AN2695
Application note

Differences between the ST10F276Z5 and its emulator

Introduction

The ST10F276Z5 is a new device of the ST10 family. Compared to the ST10F269Zx, it has more Flash memory, more RAM and better CPU performance. The serial communication peripherals have been enhanced by the addition of one I^2C, one ASC (asynchronous serial interface) and one SSC (synchronous serial interface) to the existing ones. CAN communication has been also improved by the replacement of B-CAN modules by C-CAN modules. These new features widely extend the application field of the ST10 family.

This application note covers the design and the emulation aspects in using the ST10F276Z5.

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1 ST10F276Z5 Xperipheral support

CAN module, I^2C, second ASC unit, second SSC unit, second PWM (pulse-width modulation) unit, real-time clock, interrupt subnode controller and clock-out programmable generator are ST10F276Z5 Xperipherals.

1.1 Real-time aspects

All Xperipherals are functionally supported but **not at full speed**.

The ST10F276Z5 silicon runs with 2 wait-states while the emulator requires 4 wait-states with those peripherals. This limitation is independent of the frequency of the CPU clock and is applicable to any Xperipheral except for memories.

1.2 Fully supported peripherals

Compared to the ST10F269Zx, the ST10F276Z5 has the following new peripherals: CAN module, I^2C, a second ASC unit, a second SSC unit, a second PWM unit, interrupt subnode controller and clock-out programmable generator.

All these new peripherals are fully functionally supported in emulation if the initialization sequence of the XPEREMU register is implemented. Refer to the latest ST10F276Z5 datasheet available from the STMicroelectronics website www.st.com.

2 Peripherals partly supported by the emulators

Some of the ST10F276Z5 peripherals are partly supported by the emulators. This section describes the limitations encountered in emulating these peripherals.

2.1 A/D converter

Compared to that of the ST10F269Zx, the ST10F276Z5 ADC has been improved to support 24 channels instead of 16 and to have a faster conversion time. These improvements have a small impact on the emulation and compatibility with the ST10F269Zx. They are explained in the following sections.

2.1.1 ADC calibration process

Description: the ST10F276Z5 ADC auto-calibration process cannot be interrupted for conversion. It was interruptible with the ST10F269Zx and the ST10 bond-out. The duration of the calibration of the ST10F276Z5 is 40 650 cycles, which is very close to the 40 000 CPU clock cycles of the ST10F269Zx. The calibration starts automatically on each Reset (external_hardware, internal_hardware or software reset). During the auto-calibration, the ADCON.ADBSY bit is set (same behavior as the ST10F269Zx and ST10 bond-out).

Software impact: before starting the 1st ADC conversion, the application software should check the busy bit in the ADCON register (ADBSY=1 during auto-calibration). There is no impact for subsequent ADC configuration changes.

Hardware impact: no impact.

ST10F276Z5 emulation impact: no impact if ST's advice is implemented. Real-time differences due to the change in calibration process duration have to be analyzed for each application.

Hint: check the busy bit in ADCON before the 1st initialization of the ADC.

2.1.2 ADC conversion timings

Description: to allow faster conversion, the ADC sampling clock has been changed. For the same software configuration, this results in different sampling times for the ST10F276Z5 compared to the ST10F269Zx and the ST10-emulator. To keep the same real-time behavior, the ADC overall timings between 2 consecutive conversions have not been changed.

Software impact: to avoid issues caused by sampling time not coherent with external RC filters, it is proposed to modify the software to check which processor of the ST10F276Z5 or the emulator is running the software (by checking ID-chip register), and to set the ADCON sampling clock accordingly.

Hardware impact: no impact.

ST10F276Z5 emulation impact: no impact if ST's advice is implemented.

2.1.3 ADC power consumption control

Description: the ST10F276Z5 ADC can be shut off to further optimize power consumption. This is done through the ADCON.6 (ADOFF) bit. This bit is not supported by the ST10 bond-out. Application software should only write to this bit and not check it.

Software impact: no impact if ST's advice is implemented.

Hardware impact: no impact.

ST10F276Z5 emulation impact: no impact if ST's advice is implemented.

2.2 Real-time clock

Description: an external oscillator is required for the RTC clock of the ST10F276Z5 emulators because the low-power oscillator used to clock the ST10F276Z5 RTC is not supported by the emulators.

Also, as the ST10F276Z5 in emulation mode cannot know if the bond-out is executing a power-down instruction, the RTCCON.7 (RTOFF) bit cannot be emulated, only the default value'0' (RTC keeps running during power-down) can be supported.

Partial implementations: some emulators do not gate the RTC clock to block it when the emulation is stopped. Some emulators also do not decode the RTCCON.8 (OSC) and RTCCON.9 (OFF32) bits. Please, contact your emulator provider to have more information on the RTC support.

Software impact: no impact for the Idle mode. For power-down, please refer to the documentation given by the emulator supplier.

Hardware impact: external crystals for RTC are not supported. An external oscillator is required to supply the emulator RTC input clock.

ST10F276Z5 emulation impact: no impact in Idle mode if ST's advice is implemented. For power-down, please refer to the documentation given by the emulator supplier.

2.3 Standby RAM

Description: the contents of the ST10F276Z5 standby RAM are not lost when the main supply is switched off. If the standby supply is switched off while the circuit has no main supply, the standby RAM contents are lost. ST10F276Z5 emulators do not support the standby pin and their supply is different from the application supply (ST10 bond-out is still supplied if main application is switched off).

Software impact: no impact.

Hardware impact: standby functionality pin is not fully supported.

ST10F276Z5 emulation impact: the main functionality of the standby RAM is emulated. The ST10 bond-out memory contents are kept when the main supply is switched off but the standby RAM functionality is not fully supported. The RAM contents are not lost when the main and standby supplies of the application are switched off.

3 ST10F276Z5 registers not supported by the emulator

This section describes all the emulation issues caused by the non-implementation of some ST10F276Z5 registers in the ST10 bond-out and ST10F276Z5 emulators.

3.1 Software advice for non-implemented registers

When an ST10F276Z5 register is not implemented in the bond-out:

- avoid unnecessary data read and check operations in this register
- if some read accesses in user mode are necessary, use the CPU IDCHIP register to detect which CPU is running the code. Then, allow the check on this register only for the ST10F276Z5. If running from the bond-out, use a predefined, but non-initialized, memory variable to set the desired configuration during emulation.

3.2 Port4 registers

Description: the ST10F276Z5 ODP4 register is not implemented on the ST10 bond-out. This register is used to set the CAN-TxD pin handling alternate functions in push-pull or open-drain. Usually, the open drain configuration on the CAN-TxD lines is used to put two CAN modules in parallel.

Software impact: application software should only write to this register.

Hardware impact: no hardware impact if ST's advice is implemented by the emulator party (check with your emulator supplier).

ST10F276Z5 emulation impact: no impact if ST's advice is implemented and if the contents of the register are fixed at initialization (never changed during run time) and if the emulator is properly configured.

Hint: use the CANPAR bit in the XMISC register to configure the two modules in parallel.

Note: This limitation is already present in the ST10F269Zx.

3.3 Port5 registers

Description: the ST10F276Z5 P5DIDIS register is not implemented in the emulator. This register is used to enhance the accuracy of analog inputs within the temperature and supply voltage ranges.

Software impact: application software should only write to this register.

ST10F276Z5 emulation impact: no impact if software recommendations are used.

Note: This limitation is already present in the ST10F269Zx.

3.4 XPERCON register

Description: this register is not implemented in the emulator, but is implemented in the ST10F276Z5. The emulator XPeripherals are enabled by the user in the emulator environment.

Software impact: application software should only write to this register.

ST10F276Z5 emulation impact: no impact if the software recommendations are used and if the emulator is properly configured.

4 ST10F276Z5 registers partly supported by the emulator

This section describes all the emulation issues caused by ST10F276Z5 registers that are implemented in the emulator in a different way in the ST10F276Z5 (new bits added or modified bit functionality).

4.1 WDTCON register

Description: this register is implemented in the ST10 bond-out chip but not all the bits used to identify the reset cause are implemented.

Software impact: the cause of the reset cannot by known by software when using emulators.

ST10F276Z5 emulation impact: it is proposed:

- to simulate the reset causes during emulation,
- to write the reset procedure so as to detect, via the IDCHIP register, which of the ST10F276Z5 or the bond-out is running the software. Then, to use a non-initialized variable (initialized by the user before running emulation) to check the reset cause when running code with the bond-out.

5 ST10F276Z5 peripherals not supported by the emulators

This section describes all emulation issues caused by peripherals not supported by the ST10 emulators.

5.1 ST10F276Z5 Flash memory

Description: in emulation, the bond-out is running code from the RAM mapped into the ST10 bond-out memory space.

ST10F276Z5 emulation impacts:

- the automatic remapping of the Flash memory in normal or bootstrap mode is not supported. This leads to have a specific software for each memory mapping.
- the Flash memory specificities are not supported (Flash programming commands are not recognized, reading any Flash memory register leads to undefined contents).

ST10F276Z5 Flash memory limitations: during emulation, some emulators do not protect the emulated Flash memory against write access by the ST10F276Z5. The bond-out, when properly configured, protects the internal Flash memory. Then, external hardware placed on the emulated XFlash can protect it during emulation.

Please, contact your emulator provider to have more information on the Flash memory support.

5.2 Bootstrap and Alternate Boot mode

Description: the ST10F276Z5 bootstrap modes cannot be supported by the emulator. The ST10F276Z5 has a dual bootstrap via UART or CAN and supports alternate boot.

This limitation is not specific to the ST10F276Z5, it is also applicable to the ST10F269Zx.

ST10F276Z5 emulation impacts:

- the dual boot is not supported
- alternate bootstrap is not supported (ST10 bond-out does not decode Port0 configuration for alternate boot).

To debug the bootstrap software routines, it is required to have a specific software for this mode. This specific software, loaded into the emulator memory, must have the same boot software as the one inside the boot-Flash of the ST10F276Z5, and all the needed software from the other blocks of the Flash memory.

6 Maximum frequency

Processed in 0.18 µm technology, the ST10F276Z5 is designed to run at up to 64 MHz.

The emulators' maximum frequency is limited to 50 MHz. Real-time emulation is limited to 50 MHz.

Application debugging at higher frequencies is possible by using embedded monitors.

Important note: it is highly recommended not to overclock emulators.

7 DC/AC parameter differences

Although minimized as much as possible, there are differences in DC and AC parameters.

For detailed differences in DC or AC parameters, please refer to the latest ST10F276Z5 datasheet.

8 Revision history

Table 1. Document revision history

Date	Revision	Changes
06-Mar-2008	1	Initial release.

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