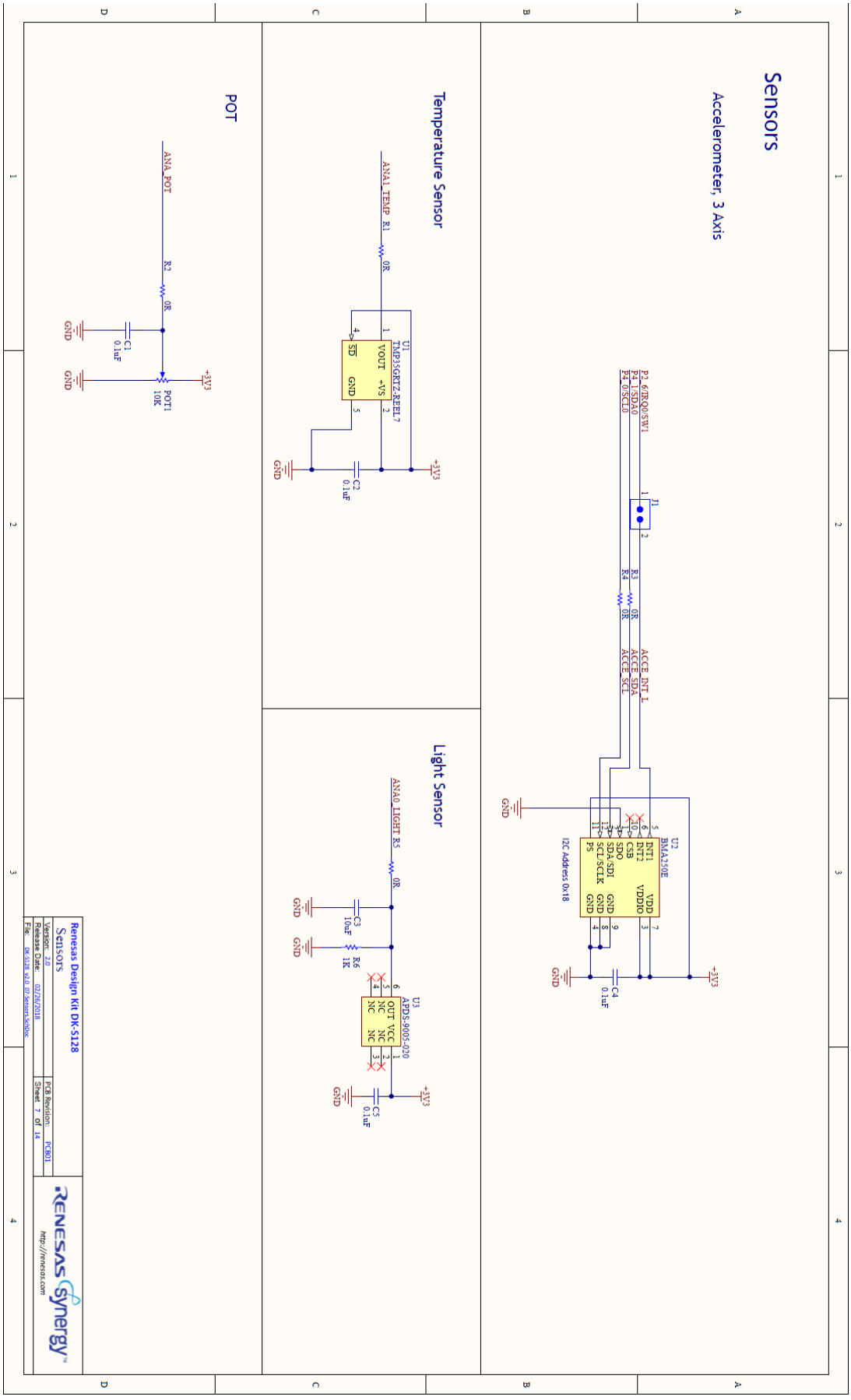

Power
+5VUSBJ
J2
+5.5V MAX
+VIN
C6
0.1uF
Q1
Si1416EDH-T1-GE3
U4
LTC4360ISC8-1#TRMPBF
IN
ON
GND
GATE
OUT
PWG
D1
SK23-LTP
D2
SK23-LTP
C7
1uF
C8
22uF
C9
22uF
C10
0.47uF
C11
0.1uF
+5V
R7
100K
R8
30K
U5
TLV70033DSET
VIN
EN
GND
OUT
NC
U6
ISL80015A
VIN
EN
SGND
PG
PAD
PH
PGND
NC
FB
L1
2.2uH
R9
100K
R10
453K
C13
22pF
C12
1uF
+3V3ANA
+3V3ANA_MCU
+3V3
+3V3MCU
VBAT
J3
BAT1
04-SH-201-01
C14
22uF
C15
22uF
C16
0.1uF
R11
1K
R12
1K
JLED
LED4
Green
LED6
RED
GND
STP1
STP2
STP3
Renesas Design Kit DK-S128
Power
Version: 2.0
Release Date: 02/26/2018
PCB Revision: PCB01
Sheet 2 of 14
File: DK-S128_v2.0_02-Power.SchDoc
RENESAS Synergy
http://renesas.com


MCU
S128-LQFP64
Renesas Design Kit DK-S128
MCU
RENESAS Synergy
http://renesas.com


Touch / PMOD
DALI, PWM
Bus MUX topology
UART, RSPI
LED3, CAN
P5_0 Analog
Function Selection DIP switch SW6
Switch On
Function
SW-1 Disable LED1, SW-1.
SW-2 Enable PMOD interface.
SW-3 Enable RSPI, BLE and 8-pin SPI header. SW-4 must be off
SW-4 Enable UART. SW-3 must be off
SW-5 Enable RGB LED
SW-6 Enable DALI
Renesas Design Kit DK-S128
Bus Mux
RENESAS Synergy
http://renesas.com


Prototype Area
MCU
EXP Header
12 x 24 Bread Board
3.3V
GND
3.3V
GND
Renesas Design Kit DK-S128
OP Amplifier
Version: 2.0
Release Date: 02/26/2018
File: dk-s128_ek2_op-amp.SchDoc
PCB Revision: PC601
Sheet 5 of 14
RENESAS Synergy
http://renesas.com


DALI
RGB LED
Overcurrent Protection
500mA Limit
Overvoltage Protection
24V limit at room temperature
RX Current Limiter
Renesas Design Kit DK-S128
DALI RGB LED


Sensors
Accelerometer, 3 Axis
Temperature Sensor
Light Sensor
POT
Renesas Design Kit DK-S128
Sensors
RENESAS Synergy
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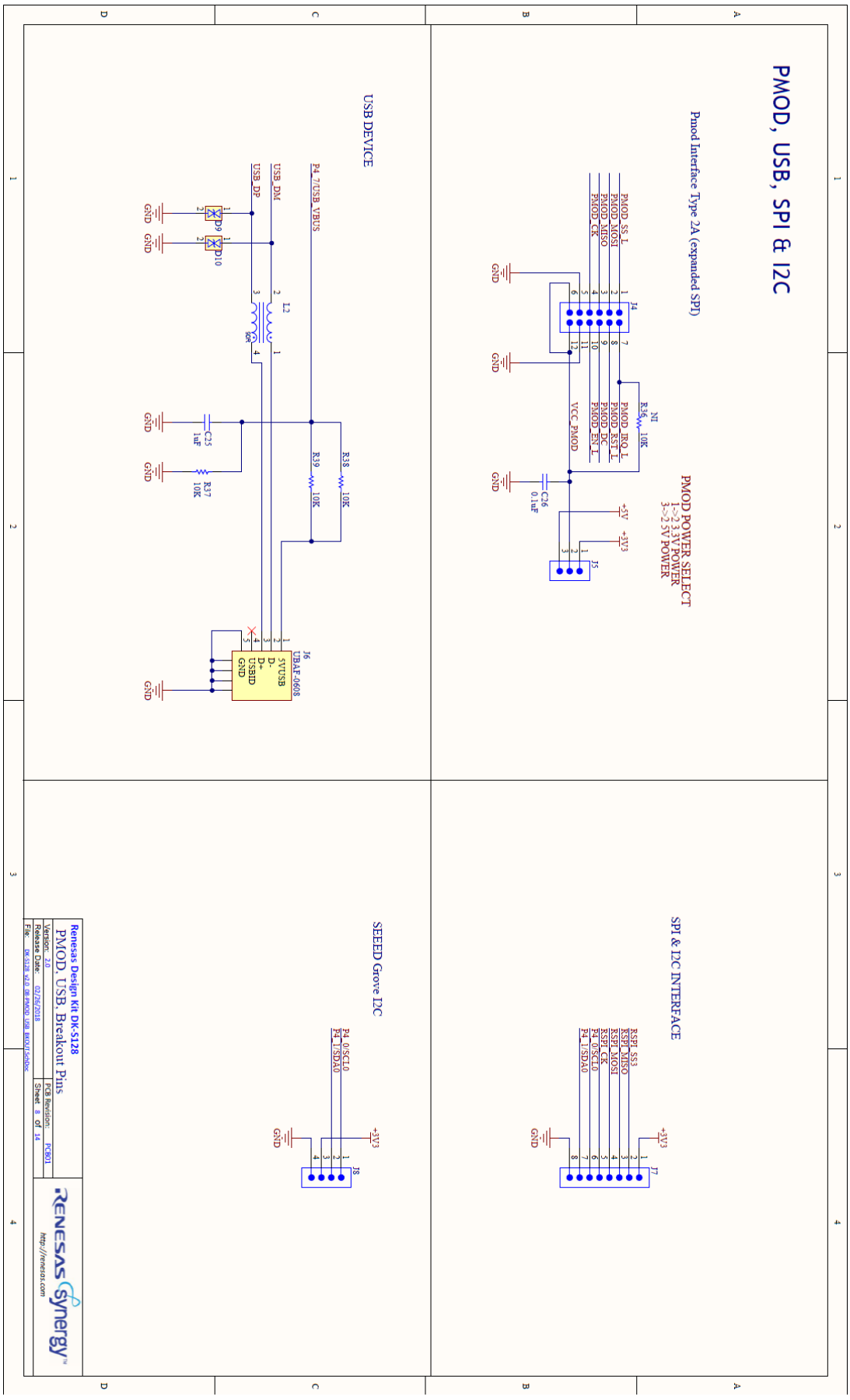
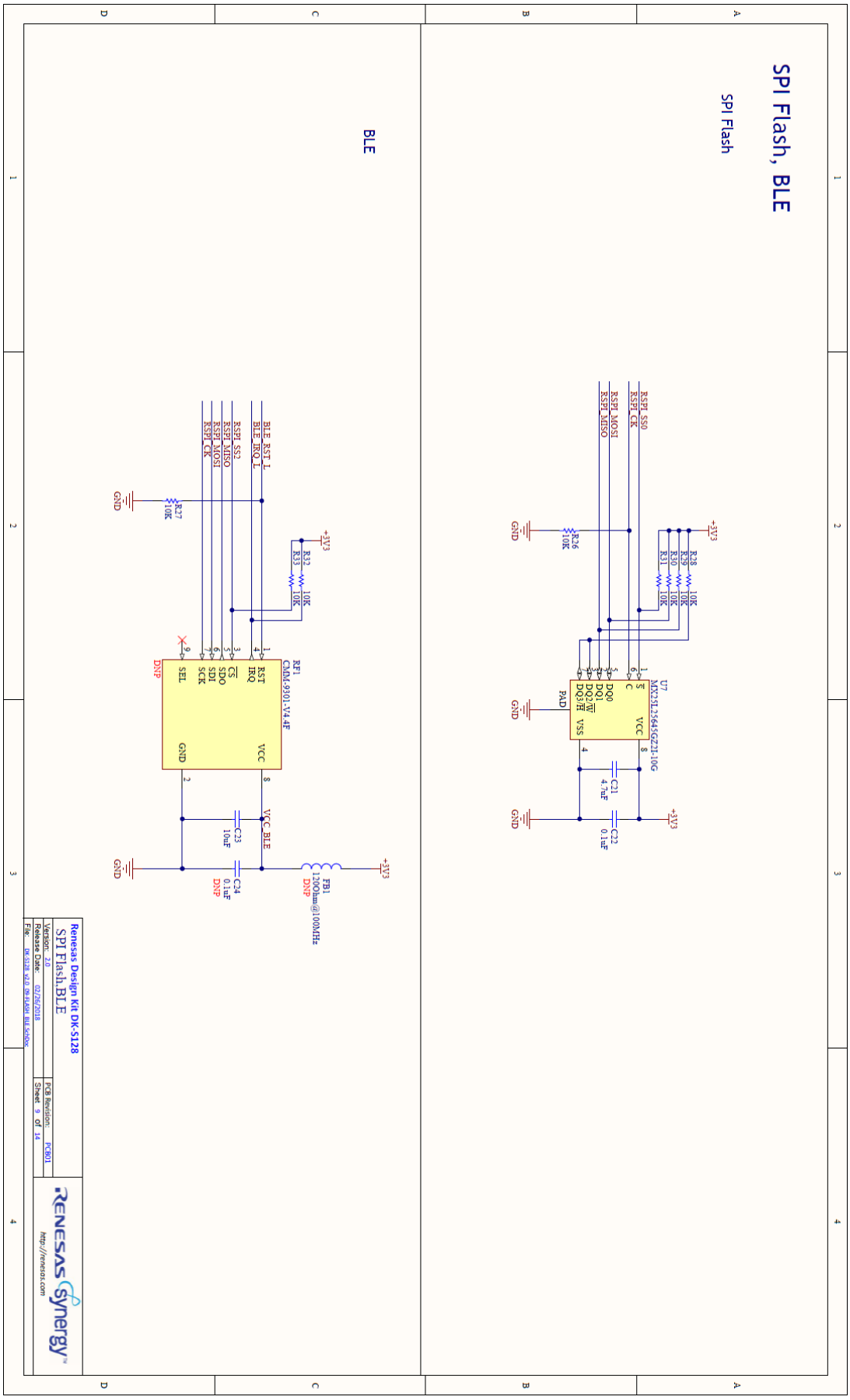
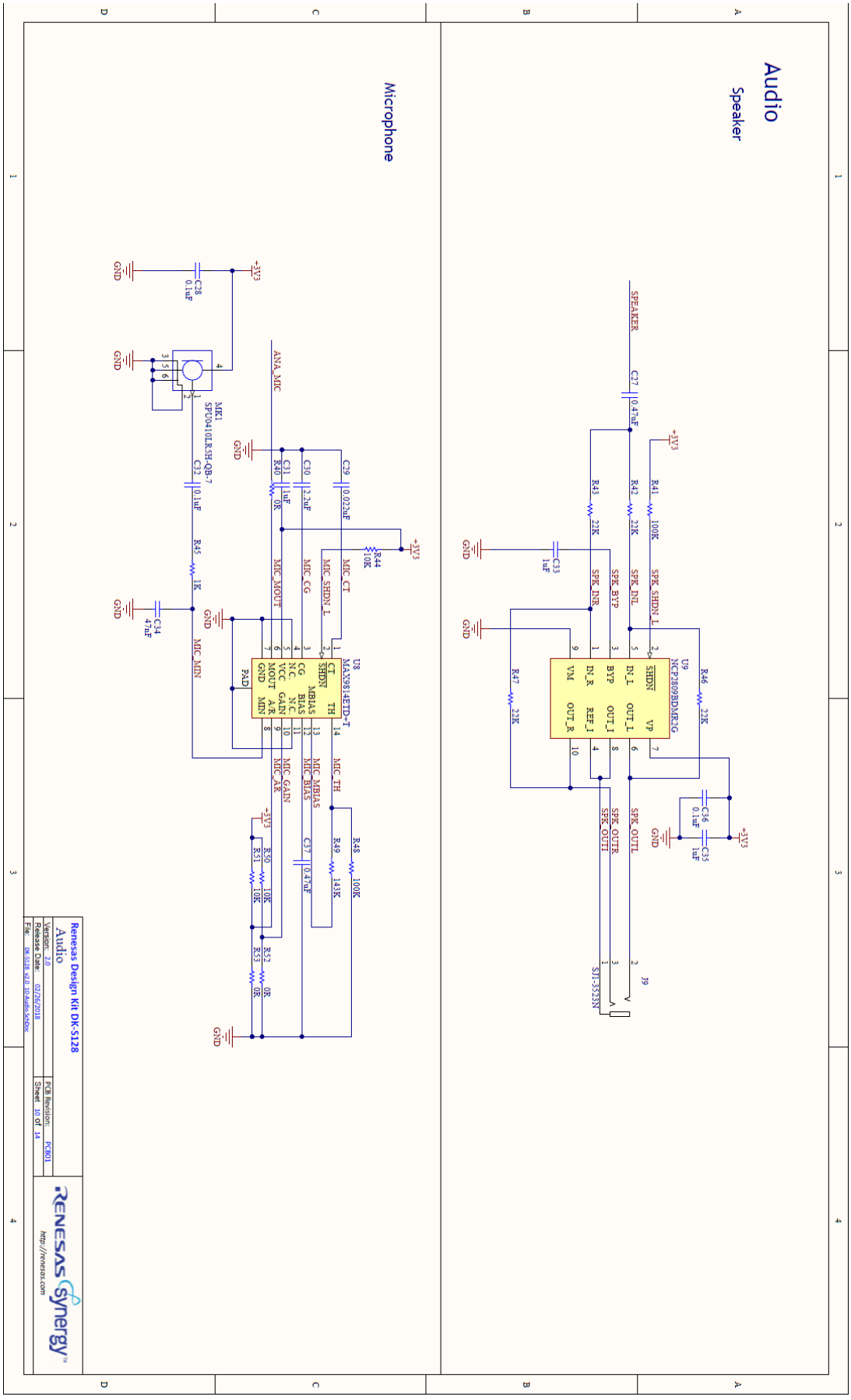
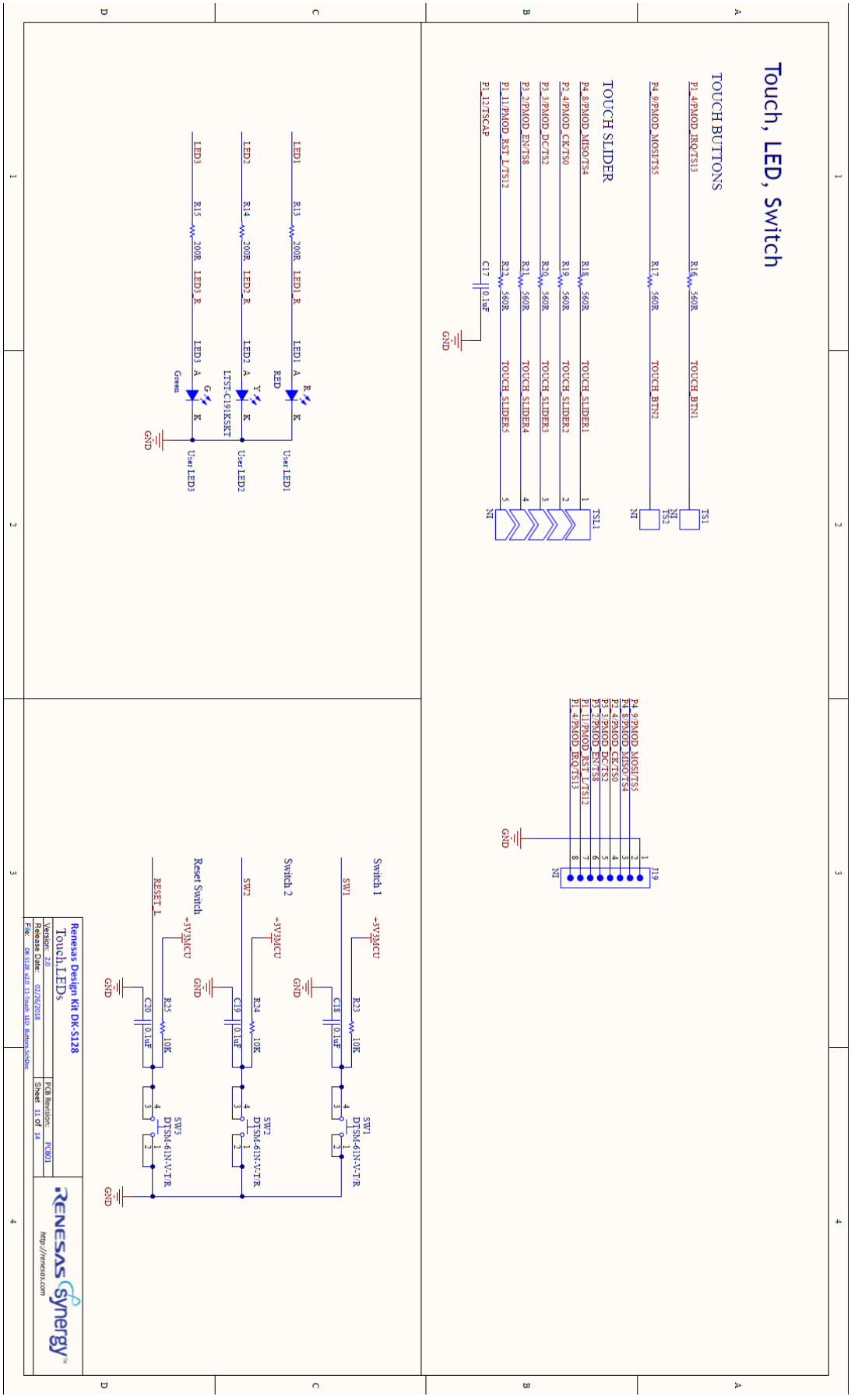
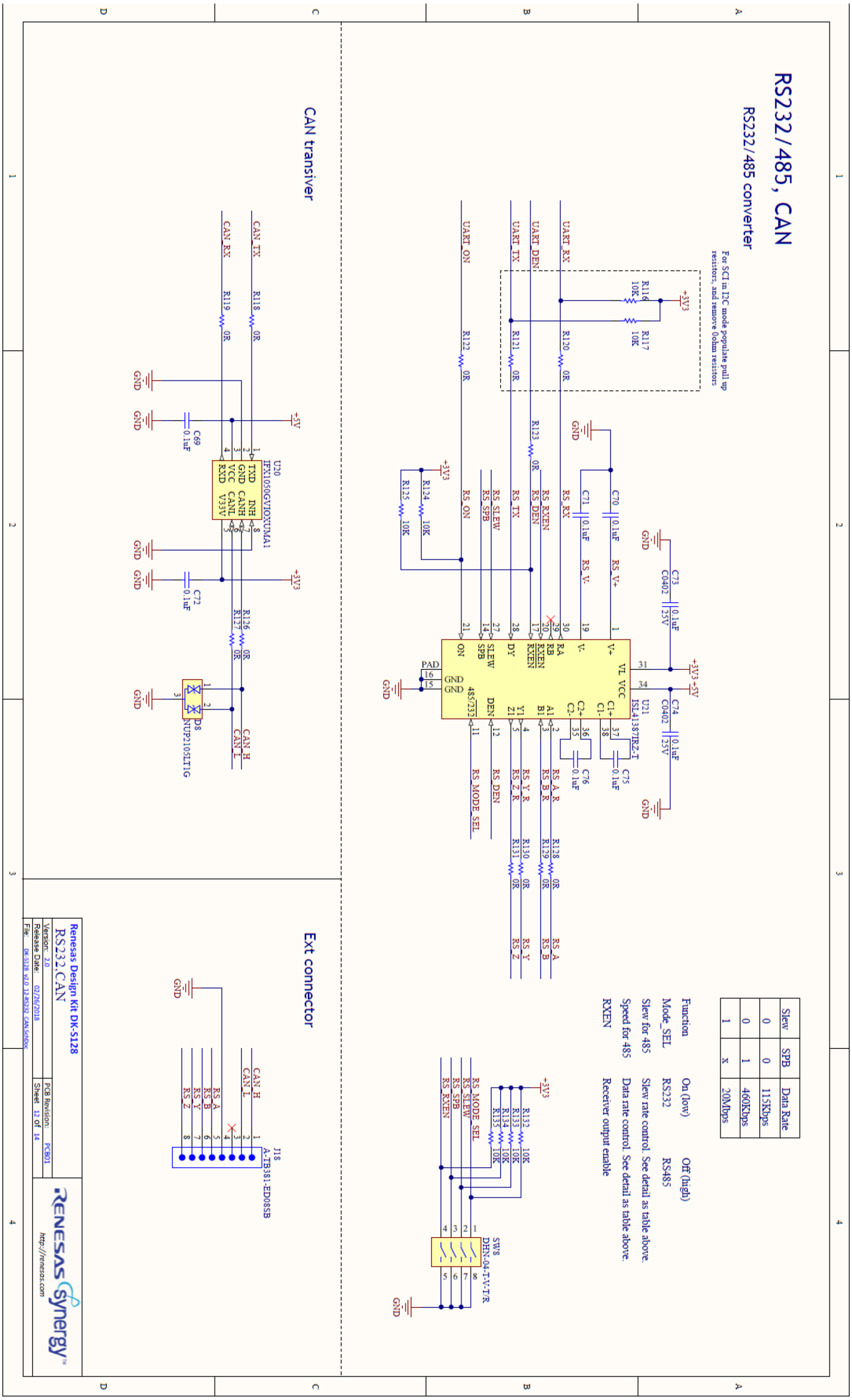
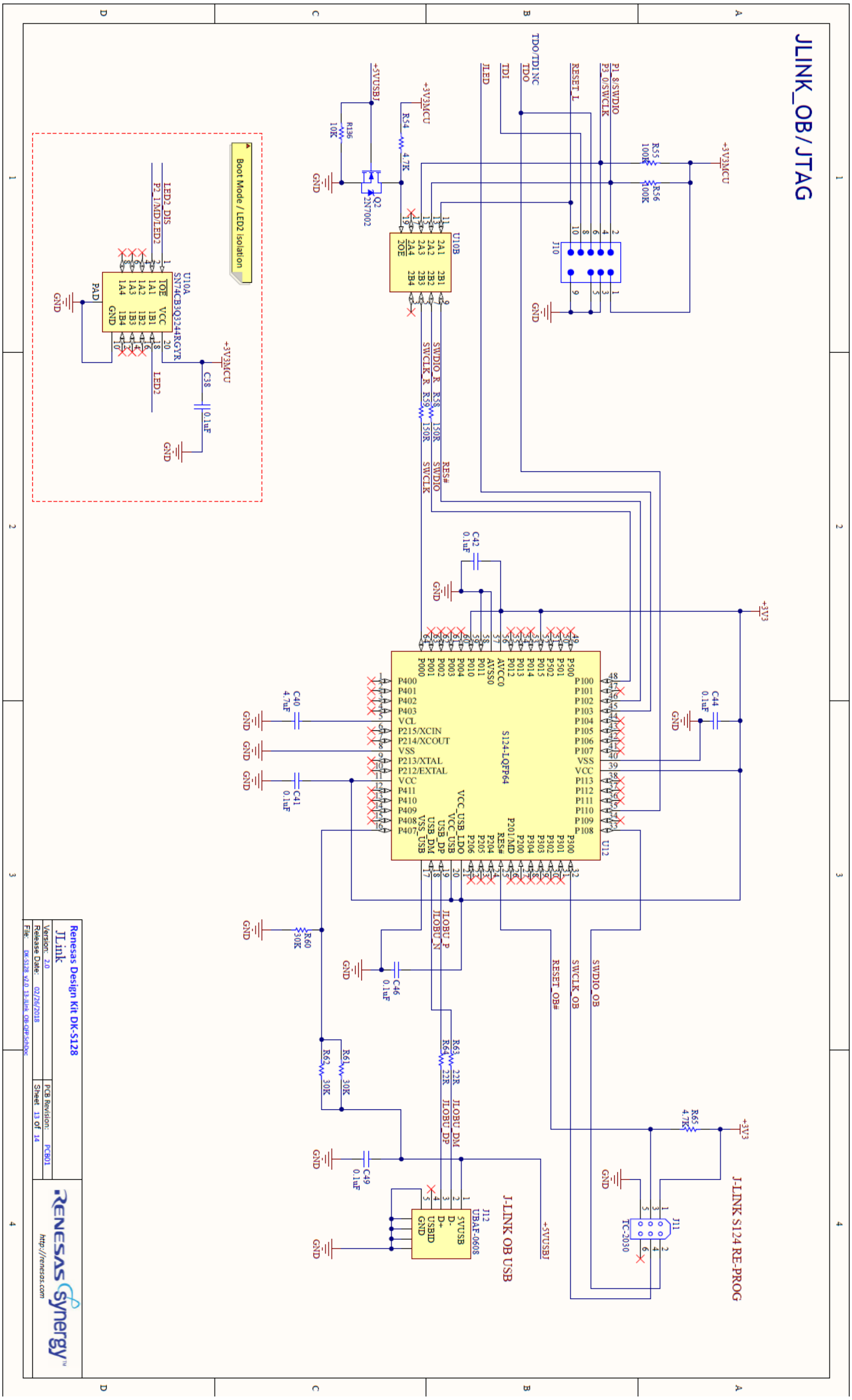

PMOD, USB, SPI & I2C
Pmod Interface Type 2A (expanded SPI)
PMOD POWER SELECT
1->2 3.3V POWER
3->2 5V POWER
USB DEVICE
SEEED Grove I2C
SPI & I2C INTERFACE
Renesas Design Kit DK-S128
PMOD, USB, Breakout Pins
Version: 2.0
Release Date: 02/26/2018
PCB Revision: PC0601
Sheet 8 of 14
File: dk-s128_rd2_de-pmod_usb_breakout.sch
RENESAS Synergy
http://renesas.com

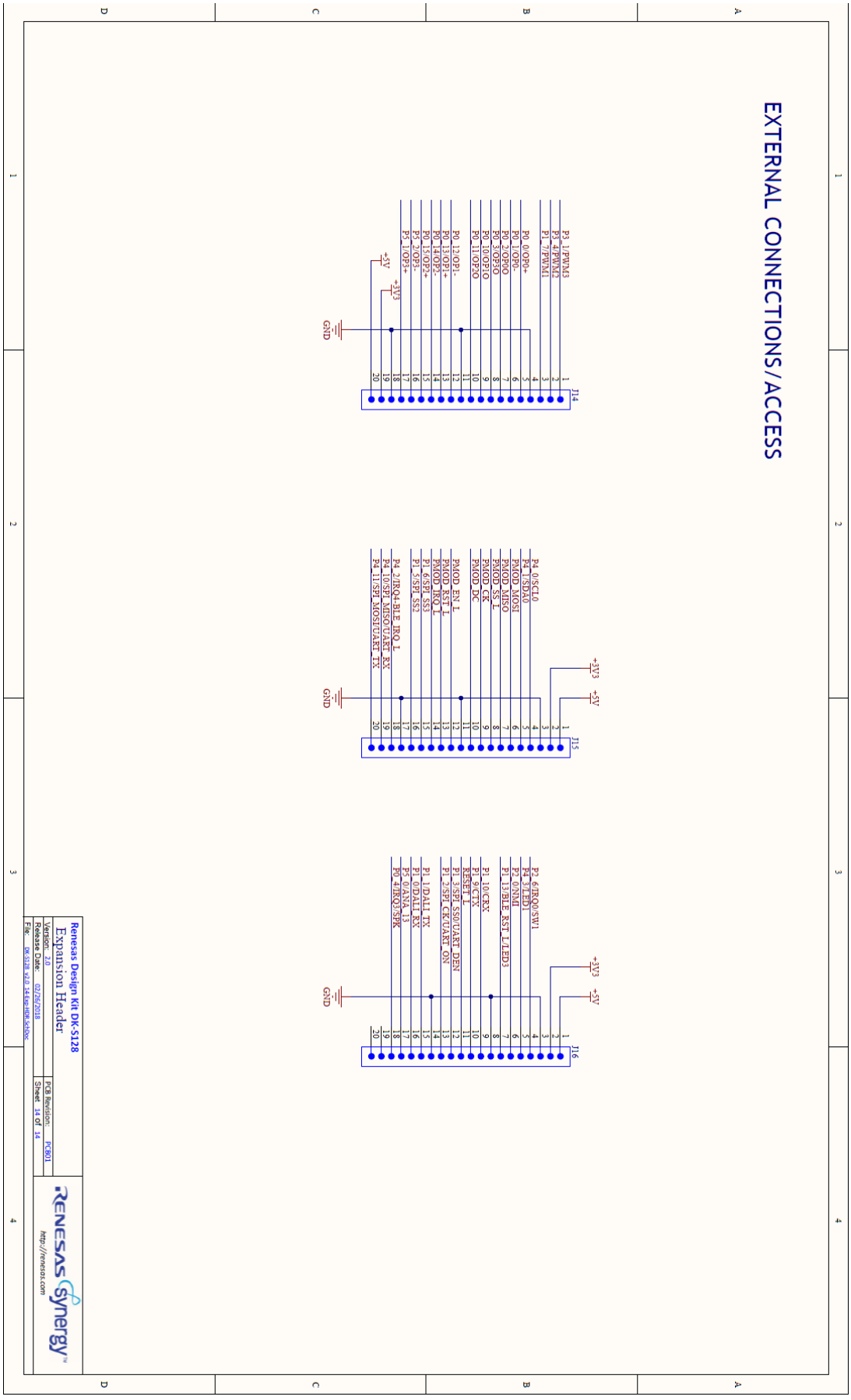

SPI Flash, BLE
SPI Flash
BLE
Renesas Design Kit DK-S128
SPI Flash,BLE
Version: 2.0
Release Date: 02/28/2018
File: DK-S128 V2.0 SPI+BLE.DSN
PCB Revision: PCB01
Sheet 9 of 14
RENESAS Synergy
http://renesas.com


Audio
Speaker
Microphone
Renesas Design Kit DK-S128
Audio
RENESAS Synergy
http://renesas.com

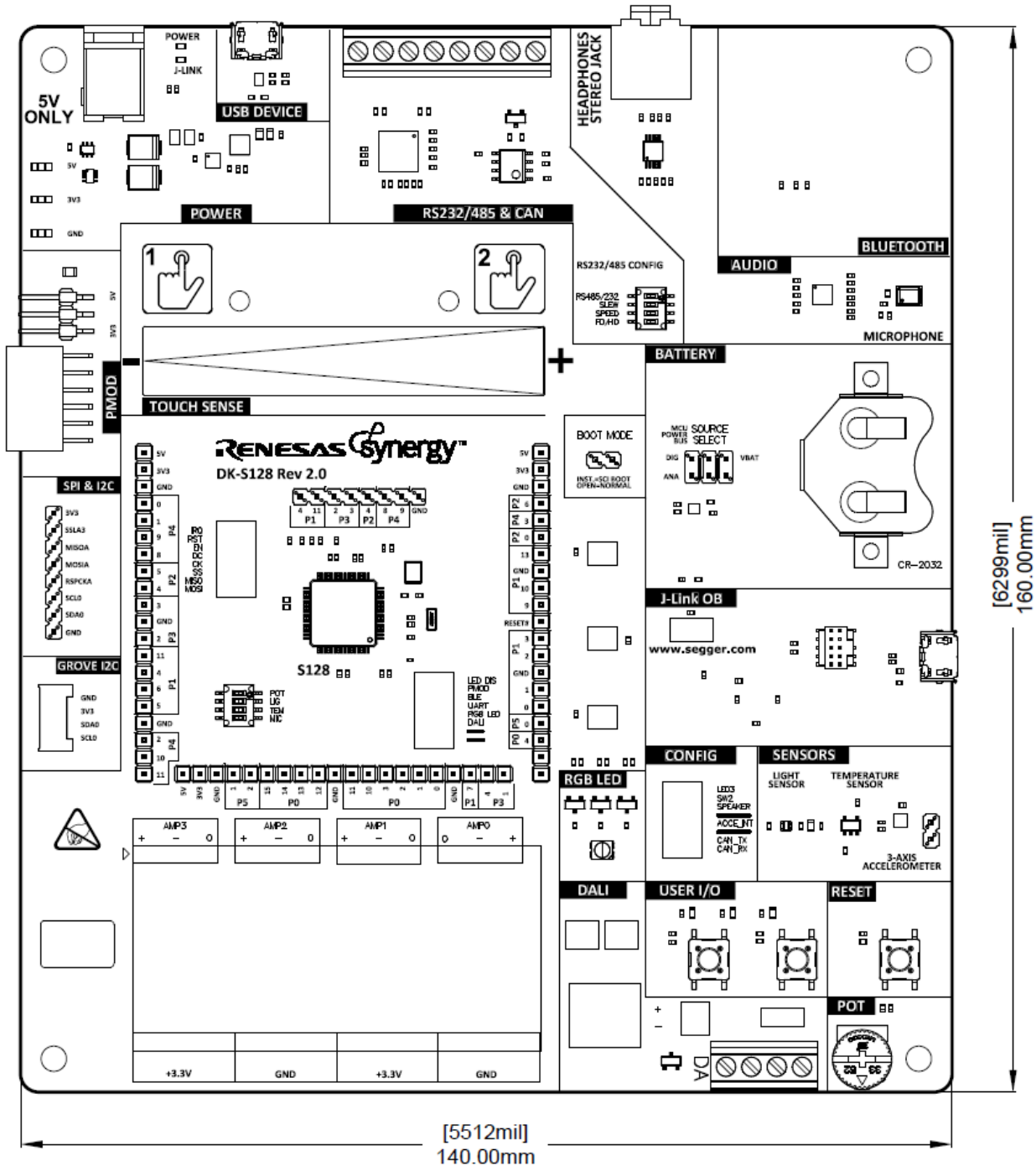

Touch, LED, Switch
TOUCH BUTTONS
TOUCH SLIDER
Renesas Design Kit DK-S128
Touch,LEDs
RENESAS Synergy
http://renesas.com


RS232/485, CAN
RS232/485 converter
For SCI in I2C mode populate pull up resistors, and remove 0ohm resistors
CAN transiver
Ext connector
Renesas Design Kit DK-S128
RS232,CAN


JLINK_OB / JTAG
Boot Mode / LED2 isolation
J-LINK OB USB
J-LINK S124 RE-PROG
S124-LQFP64
Renesas Design Kit DK-S128
JLink


EXTERNAL CONNECTIONS/ACCESS
J14
J15
J16
GND
+3V3
+5V
Renesas Design Kit DK-S128
Expansion Header
Version: 2.0
Release Date: 02/26/2018
File: DK-S128 V2.0 Schematic.SchDoc
PCB Revision: PCB01
Sheet 14 of 14
RENESAS Synergy
http://renesas.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.

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

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	May.08.19	-	Initial release

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Publication Date: May.08.19

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Development Kit S128 (DK-S128)

Renesas Electronics Corporation

R12UM0036EU0100