RELEASE NOTES

AmbiqSuite SDK v2.5.1

Ultra-Low Power Apollo SoC Family

A-SOCAPG-RNGA01EN v1.1

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Revision History

Revision	Date	Description
1.0	September 2020	Initial release
1.1	January 10, 2023	Updated document template

Reference Documents

Document ID	Description

Table of Contents

SECTION

1

Overview

This document is the release notes for the AmbiqSuite SDK v2.5.1. The Ambiq Suite SDK is a collection of software enablement for the Apollo, Apollo2, Apollo3 Blue, and the Apollo3 Blue Plus SoC based EVBs. The SDK includes a hardware abstraction layer (HAL), device drivers, and example applications to speed the understanding of the operation of the SoCs. This release include support for the Cygnus Shield board which contains peripheral memories, display devices and microphones that demonstrate more of the Apollo3 family SoC capabilities. Third party software including the open source Cordio Bluetooth Low Energy Host stack and FreeRTOS v10.1.1 are distributed along with debugging tools and other support. Additional support for Ambiq products can be found at https://support.ambiq.com/hc/en-us.

> **NOTE:** Some files show preliminary support for the Apollo4/Apollo4 Blue SoCs.. This conditional code should be ignored for the release.

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Target Hardware Supported

This release of the SDK enables support for the following targets:

- apollo1_evb (Apollo1 APOLLO512-KBR Board Rev 1.0)
- apollo2_blue_evb (Apollo2-Blue EVB Rev 1.0)
- apollo2_evb (Apollo2 AMAPH1KK-KBR EVB Rev 1.1)
- apollo3_evb (AMA3B1KK-KBR EVB Rev 1.0 and Rev 1.7)
- apollo3_evb_cygnus (AMA3B1KK-KBR EVB Rev 1.7 + Cygnus Shield V1.02)
- apollo3p_evb (AMA3B2EVB Rev 1.0)
- apollo3p_evb_cygnus (AMA3B2EVB Rev 1.0 + Cygnus Shield V1.02)

SECTION

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Development Tools

The Ambiq Suite SDK has been tested with the following Integrated Development Environments:

- IAR Embedded Workbench 8.50.5
- Keil uVision 5.27.1
- GCC 5.4.1
- SEGGER JLink V6.80a or later

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Resolved Defects

Table 4-1: Resolved Defects

Module	Target	Description
ADC	Apollo3 Blue Apollo3 Blue Plus	Fixed defect to avoid reading from FIFOPR when reading samples from SRAM buffer.
BLE 3.3V Power Initialization	Apollo3 Blue Apollo3 Blue Plus	Conditional code in BSP (see am_bsp_ble_3p3v_low_power_mode).
CMSIS register definitions (apollo3.h, apollo3p.h)	Apollo3 Blue Apollo3 Blue Plus	Corrected GPIO function select names. Added MSPI PADOUTEN and XIPMIXED enumerations.
CLKGEN	Apollo3 Blue Plus	SW workaround to guarantee proper function of HFADJ.
CTIMER	Apollo3 Blue Plus	Added support for CT on GPIO pins beyond pin 49.
GPIO	Apollo Apollo2 Apollo2 Blue Apollo3 Blue Apollo3 Blue Plus	Unified behavior of AM_HAL_GPIO_MASKBIT macro. Introduced new macro AM_HAL_GPIO_MASKBITSMULT
STIMER (am_hal_stimer.c)	Apollo2 Apollo2 Blue Apollo3 Blue Apollo3 Blue Plus	STIMER read workaround with call to am_hal_triple_read function.
SYSCTRL	Apollo2	Improved Buck zero-crossing SW workaround.

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New Features

Table 5-1: New Features

Module	Target	Description
New Shield Board	Apollo3 Blue Apollo3 Blue Plus	Added support for Cygnus V1.02 shield with peripheral memories and displays.
BLE Examples	Apollo3 Blue Plus	Additional Bluetooth Low Energy examples ported to Apollo3 Blue Plus.
BLE Stack	Apollo2 Blue Apollo3 Blue Apollo3 Blue Plus	Revised vendor specific command function names. Added vendor specific functions for custom Bluetooth address. Fixed AES mismatch handling issue. Fixed security connection issue when no input no output on either side. Added bonding information save into internal NVM function.
Updated BLE Controller firmware patch	Apollo3 Blue (B0) Apollo3 Blue Plus	Fixed a few potential Sweyntooth Bluetooth Low Energy security issues. Fixed channel map update defects. Fixed the issue of interrupt nested disable/restore. Fixed LMP timeout issue. Fixed HCI command timeout issue when reading remote feature. Improved the RSSI accuracy for scan report (AGC disabled) Added one parameter for changing channel reassess duration
Support for MSPI mixed modes	Apollo3 Blue Apollo3 Blue Plus	Added support for multiple MSPI modes (3WIRE, 1-1-2, 1-2-2, 1-1-4, 1-4-4)
BSP	Apollo3 Blue	Added PDM and SCARD pins in apollo3_evb BSP.
SPI-to-USB	Apollo3 Blue Apollo3 Blue Plus	Added FT4222 on board SPI to USB converter device support for Apollo3p_evb.
Display	Apollo3 Blue Plus	Added display module control I/O support for apollo3_evb BSP.
IOM HAL	Apollo3 Blue Plus	Added full-duplex SPI support.
Device Drivers	Apollo3 Blue Apollo3 Blue Plus	Added support for MX25U128 QSPI NOR Flash and RM69330 Display.

SECTION

6 Detail Change List

6.1 Overall

Copyright name updates to “Ambiq Micro, Inc.”

6.2 MCU HAL

1. hal\am_hal_ctimer.c: Moved multiple reads of peripheral register helper functions to am_hal_global.c and renamed as am_hal_triple_read() for Apollo1, Apollo2, Apollo3 and Apollo3p
2. hal\am_hal_gpio.h: Unified behavior of AM_HAL_GPIO_MASKBIT() macro and introduced new macro AM_HAL_GPIO_MASKBITSMULT() for Apollo1, Apollo2, Apollo3 and Apollo3p
3. hal\am_hal_stimer.c: Stimer read workaround with am_hal_triple_read() added for Apollo2, Apollo3 and Apollo3p
4. apollo2\hal\am_hal_sysctrl.c: Removed g_sBuckTimer and use corresponding CTIMER instances instead.
5. apollo2\hal\am_hal_sysctrl.c: Apollo2 ZX workaround changed to new algorithm.
6. hal\am_hal_adc.c: Bug fix, do not read from FIFOPR when reading samples from SRAM buffer for Apollo3 and Apollo3p
7. apollo3\hal\am_hal_burst.c: Removed am_hal_pwrctrl_blebuck_trim() call
8. apollo3\hal\am_hal_iom.c: Added return value check and return to am_hal_iom_power_ctrl() for peripheral power on failure.
9. apollo3\hal\am_hal_iom.c: Added SPI Full-duplex interfaces

10. apollo3\hal\am_hal_iom.h: Correct AM_HAL_IOM_MAX_TXNSIZE_I2C to 255
11. apollo3\hal\am_hal_mspi.c: Added AM_HAL_MSPI_REQ_CLOCK_CONFIG option to am_hal_mspi_device_configure()
12. hal\am_hal_mspi: Added support for multiple MSPI modes (3WIRE, 1-1-2, 1-2-2, 1-1-4, 1-4-4) for Apollo3 and Apollo3p, code style cleaned up.
13. Use AM_HAL_MSPI_MAX_TRANS_SIZE instead of hard code."
14. apollo3\hal\am_hal_pin.h: Added AM_HAL_PIN_2_UART1RX, AM_HAL_PIN_10_UART1TX; corrected AM_HAL_PIN_4_UART1RX, AM_HAL_PIN_23_MSPI3, AM_HAL_PIN_44_UART0TX
15. hal\am_hal_pwrctrl.c: moved am_hal_pwrctrl_blebuck_trim() to am_hal_pwrctrl_low_power_init() from am_hal_burst_mode_initialize() for Apollo3 and Apollo3P
16. apollo3p\hal\am_hal_clkgen.c: make Software Workaround to guarantee proper function of HFADJ valid for Apollo3p (AM_HAL_CLKGEN_CONTROL_XTAL_STOP)
17. apollo3p\hal\am_hal_ctimer.c: Added support for CT on PADs beyond PAD 49.
18. apollo3p\hal\am_hal_iom.c: Added return value check and return to am_hal_iom_power_ctrl() for peripheral power on failure.
19. apollo3p\hal\am_hal_mspi.c: Added AM_HAL_MSPI_REQ_CLOCK_CONFIG and AM_HAL_MSPI_REQ_ASIZE_SET options to am_hal_mspi_device_configure()
20. apollo3p\hal\am_hal_pin.h: removed AM_HAL_PIN_12_SLnCE
21. apollo3p\hal\am_hal_pwrctrl.c: added new simobuck trim settings in am_hal_pwrctrl_low_power_init()
22. apollo3p\hal\am_hal_security.c: added AM_HAL_STATUS_FAIL return for am_hal_security_get_info()

6.3 BLE Stack

1. BLE stack supporting Apollo4Blue now.
2. Cordio stack path changed to third_party/cordio.
3. Added HID/barebone/throughput/beaconscanner/eddystone_url BLE examples to Apollo3/3P.
4. Refactored API for HCI vendor specific commands for Apollo3/3p.

   Function name changed (with backward compatibility):
   from HciVsA3_SetRfPowerLevelEx() to HciVscSetRfPowerLevelEx();

from HciVsA3_ConstantTransmission() to HciVscConstantTransmission();
from HciVsA3_CarrierWaveMode() to HciVscCarrierWaveMode();
added HciVscSetCustom_BDAddr() and HciVscUpdateBDAddress();"

5. Provided APIs to application layer to set custom Bluetooth address in place of using Apollo's device ID. (HciVscSetCustom_BDAddr() and HciVscUpdateBDAddress();)
6. cordio\ble-profiles\sources\apps\app\common\app_db.c: Fixed HID reconnection failure issue when resetting the EVB board by saving bonding into flash.
7. Worked around a Stimer issue to fix OTA failure issue, changes done mainly in hci\ambiq\apollo3\hci_drv_apollo3.c and cordio\wsf\sources\port\freertos\wsf_os.c
8. Fixed memory alignment hard fault issue during ANCS example testing when Cordio stack is compiled with optimization.
9. cordio\ble-host\sources\stack\smp\smp_main.c: Cleared AES queued buffer if AES token mismatch during pairing in SMP module.
10. cordio\ble-host\sources\stack\smp\smp_sc_act.c: Fixed the issue where LE secure connection is not authentically established when there's no IO CAP on either side in SMP module.
11. Turned on compiling optimization (-O3) by default for BLE examples.
12. Bug fix for WsfTimerInit() in wsf_timer.c.
13. Added appExtConnCb[] to app_main.c/h and adv_ext_main.c, adv_ext_api.h to handle extended advertising. (only supported by Apollo4B)
14. Correct protective macro for ble_freertos_amota.h.
15. cordio\ble-host\include\dm_api.h: added DM_CONNLESS_IQ_REPORT_IND and connlessIQReport.
16. cordio\ble-host\sources\hci\ambiq\hci_cmd.c: Added HCI commands for test (HciLeReceiverTestCmdV3(), HciLeTransmitterTestCmdV3())
17. cordio\ble-host\sources\hci\ambiq\hci_cmd_cte.c: Added connectless CTE commands (HciLeSetConnectionlessCteTxParamsCmd(), HciLeConnectionlessCteTxEnableCmd(), HciLeSetConlessIQSampleEnCmd())
18. cordio\ble-host\sources\hci\ambiq\hci_core.c: Added new events HCI_EVT_MASK_LE_CONNLESS_IQ_REPORT_EVT, HCI_EVT_MASK_LE_CONN_IQ_REPORT_EVT, HCI_EVT_MASK_LE_CTE_REQ_FAILED_EVT
19. cordio\ble-host\sources\hci\ambiq\hci_evt.c: added CTE related events handling.
20. cordio\ble-host\sources\stack\dm\dm_conn_cte.c: added handling of HCI_LE_CONNLESS_IQ_REPORT_CBACK_EVT in dmConnCteHciHandler()

21. cordio\ble-host\sources\hci\ambiq\hci_tr.c: hciTrSendCmd() increased data lengh scale from 8bit to 16bit
22. cordio\ble-host\sources\hci\ambiq\hci_vs_ae.c: add HCI_OP-CODE_LE_WRITE_DEF_DATA_LEN event handling in hciCoreExtResetSe-quence().
23. cordio\ble-host\sources\stack\cfg\cfg_stack.h: DM_NUM_ADV_SETS and DM_NUM_PHYS set to 2 to support extended adv.
24. cordio\ble-host\sources\stack\dm\dm_dev.c: added HCI_VENDOR_SPEC_CM-D_CMPL_CBACK_EVT event handling
25. cordio\ble-host\sources\stack\dm\dm_main.c, .h: added DM IDs for HCI event callback table: DM_ID_CIS, DM_ID_CIS, DM_ID_REQ_SCA
26. cordio\ble-profiles\include\app\app_api.h: added definition for MTU_REQ_-SIZE, LE_MAX_TX_SIZE, LE_MAX_TX_TIME; and secPhy in appDevInfo_t to support secondary adv channel
27. cordio\ble-profiles\sources\apps\app\app_master.c: added support for extended scan.
28. cordio\ble-profiles\sources\apps\app\app_slave.c: added support for bond information saving in internal NVM.
29. cordio\ble-profiles\sources\apps\app\app_slave_ae.c: added appSla-veCb.advState[advHandle] = APP_ADV_STATE1 in AppExtSetAdvType()
30. cordio\ble-profiles\sources\apps\app\app_slave_leg.c: added appSla-veCb.advState[DM_ADV_HANDLE_DEFAULT] = APP_ADV_STATE1; in AppSe-tAdvType()
31. cordio\ble-profiles\sources\apps\assettag\assettag_main.c: update assetTag example to support advertise legacy and extended advertising packetes alter-natively.
32. cordio\ble-profiles\sources\apps\locator\locator_main.c: updated locator example.
33. cordio\ble-profiles\sources\profiles\atpc\atpc_main.c, atpc_api.h: added cte support.
34. cordio\ble-profiles\sources\profiles\atps\atps_main.c, atpc_api.h: added cte support.
35. cordio\ble-profiles\sources\services\svc_cte.c: set cteValEnable[] length to 2 bytes.

6.4 BLE Controller Patch

1. Controller patch updated to V0.6 with the following changes:
2. Fixed a few potential Sweyntooth security issues.
3. Fixed channel number less than 2 during channel map update.
4. Added protection for certain TX buffer list operation.
5. Disabled interrupt during AES operation requested from host.
6. Fixed the issue of interrupt nested disable/restore.
7. Optimized 0x28(INSTANT PASSED) issue when receiving error packet during connection update/channel map update procedure.
8. Increased the time spent on preparing for sleep in BLE controller to accommodate variations of Apollo3/3P. This was found to be the root-cause of various disconnection issues.
9. Fixed 0x22(LMP RESPONSE TIMEOUT / LL RESPONSE TIMEOUT) issue when not receiving the acknowledge of LLCP_TERMINATE message from phone.
10. Fixed HCI command timeout issue when reading remote feature in a row.
11. Improved the RSSI accuracy for scan report (only when AGC is disabled)
12. Added one parameter for changing channel reassess duration
13. ANCS example updated with button functions.

6.5 CMSIS

1. Update CMSIS to version 5.0.4
2. apollo3.h and apollo3p.h added new register support for SIMOBUCK
3. apollo3.h correct PAD function names:

   GPIO_PADREGB_PAD4FNCSEL_UART1RX. (was GPIO_PADREGB_PAD4FNCSEL_UART0RX)

   GPIO_PADREGL_PAD44FNCSEL_UART0TX (was GPIO_PADREGL_PAD44FNCSEL_M5nCE6)"
4. apollo3.h Added MSPI_PADOUTEN_OUTEN_SERIAL1 and XIPMIXED enum definitions.
5. apollo3p.h removed GPIO_PADREGD_PAD12FNCSEL_SLnCE. Added MSPI0_PADOUTEN_OUTEN_SERIAL1.

6.6 Devices

1. Added Apollo4 and Apollo4B support to all devices.
2. Added new devices: am_devices_mspi_mx25u12835f.c/h, am_devices_mspi_rm69330.c/h
3. Improved RM67162 device driver with user interface clock selection.
4. Revised s25fs064s driver with style clean up.

6.7 Boards and BSP

1. Added new boards of apollo3_evb_cygnus, and apollo3p_evb_cygnus with various examples.
2. Added conditionals around the new BLE 3.3V power initialization function for Apollo3 and Apollo3p.
3. Customer will have to enable this code now is both BSP and example. (added am_bsp_ble_3p3v_low_power_mode())
4. Added support for multiple MSPI modes (3WIRE, 1-1-2, 1-2-2, 1-1-4, 1-4-4)
5. Correct a typo in apollo3_evb BSP am_bsp_pins.c for AM_HAL_PIN_23_MSPI3 (was AM_HAL_PIN_23_MSPI13).
6. Added PDM and SCARD pins in am_bsp_pins.c for apollo3_evb.
7. Removed Fireball support.
8. Added FT4222 on board SPI to USB converter device support for Apollo3p_evb.
9. Added display module control IO support for Apollo3p_evb.

6.8 Bootloader

Added support for Apollo4 and Apollo4 Blue

6.9 Third_party

Added Apollo4 and Apollo4B support to FreeRTOS v10.1.1.

6.10 Utils

Added support for device Apollo4 and Apollo4B

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