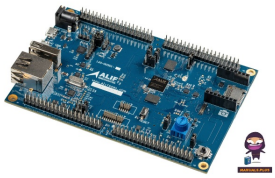
ALIF SEMICONDUCTOR
Ensemble DevKit Gen 2



ALIF Ensemble DevKit Gen 2 User Guide

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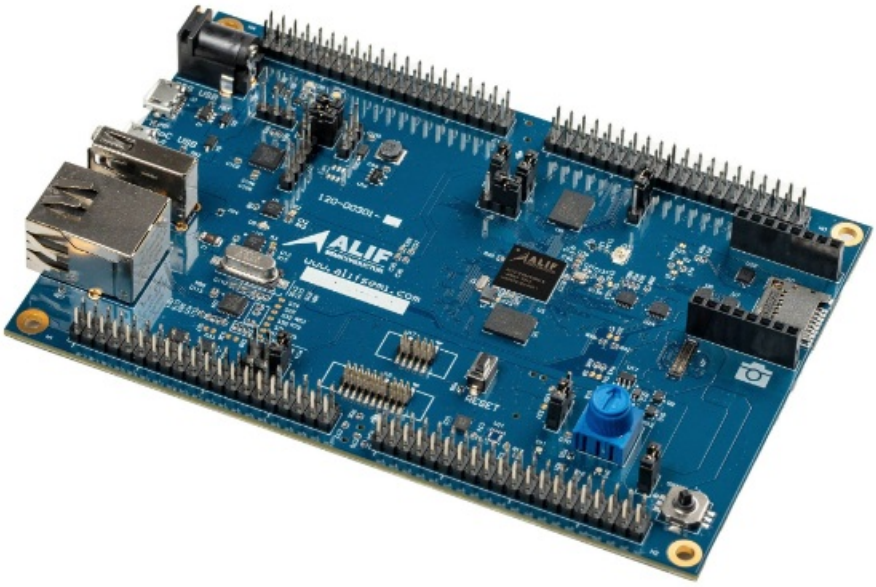


Specifications

Ensemble DevKit Gen 2

- Contains an Ensemble E7 device with Application Processor cores
- Real-Time Processor cores include:
  - High-Performance Arm Cortex-M55 (M55-HP) operating at up to 400 MHz with a 256 MAC wide
  - High-Efficiency Arm Cortex-M55 (M55-HE) operating at up to 160 MHz with a 128 MAC wide

FAQ

- **Q:** How can I reset the DevKit?
- **A:** You can reset the DevKit by pressing the RESET button located on the board.
- **Q:** Where can I find more information about the E7 MCU architecture?
- **A**: Details about the E7 MCU architecture are discussed in the white paper Fusion Processors System Architecture Introduction available on the Alif Semiconductor website.

Introduction

This user guide will take you through the steps of initial setup to power up the Alif Semiconductor® Ensemble® Development Kit (DevKit) Gen 2 and observe the factory LED blinky application.
We will then go through the possible options for setting up options for things such as access to one of the user UART ports of the device, where to connect a JTAG debugger, and how to use other optional signal connections.
The Ensemble DevKit Gen 2 contains an Ensemble E7 device with Application Processor cores consisting of dual-core Arm Cortex®-A32 processors and Real-Time Processor Cores consisting of Cortex-M55 processors. The Real-Time Processor cores implement the Arm v8.1 instruction set, including Helium M-Profile Vector Extension (MVE).
The Real-Time Processor cores are:

- High-Performance Arm Cortex-M55 (M55-HP) operating at up to 400 MHz with a 256 MAC wide Ethos® U55 NPU
- High-Efficiency Arm Cortex-M55 (M55-HE) operating at up to 160 MHz with a 128 MAC wide Ethos® U55 NPU

The Alif Semiconductor Ensemble family of Fusion Processors incorporates multiple CPU and NPU cores, large on-chip RAM and non-volatile memory, and analog and digital peripherals supporting wired connectivity. Their range of computational performance, power efficiency, and rich peripheral set make them suitable for a wide range of embedded IoT applications.
Each CPU subsystem can execute code independently of others but may share a power domain and memory and peripherals can be shared between subsystems.
Details of the E7 MCU architecture are discussed in the white paper "**Fusion Processors System Architecture Introduction**".

Target Setup Requirements

- Ensemble DevKit Gen 2
- Micro-USB Cable (included in the kit)
- Windows PC with terminal emulation software
- JTAG debugger such as Segger J-Link or Arm ULINKpro

Check Board Jumpers

Before powering up your board, check the jumpers to ensure they are in the default positions as shown in the diagram below. A table of the jumper setting definitions is included at the end of this user guide

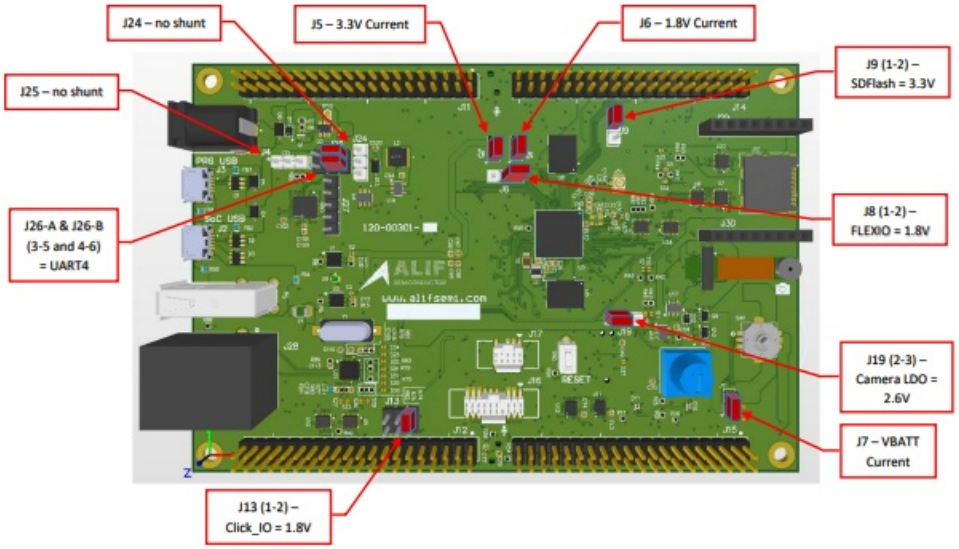
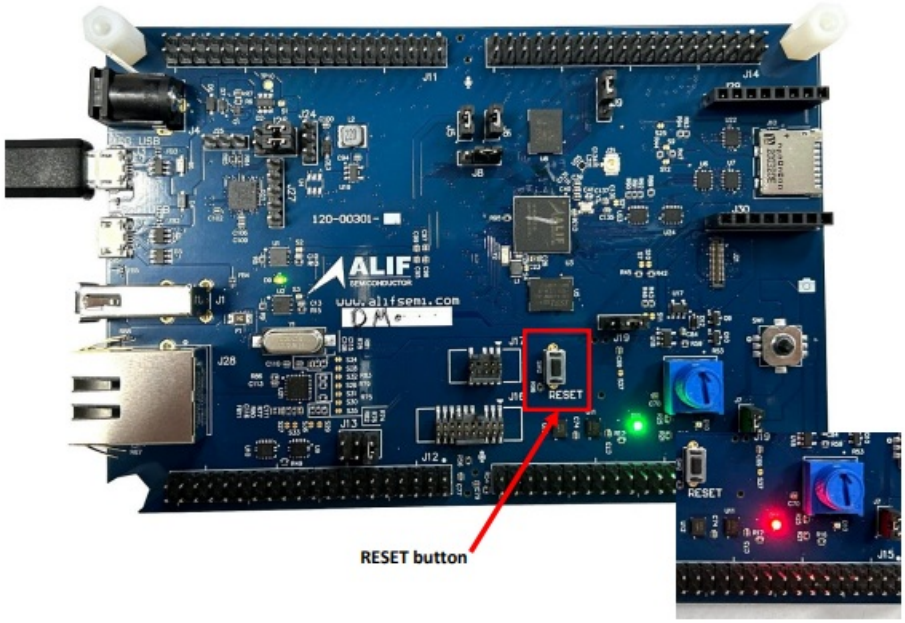


Figure 1 – Configuration Jumpers – Factory Default Settings

Powering The Board

To power your DevKit, connect a USB cable from your computer to the "PRG USB" micro-USB socket on the board. Upon powering the board, the green power LED next to the Alif Semiconductor logo will illuminate and the factory default application will begin blinking the RGB LED near the lower edge of the board in an alternating red and green pattern.



Install the Alif Security Toolkit

The next step is to install the latest release of the Alif Security Toolkit (SETOOLS). Refer to the Alif Security Toolkit Quick Start Guide [**click here**] for installation instructions. You should download the latest version of the SETOOLS (the filename begins with “app-release-exec”) that is Version 1.0.0 or higher. It is available on the Ensemble DevKit Gen 2 page at **https://alifsemi.com/support/kits/ensemble-devkit-gen2/**

For example, version 1.0.0 for Windows is filename “app-release-exec-windows-SE_FW_1.0.0

Determining UART Port Assignments

The DevKit has a 2-channel USB UART adapter on the board. It is connected to the SEUART that is used by the SETOOLS applications to query device status and program images into the MRAM. The other channel can be connected to either the UART2 or the UART4 general-purpose UART ports of the Ensemble device.

SETOOLS Port Discovery
The first time you execute one of the SETOOLS scripts you will be prompted for the required serial port. When the ports are presented, just enter the port name and press [ENTER].
This port data is saved in a local configuration file (isp_config_data.cfg). The next time a command is invoked and this configuration file is present, it will use the parameters from this file. To override this option simply use the -d option: This will force a re-discovery of the Serial ports.

```
c:\app-release-exec-73>maintenance -d
Discover
COM ports detected = 2
-> COM6
-> COM8
Enter port name:COM6
[INFO] COM6 open Serial port success
[INFO] baud rate 55000

Available options:

 1 - Device Control
 2 - Device Information
 3 - MRAM
 4 - Utilities
 5 - Setting capabilities
 6 - ROM

Select an option (Enter to exit):
```

UART Errors

There is only one SE-UART on the device. When running the SETOOLS, please ensure you have no other Tera term or putty sessions using the same SE-UART. The following shows the output if the SE-UART is already being used by another program

```
c:\app-release-exec-65>maintenance -d
COM ports detected = 2
-> COM6
-> COM8
Enter port name:COM6
[ERROR] openSerial could not open port 'COM6': PermissionError(13, 'Access is denied.', None, 5)
[ERROR] isp openSerial failed for COM6

c:\app-release-exec-65>
```

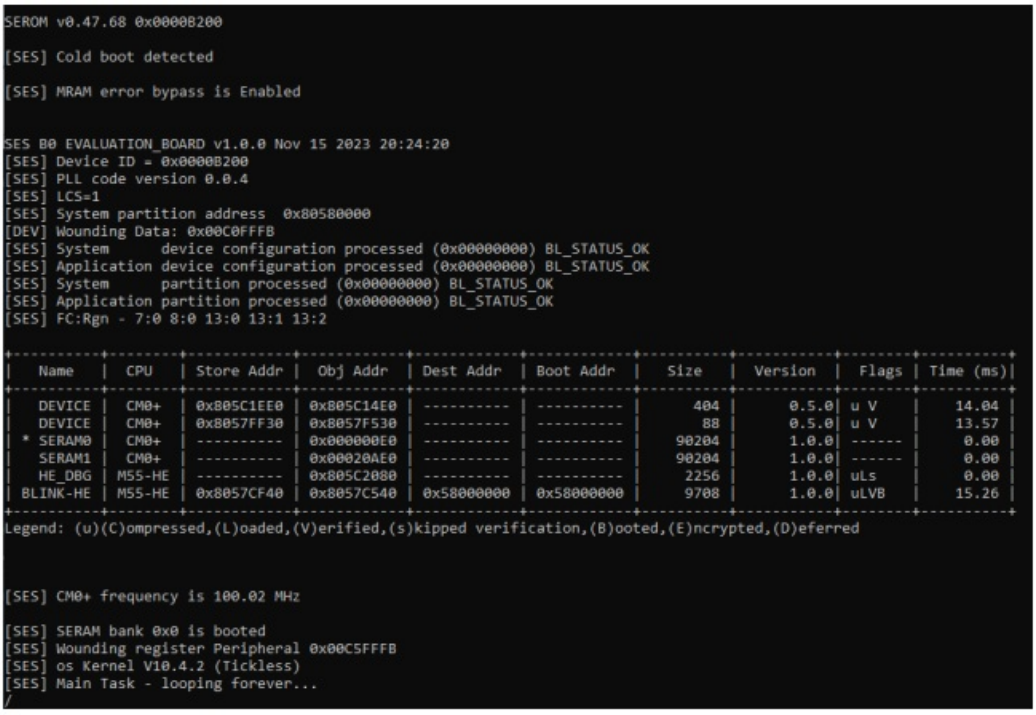
Determining SEUART Port Assignment

The SEUART port will usually appear as the lowest numbered port available from the USB UART adapter\ chip on the board but depending on other USB port assignments in the system, it sometimes is the higher numbered port. With the SEUART connected to your PC, open a Windows command prompt and navigate to the SETOOLS release directory. Run “maintenance -d” and select the lower numbered COM port. Then, from the available options in the maintenance\ program menu:

```
c:\app-release-exec-73>maintenance -d
Discover
COM ports detected = 2
-> COM6
-> COM8
Enter port name:COM6
[INFO] COM6 open Serial port success
[INFO] baud rate 55000

Available options:

 1 - Device Control
 2 - Device Information
 3 - MRAM
 4 - Utilities
 5 - Setting capabilities
 6 - ROM

Select an option (Enter to exit): 4

Available options:

 1 - Terminal mode
 2 - Get SERAM metrics
 3 - Get address
 4 - Set address

Select an option (Enter to return): 1
[TERMINAL] Ctrl-C to exit
/
```

1. select “4 – Utilities”
2. select “1 – Terminal Mode”
3. Press the RESET button

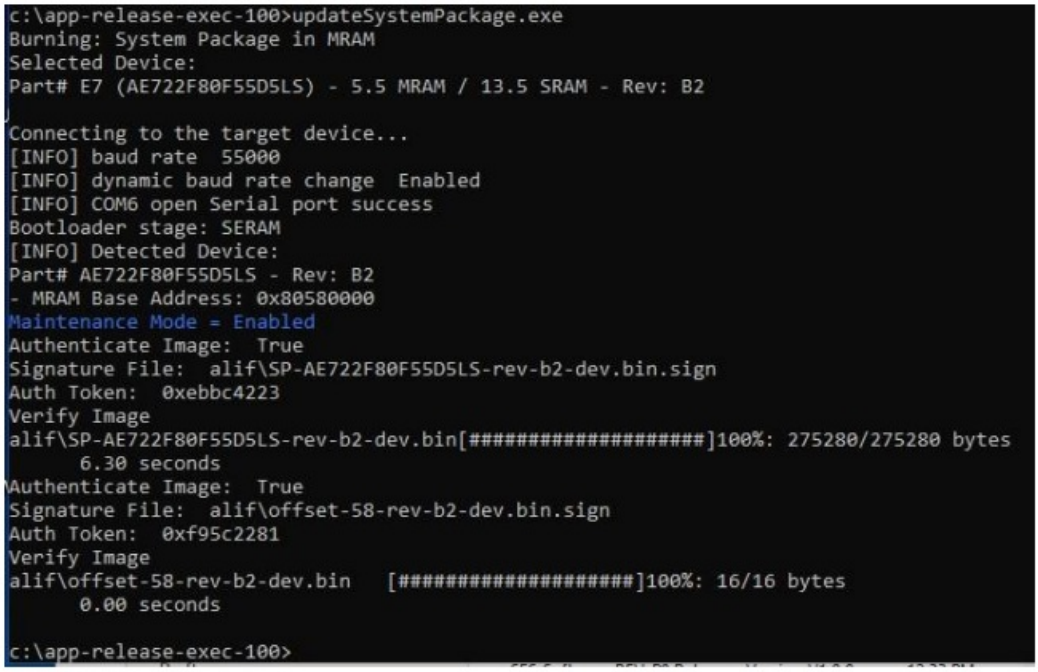
If you are connected to the SEUART port, you will see a log file as shown below.



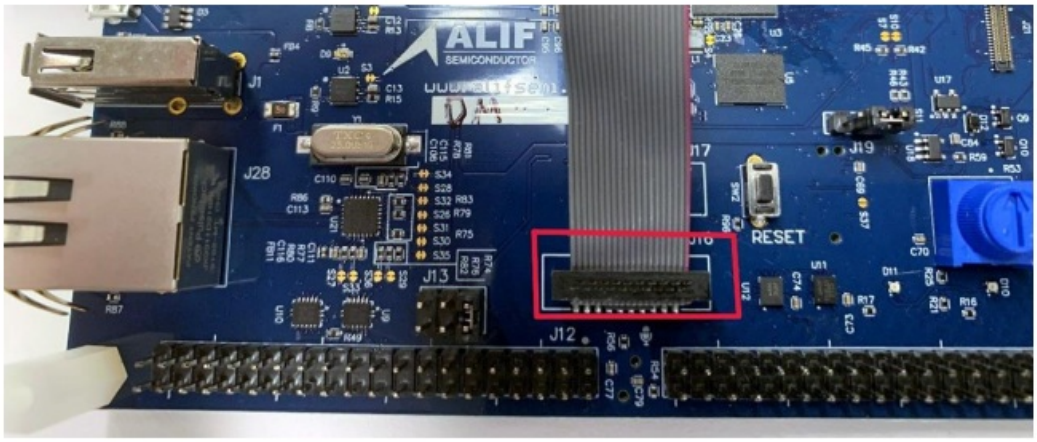
If you see no output, you should exit the maintenance program terminal mode by pressing Ctrl-C, then press RETURN twice to exit maintenance mode. Then rerun the process while selecting the higher numbered COM port and you should see the SEUART boot screen shown above. The tools will remember the last port selection used, so once you have the correct port for the SEUART you will not have to go back through port discovery

Updating Device Firmware

To update the device firmware image, go to the top-level SETOOLS directory for the version you just downloaded (the default location is C:\app-release-exec) and execute the command “updateSystemPackage”. The program will determine the correct baud rate and update your firmware



Connecting a JTAG Debugger
JTAG debugger connections are available in the middle of the board near the lower edge. The picture below shows a Segger J-Link with 19-pin Cortex-M adapter connected to J16 on the DevKit which is the 19-pin JTAG-0 connector



After you have updated your internal system image and connected your debugger, you can proceed with design and debug. A complete step-by-step tutorial on doing bare metal design using VSCode + GNU tools is available upon request from the Alif Semiconductor applications team.

Optional User UART Connections

- If an example application you are going to use specifies the need for additional UART connections, the instructions below will show you how to connect to UART2 or UART4.
- When a micro-USB cable is plugged into the “PRG USB” port (the port closest to the corner of the board), power is applied to the board and there is access to 2 UART ports. One of these will be the SEUART that is used to access the
- Secure Enclave to get device status and to program application images into the non-volatile MRAM of the device. You determined how to select the SEUART port in a previous section.
- The other port is either the UART2 or UART4 general-purpose peripheral port depending on jumper settings for header pins labeled “UART SEL SW” in between the 2 micro-USB sockets.
- Putting jumpers on the two pairs of pins closer to the center of the board selects UART4 which is the default selection, while putting jumpers on the two pairs of pins closer to the edge of the board selects UART2.

UART4 Selection (default)

UART2 Selection

The SoC USB connector is connected directly to the USB peripheral output pins of the Ensemble E7 SoC device and can be used in program development.

Ensemble DevKit Key Components

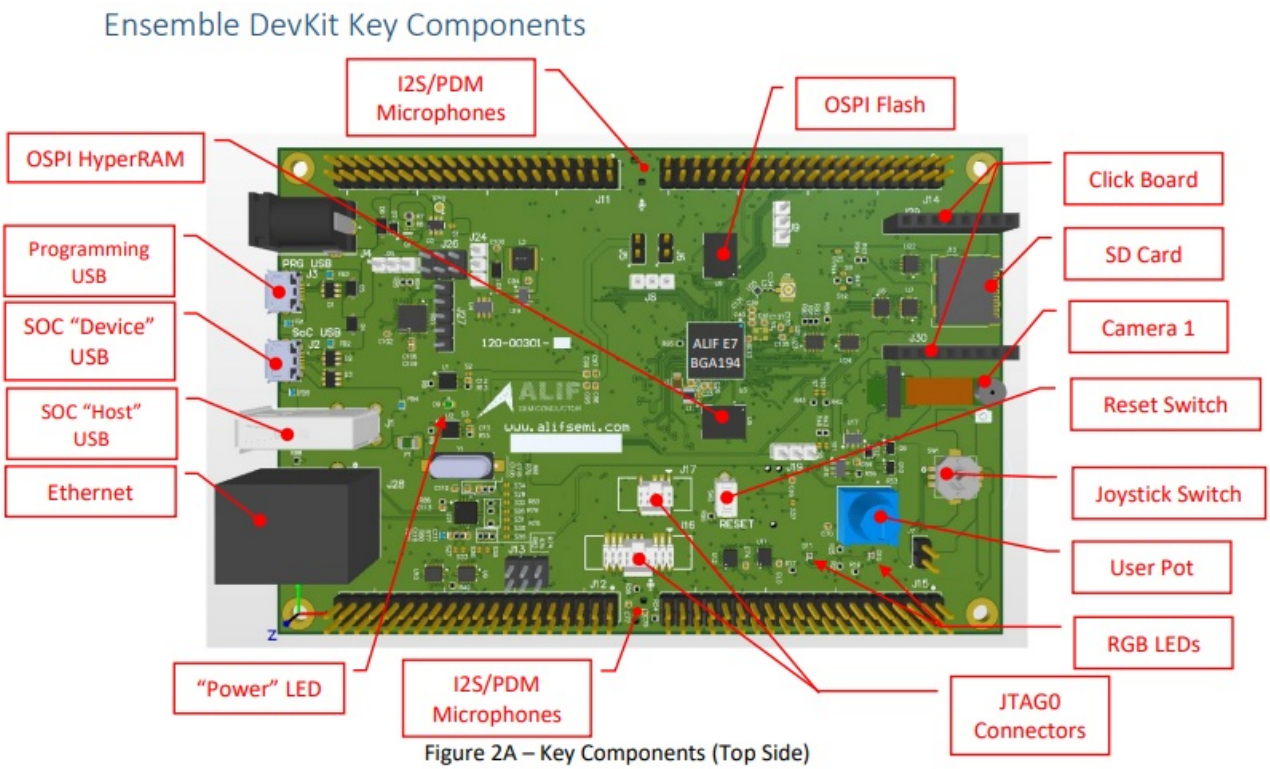


Figure 2A – Key Components (Top Side)

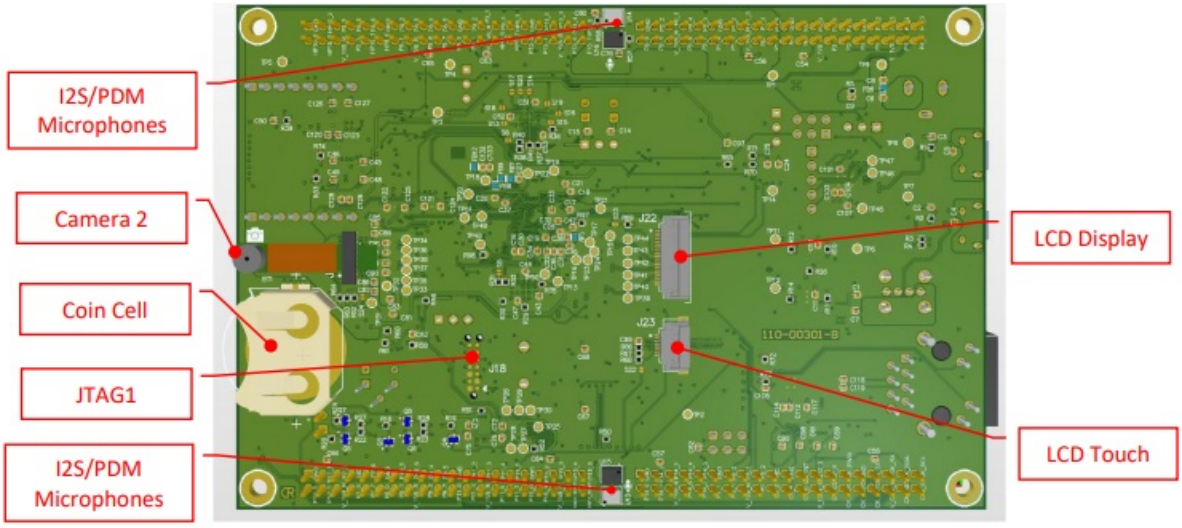


Figure 2B – Key Components (Bottom Side)

Ensemble DevKit Connectors

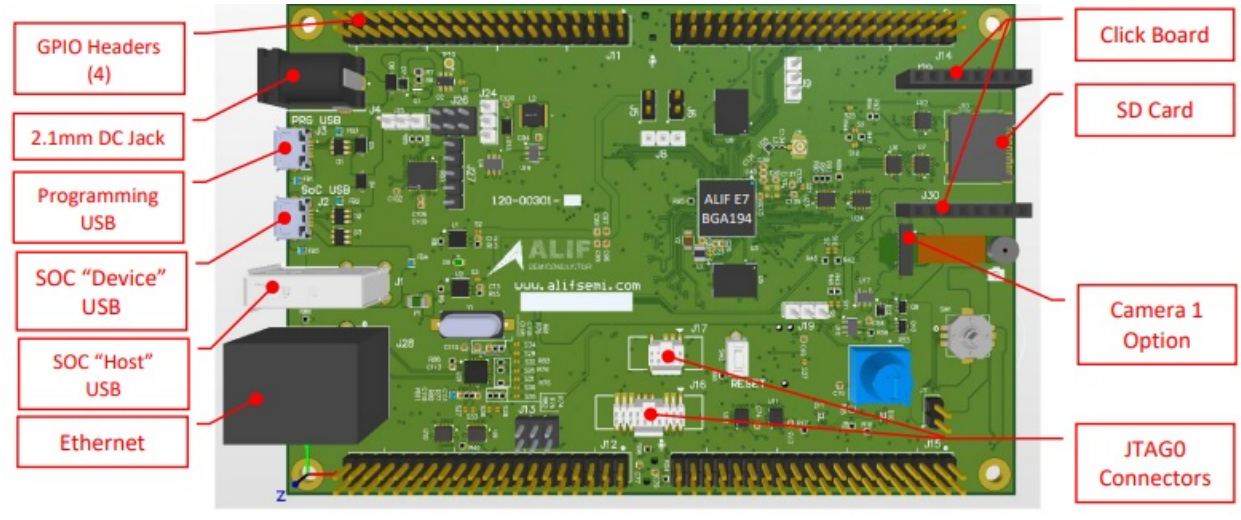


Figure 3 – Connectors

See Figure 2B for Bottom Side Connectors

Ensemble DevKit Configuration Jumpers

- J5 – SOC 3.3V Current Measurement
- J6 – SOC 1.8V Current Measurement
- J7 – SOC Coin Cell (VBATT) Current Measurement
- J8 – FLEXIO Voltage Selection
  - Pin 1-2 FLEXIO = 1.8V **
  - Pin 2-3 FLEXIO = 3.3V
- J9 – SD Flash Card Voltage Selection
  - Pins 1-2 SD Flash = 3.3V **
  - Pins 2-3 SD Flash = 1.8V
- J13 – Click Board and a Few Other GPIOs Voltage selection
  - Pins 1-2 Click I/O = 1.8V **
  - Pins 3-4 Click I/O = 3.3V
  - Pins 5-6 Click I/O = 5.0V
- J19 – MIPI Camera LDO Analog Voltage Selection
  - Pins 1-2 Analog Voltage = 2.8V
  - Pins 2-3 Analog Voltage = 2.6V **
- J26 – UART Selection between SOC and Cypress UART / USB Bridge
  - Pins 1-3 and 2-4 = UART2
  - Pins 3-5 and 4-6 = UART4 **

All Configuration Jumpers are male headers, 2.54mm pin spacing. Factory default settings are denoted with **

FCC STATEMENT

Regulatory Compliance Statements
Federal Communications Commission (FCC) and ISED Canada Compliance Statements

FCC

Identification of product: DK-E7
This device complies with Part 15(B) of the FCC Rules. Operation is subject to the following two conditions:

1. This device may not cause harmful interference, and
2. The device must accept any interference received, including interference that may cause undesired operation. Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

EMC
Class B
This equipment has been tested and found to comply with the limits for a Class B digital device, under part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used by the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user

is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and the receiver.
- Connect the equipment to an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

ISED CANADA
This device complies with Industry Canada License-exempt RSS standard(s). Operation is subject to the following two conditions:

1. This device may not cause harmful interference, and
2. The device must accept any interference received, including interference that may cause undesired operation.

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment

RoHS Compliant
DIRECTIVE 2011/65/EU OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 8 June 2011
DIRECTIVE (EU) 2017/2102 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 15 November 2017 amending Directive 2011/65/EU on the restriction of the use of certain hazardous substances in electrical and electronic equipment

Simplified DoFC

Hereby, Alif Semiconductor, Inc. declares that the radio equipment type DK-E7 is in compliance with Directive 2014/53/EU. The full text of the EU Declaration of Conformity is available at the following internet address: **https://alifsemi.com/support/kits/ensemble-devkit-gen2/**

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Related Documents and Tools

- Alif Semiconductor device series-specific Hardware Reference Manual (HWRM)
- Alif Semiconductor device series-specific Software Reference Manual (SWRM)
- Alif Semiconductor device series-specific Datasheet For additional Alif Semiconductor technical documentation and software resources please visit:
- **User Guides & App Notes**
- **Software & Tools**

For managing software configurations of device resources, power, pins, clocks, DMA requests, interrupts, and various other additional settings, refer to the Alif Conductor tool.

Contact

Information

- For more information visit our website Alif Semiconductor (**www.alifsemi.com**) or contact us:
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Document History

Version	Change Log
V0.91	Pre-release copy
V1.0	Initial production release
V1.1	Added Regulatory Compliance Statements
V1.2	Updated screenshots and minor edits
V1.3	Edited Regulatory Compliance Statements

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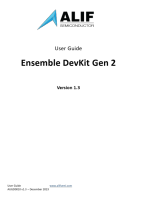	**ALIF Ensemble DevKit Gen 2** [pdf] User Guide Ensemble DevKit Gen 2, DevKit Gen 2, Gen 2

References

- **32-bit Microcontrollers (MCU), AI/ML | Alif Semiconductor**
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