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TN1201
Technical note

Migrating from STM32L15/6xxD to STM32L15/6xVD-X

Introduction

To ease the development of STM32 microcontroller applications, it is important to be able to smoothly replace one microcontroller type with another from the same product family. The purpose of this technical note is to help users with the migration from an STM32L15/6xxD (348KB Flash and 48KB RAM) device to an STM32L15/6xVD-X (384KB Flash and 80KB RAM) device. This document includes the relevant information for users.

Prior to migrating an application, the users need to analyze the hardware migration, the peripheral migration and the firmware migration. To better understand the information included in this technical note, the users should be familiar with the STM32L1 microcontroller family.

For additional information, please refer to the STM32L100xx, STM32L151xx, STM32L152xx and STM32L162xx advanced ARM®-based 32-bit MCUs reference manual RM0038 in which STM32L15/6xxD is ‘Cat.4’ device, STM32L15/6xVD-X is ‘Cat.5’ device, and to the STM32L15/6xxD, STM32L15/6xVD-X datasheets. Documents are available for download from the company website at www.st.com/stm32.

Table 1 lists the STM32 microcontrollers concerned by this technical note.

Table 1. Applicable products

Type	Part numbers
Microcontrollers	STM32L151QD, STM32L151RD, STM32L151VD, STM32L151ZD, STM32L152QD, STM32L152RD, STM32L152VD, STM32L152ZD, STM32L162QD, STM32L162RD, STM32L162VD, STM32L162ZD, STM32L151VD-X, STM32L152VD-X, STM32L162VD-X

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1 Codification/package changes

Table 2 presents the list of references, part numbers and packages for the STM32L15/6xxD and STM32L15/6xVD-X products.

Table 2. STM32L15/6xxD and STM32L15/6xVD-X codification summary

Device description	Reference products	Part numbers	Packages
Up to: STM32L15/6xxD - 384KB Flash 48KB RAM 12KB EEPROM	STM32L151xD STM32L152xD STM32L162xD	STM32L151QD STM32L151RD STM32L151VD STM32L151ZD STM32L152QD STM32L152RD STM32L152VD STM32L152ZD STM32L162RD STM32L162VD STM32L162ZD	LQFP144 LQFP100 LQFP64 UFBGA132 WLCSP64
Up to: STM32L15/6xVD-X - 384KB Flash 80KB RAM 16KB EEPROM	STM32L15/6xVD-X	STM32L151VD-X, STM32L152VD-X, STM32L162VD-X	LQFP100 WLCSP104

The changes and similarities in the codification/packages in STM32L15/6xVD-X versus STM32L15/6xxD are the following:

- the packages are the same except the WLCSP packages,
- the pinout is the same except for WLCSP packages.

2 Hardware migration

The STM32L15/6xxD and STM32L15/6xVD-X devices are produced in the same packages and are pin-to-pin compatible except for WLCSP packages. All common peripherals share the same pins.

The FSMC and SDIO and OPAMP3 peripherals are not present in STM32L15/6xVD-X devices. In case FSMC or SDIO or the OPAMP3 were used in STM32L15/6xxD and are no longer needed in the STM32L15/6xVD-X-based new design, some hardware changes are needed when migrating from STM32L15/6xxD to STM32L15/6xVD-X devices.

In case FSMC or SDIO or OPAMP3 peripheral were not used in STM32L15/6xxD hardware design, the transition from the STM32L15/6xxD device to the STM32L15/6xVD-X device is simple. The device can be replaced without any hardware change on the application PCB (except for WLCSP).

In case of moving from WLCSP64 to WLCSP104 there is of course a hardware redesign needed.

3 Peripheral migration

Table 3 lists the main product peripherals and system features for both product sets. The common peripherals are supported with the dedicated firmware library (from version 1.3.0) without any modification. Users can change the instance and all the related features (clock configuration, pin configuration, interrupt/DMA request).

The main peripherals changes are described in *Section 3.1: Main peripherals/system changes*. The changes which are also needed in the development tools configuration are described in *Section 4: Development tool adaptations*.

Table 3 presents the differences between STM32L15/6xxD and STM32L15/6xVD-X devices regarding the peripherals and system differences, as well as the impact on the software.

Table 3. STM32L15/6xxD and STM32L15/6xVD-X device difference summary

Function	STM32L15/6xxD	STM32L15/6xVD-X	Behavior / impact to software
Core @ 32MHz	ARM® Cortex®-M3	ARM ®Cortex®-M3	-
Max DMIPS/MHz	1.25	1.25	-
Flash [KB]	Dual bank 2 x 192 KB	Dual bank 2 x 192 KB	-
RAM [KB]	48	80	Enhancement. The application can use larger RAM memory space.
EEPROM [KB]	Dual bank 2 x 6 KB	Dual bank 2 x 8 KB	Enhancement. The application can use larger EEPROM memory space.
Backup registers [B]	128	128	-
Flash interface [bits]	64/32	64/32	-
Bootloader	USART/USB	USART/USB	-
DMA / channels	2 / 12ch	2 / 12ch	-
USART/UART	3 / 2	3 / 2	-
SPI / I2S	3 / 2	3 / 2	-
I2C	2	2	-
USB 2.0	1 x FS	1 x FS	-
LCD [seg x com]	8 x 40	8 x 40	-
LCD rails decoupling	NO	NO	-
TIMER [32-bit/16-bit/Lite]	1/6/2	1/6/2	-
IWDG/WWDG	1/1	1/1	-
Clock	HSI/HSE/LSI/LSE CSS on HSE/LSE	HSI/HSE/LSI/LSE CSS on HSE/LSE	-

Table 3. STM32L15/6xxD and STM32L15/6xVD-X device difference summary (continued)

Function	STM32L15/6xxD	STM32L15/6xVD-X	Behavior / impact to software
HSI/HSI clock trimming	+/- 1%	+/- 1%	-
RTC version	RTC V2.0	RTC V2.0	-
DAC	2	2	-
ADC (total / fast channels)	1 (40 / 6)	1 (40 / 6)	-
Comparator	2	2	-
Touch sensing [channels]	34	34	-
Temperature sensor	YES	YES	-
Internal voltage reference	YES	YES	-
Unique ID	YES	YES	-
MCO	YES	YES	-
FSMC	YES	NO	FSMC is not present. Hardware and software must be adapted in STM32L15/6xVD-X if FSMC is used in STM32L15/6xxD.
SDIO	YES	NO	SDIO is not present. Hardware and software must be adapted in STM32L15/6xVD-X if SDIO is used in STM32L15/6xxD.
Operational amplifier	3	2	OPAMP3 is not present. Hardware and software must be adapted in STM32L15/6xVD-X if OPAMP3 is used in STM32L15/6xxD.

3.1 Main peripherals/system changes

Some system properties and peripherals configuration are changed in the STM32L15/6xVD-X device. The following sections describe these changes.

3.1.1 Memory space increase

The memory areas are increased in the STM32L15/6xVD-X device as follows:

- RAM: from 48 KB to 80 KB
- EEPROM: from 12 KB to 16 KB

The memory increases permit to use STM32L15/6xVD-X device in more complex applications.

3.1.2 FSMC removal

The flexible static memory controller (FSMC) is not present in the STM32L15/6xVD-X device. The software and hardware must be adapted when migrating to STM32L15/6xVD-X device in case the FSMC peripheral is used in the hardware design using the STM32L15/6xxD device.

3.1.3 SDIO removal

The secure digital input/output interface (SDIO) is not present in the STM32L15/6xVD-X device. The software and hardware must be adapted when migrating to STM32L15/6xVD-X device in case the SDIO peripheral is used in the hardware design using the STM32L15/6xxD device.

3.1.4 OPAMP3 removal

One operational amplifier (OPAMP3) is not present in the STM32L15/6xVD-X device. The software and hardware must be adapted when migrating to STM32L15/6xVD-X device in case the OPAMP3 peripheral is used in the hardware design using the STM32L15/6xxD device.

3.2 Device limitation changes/updates

The errata sheet on STM32L15/6xVD-X devices is available on the company website at *www.st.com*. Several limitations that had been reported for the STM32L15/6xxD have been solved, while other limitations have been introduced. This section describes the changes in the device limitations.

Please refer to STM32L15/6xxD errata sheet and STM32L15/6xVD-X errata sheet for details on the device limitations.

3.2.1 STM32L15/6xxD specific limitations

The following limitations that apply to STM32L15/6xxD devices do not apply to STM32L15/6xVD-X devices:

- Missing analog switch on GPIO PC10,
- Pull-up on PB7 when configured in analog mode,
- Debugging Stop mode with WFE entry.

3.2.2 STM32L15/6xVD-X specific limitations

The following limitations which do not concern the STM32L15/6xxD devices have been introduced for STM32L15/6xVD-X devices:

- Erase/program operations partially executed if used multi-cycle STRD instruction is interrupted,
- Data EEPROM cycling is limited to 100 kcycles instead of 300 kcycles.

4 Development tool adaptations

When migrating from STM32L15/6xxD to STM32L15/6xVD-X some changes in the development tools are necessary. Following the change of device identifier (DEV_ID) and some peripherals changes with the addition of new features, it has been necessary to upgrade the development tools as detailed hereafter.

1. DEV_ID changes:
   In STM32L15/6xxD devices, DEV_ID = 0x436
   In STM32L15/6xVD-X devices, DEV_ID = 0x437
   If the software or programming tool is using DEV_ID[11:0] field (in DBGMCU_IDCODE register) then the relevant changes must be applied in the software or tool.
2. Changes in the development tool configurations:
   a) IAR - install the latest version or apply the patch provided by ST support team to support the STM32L15/6xVD-X device, and change the device type in the configuration.
   b) Keil - install the latest version that supports the STM32L15/6xVD-X device, change the device type in the configuration, and change the ST-LINK programming algorithm.
   c) Others - install the latest version that supports the STM32L15/6xVD-X device, and change the device type in the configuration.
3. STM32L1xx standard peripherals library update:
   STM32L15/6xVD-X devices are supported in the latest version of STM32L1xx standard peripherals library. Make sure to use the latest version of STM32L1xx standard peripherals library to use the STM32L15/6xVD-X device features.
   a) Define the macro STM32L1XX_XL and use in the project the *startup_stm32l1xx_xl.s* file.
   b) Rebuild the existing project with the new library so it can be run on STM32L15/6xVD-X devices.
4. Programming tool adaptations:
   In the programming tool configurations (for example ST-LINK with the related software) the device type must be changed to correctly program the new STM32L15/6xVD-X devices.
   Use the latest ST Visual Programmer (STVP) or the latest ST-LINK utility which support the STM32L15/6xVD-X devices (both are available at www.st.com/stm32).

5 Consumption comparison

The STM32L15/6xVD-X devices feature less dynamic consumption than the STM32L15/6xxD devices, due to the advanced manufacturing technology. The power consumptions in low-power modes are on similar levels.

Table 4 shows the differences in power consumption between the devices in the various operating modes.

Table 4. Consumption difference summary

Parameters (all at V_{DD}=3V)	STM32L15/6xxD	STM32L15/6xVD-X
Full speed from flash (32 MHz in HSI)	325 µA/MHz	270 µA/MHz
MSI clock from flash (4.2 MHz)	230 µA/MHz	195 µA/MHz
Low-power Run from RAM @ 32 kHz	12.5 µA	11.0 µA
Low-power sleep from RAM @ 32 kHz	6.1 µA	5.5 µA
Stop mode	476 nA	560 nA
Stop mode with RTC on LSI	1.35 µA	1.40 µA
Standby mode	305 nA	290 nA
Standby mode with RTC on LSI	1.16 µA	1.04 µA

6 Revision history

Table 5. Document revision history

Date	Revision	Changes
09-Jan-2015	1	Initial release.