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Amazon ACK HMCU On NuTiny-M4521S

www.nuvoton.com

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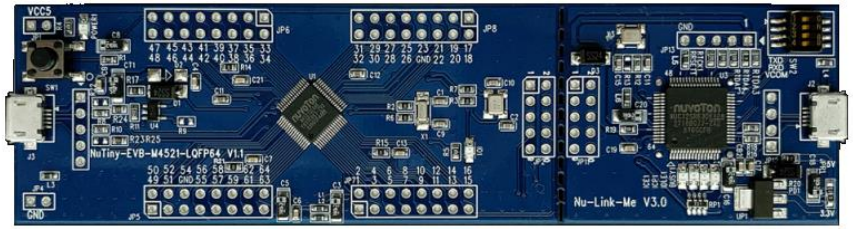
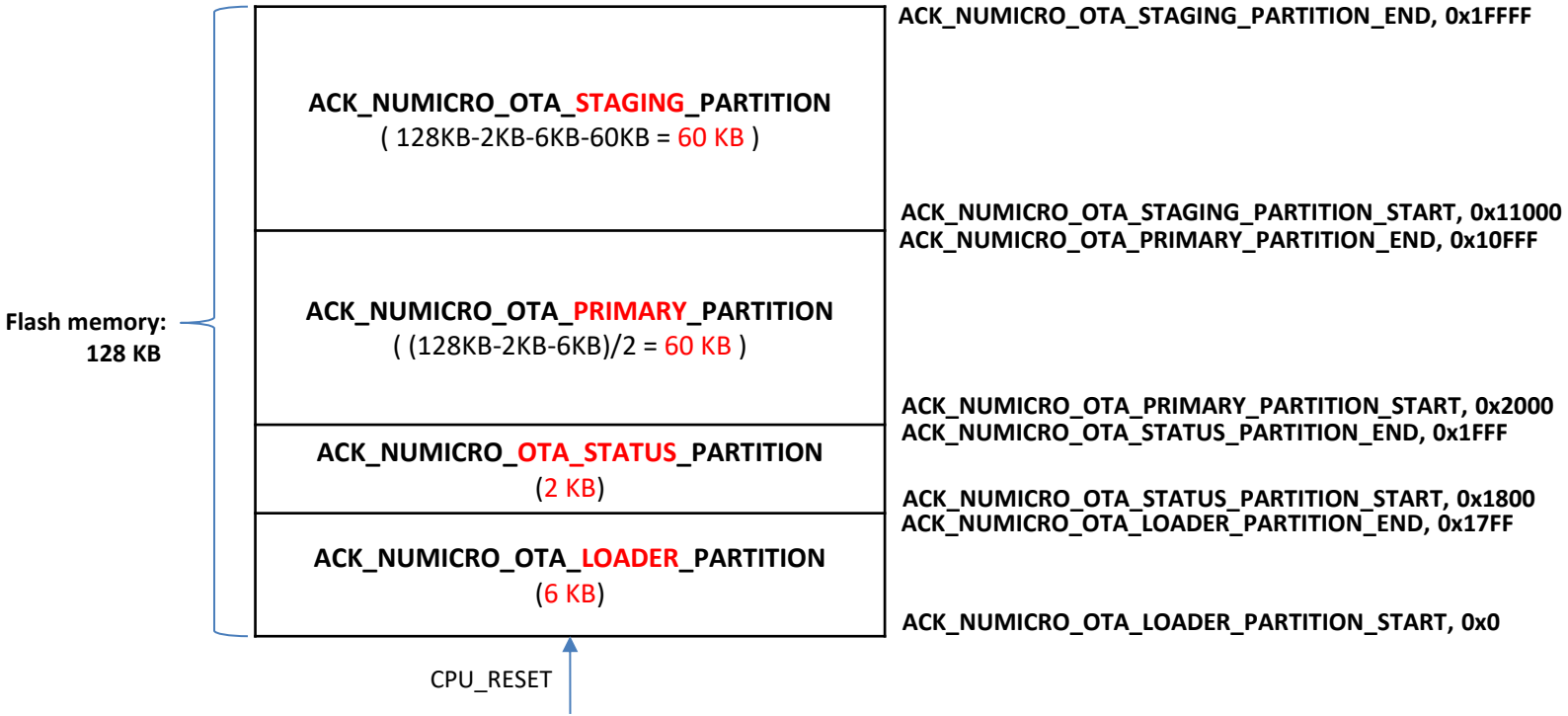
- Introduction
- Partition layout, Boot flow & OTA upgrading
- Demo
- Some notes

Introduction

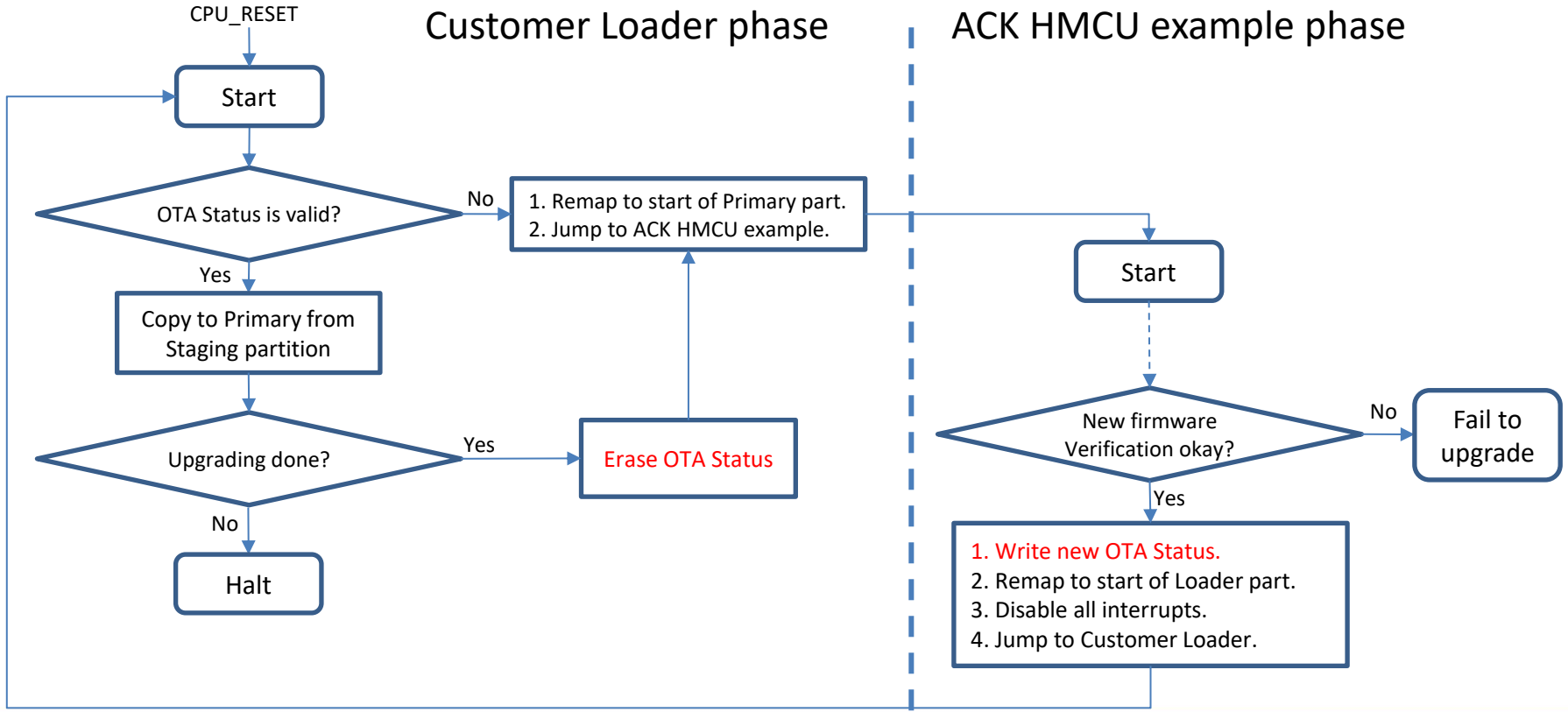
- **ACK – Alexa Connect Kit**
- **An Amazon-managed solution that makes it simpler, faster, and more economical to create and manage Alexa-controlled, Wi-Fi-enabled smart devices.**
  - ACK module
  - High-reliability/Low-latency device control cloud
  - ACK Management Console
  - Extensibility APIs
  - Dash Replenishment Service



Partition layout



Boot flow & OTA upgrading



Demo

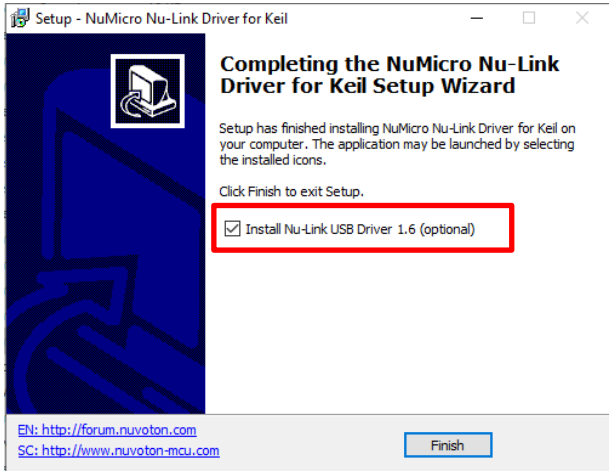
- Requirements
- Driver Installation
- Build Steps
- HMCU Board Setting
- ACK HMCU Firmware Installation
- ACK HMCU Boot Option Configuration

Requirements

- **Hardware**
  - An ACK module board (USI MT7697H development kit)
  - An development board for ACK HMCU (NuTiny-M4521S board)
  - An internet-accessible **2.4G** Wi-Fi router
  - A mobile phone with Alexa APP
  - A LED, some dupont lines and an USB Mini line
- **Software/Drivers**
  - Keil MDK 5.26
  - Latest Nu-Link Keil drivers
  - Python-3.8 environment

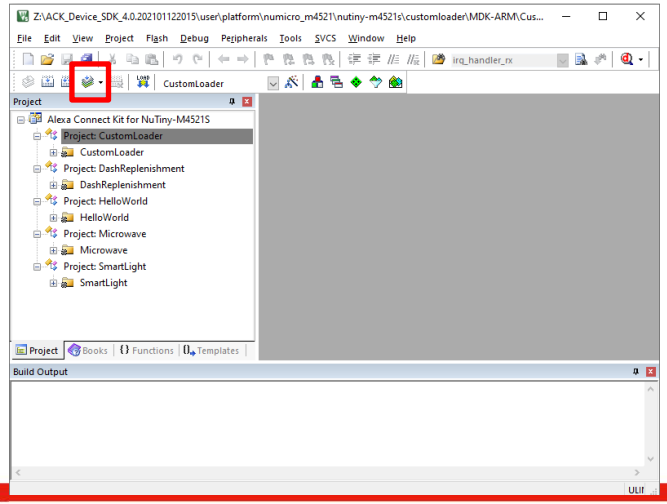
Driver Installation

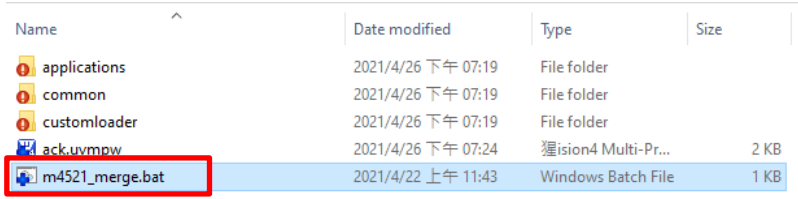
- **Install “Nu-Link Driver for Keil” on Window platform**
  - Nuvoton provides installshield wizard to help user to install these utilities for keil.
  - It also includes a Nu-Link USB Driver. Please install it for MDK-ARM debugger and Nuvoton virtual COM(VCOM) function.



Build Steps

- **Open ack.uvmpw Keil multiple project file using MDK 5.26.**
  - Path: <Path-to-ACK_Device_SDK>\user\platform\numicro_m4521\nutiny-m4521s\ack.uvmpw
- **Press “Batch rebuild” to build all examples.**
- **Finally, execute “m4521_merge.bat” to merge customer_loader and example into a hex file.**





Python Installation

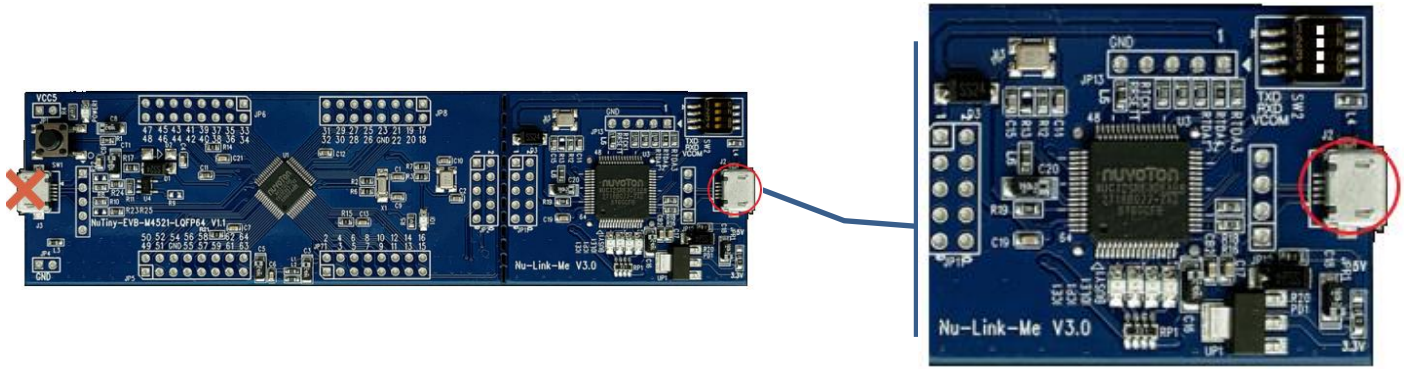
- **Python 3.8** or later is required, with the following optional modules (install with pip): intelhex, protobuf, pyserial.
  - Download: https://www.python.org/ftp/python/3.8.6/python-3.8.6-amd64.exe
  - The **intelhex** is *MUST* before you executing the **m4521_merge.bat** script.
  - To execute '**pip install intelhex**' in command line window.
  - Remember to add python execution to **PATH** variable.

m4521_merge.bat

- **This is batch script for window platform. Help user to get all merged firmwares for programming, just a double-click step.**
- **It invokes some python utilities Amazon provided**
  - For producing a merged firmware for NuMicro MCU.
    - Notice: The Nu-Link-Me on NuTiny-M4521S board is without Drag-and-drop firmware downloading function.
  - **For OTA upgrading file for publishing on Amazon Cloud.**
    - **Please remember to modify the device type for yours.**

HMCU board Setting

- Switch Pin 1 and pin 2 of VCOM(SW2) on Nu-Link-Me to “ON” position.
- Bridge USB micro line between Nu-Link-Me and PC.



- Nu-Link-Me firmware upgrade guiding
  - Please find out Chapter 5 of ‘NuMicro Cortex-M Keil ICE driver user manual.pdf’ in installed Nu-Link_Keil driver folder - C:\Program Files (x86)\Nuvoton Tools\Nu-Link_Keil\.

HMCU board and ACK shield board wiring

- Power-related Pins

NuTiny-M4521S	ACK shield board
+ 3.3v	ioref
+5v	+5v
GND	GND

- Communication-related Pins

NuTiny-M4521S	ACK shield board
P37	RX
P38	TX
P39	INT
P40	RES

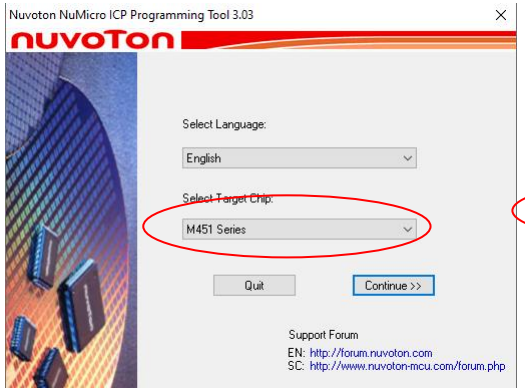
- Other I/O Pins

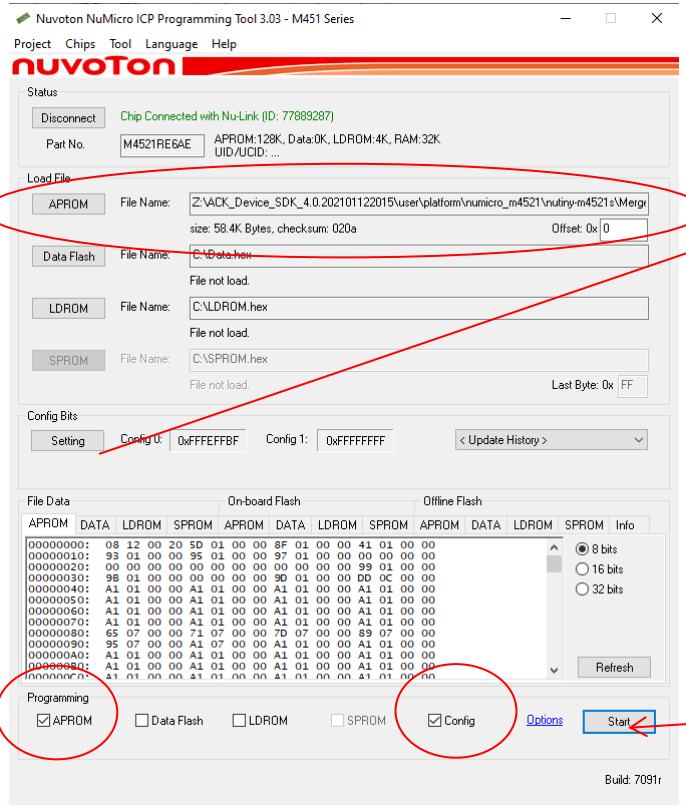
NuTiny-M4521S	Function description
On-board Heart Beat LED (GPIO output, IO1)	Alexa-connected indicator
P28 (Defined PWM I/O pin)	Smart Light LED
P23 (GPIO input)	Factory Setting Restore

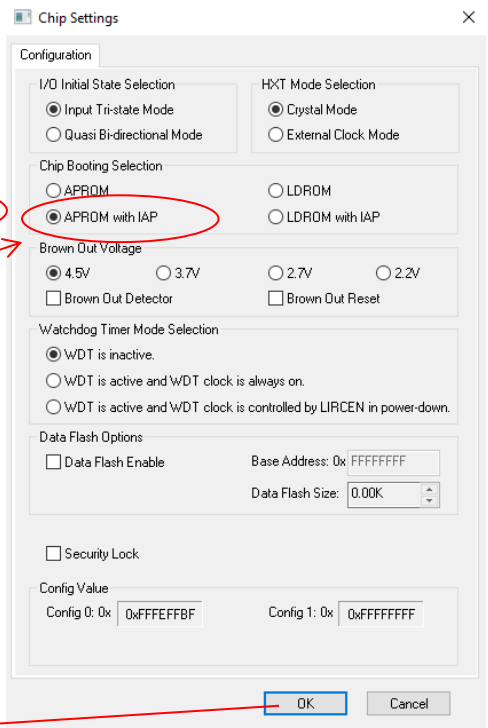
ACK HMCU Firmware Installation

- Using Nuvoton NuMicro ICP Programming Tool to program merged ACK HMCU and CustomerLoader hex file into MCU's APROM.
  - Specify the path of merged file in APROM entry.
  - Configure "Boot Options" is in "APROM with IAP" mode.
  - Select APROM and Config options to start programming.

ACK HMCU Firmware Installation





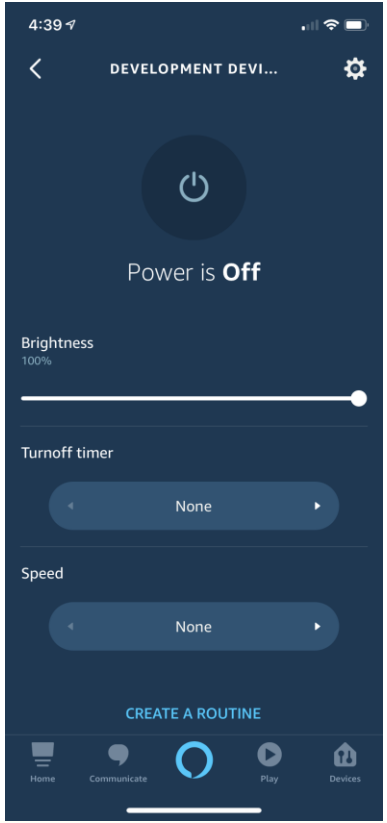


Wiring and Alexa APP

- **Mount ACK connectivity board on Arduino shield of NuMaker board.**
- **Connect a LED to P28 and GND(-).**
- **Use terminal utility to see Log**
  - Open window device manager to get Nuvoton VCOM COM port number.
  - UART communication setting is **115200N81**.
- **Associate with an Internet-accessible Wi-Fi router**
- **Install Amazon Alexa APP in your mobile device**
  - Got an Amazon account to login.
  - Make sure the APP version number is latest.

Alexa APP controlling

- **You can use Alexa APP to set smart-light functions**
  - **Press Turn-on/off button**
    - LED will be turn-on/off.
  - **Slide brightness bar to [1-100] percent.**
    - LED light brightness will be adjusted.
  - **Select speed option to none/low/medium/high.**
    - LED blink speed will changed to none/low/medium/high.
  - **Select Turnoff timer option to none/5mins/10mins/1hours.**
    - LED will be turn be after specified time.



Speech controlling

- **Golden utterances**
  - https://developer.amazon.com/zh/docs/device-apis/alexa-brightnesscontroller.html
- **You also can talk to Alexa APP below commands.**

  (Renamed development board to light)
  - **Alexa, turn-on light**
  - **Alexa, turn-off light**
  - **Alexa, set turn off timer to five minutes. (none/5minutes/10minutes/1hour)**
  - **Alexa, set the speed to low on light. (none/low/medium/high)**
  - **Alexa, set light to fifty percent. [1-100%]**

HMCU firmware version control

- **You can modify ACKUser_GetFirmwareVersion function to do version control. This version number is for ACK HMCU firmware OTA upgrading.**
  - PATH: <PATH-TO-ACKDeviceSDK>\user\platform\numicro_m4521\ack_user_device.c
  - We use building-date-time to implement the function.
  - You need to publish new version number and HMCU firmware on Amazon cloud.

ACK development kits

- **Please visit Amazon ACK official page**
  - https://developer.amazon.com/en-US/alexa/connected-devices/alexa-connect-kit/dev-kits

M4521 Series Resources

- **Link to Keil tools for Nuvoton NuMicro**
  - http://www2.keil.com/nuvoton/M0-M23
- **Technical reference manual**
  - https://www.nuvoton.com/export/resource-files/TRM_M4521_Series_EN_Rev1.00.pdf
- **Development board schematics**
  - https://www.nuvoton.com/resource-download.jsp?tp_GUID=HL0320181128163025
- **Latest Nu-Link Keil driver download**
  - https://www.nuvoton.com/opencms/resource-download.jsp?tp_GUID=SW0520101208200142
- **Latest ICP Programming tool download**
  - https://www.nuvoton.com/resource-download.jsp?tp_GUID=SW1720200221181328