F276 Emulation with the Nohau *EMUL-ST10* Emulator

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Background

The F276 microcontroller from STMicroelectronics is the latest ST10 family member. The F276 is supported with the Nohau EMUL-ST10-PC (revision C) 50 MHz bondout emulator. It is connected to a target board in Figure 1. This emulator uses the ST10-R201 50 MHz bondout controller.

The *NEW* ST10 Resources

These are the ST10 parts following the original 167. Some are available with FLASH (F), ROMless (R) and some with masked ROM (C). The 2 means the device has a MAC unit. 1 has no MAC.

F167	current	1 CAN
F168	current	1 CAN
F269	current	2 CAN
F280	current	2 CAN, XPWM, etc.
F276	new device	2 CAN, XPWM, XASC, XSSC, XI2C, XRTC, etc.

Figure 1

The F276 has the ST10 feature set plus:
- 64 MHz clock operation PQPF/ TQFP
- Contact ST for other parts
- 31.25 ns instruction time (64 MHz)
- Multiply/Accumulate Unit: MAC
- 2 CAN 2.0b ports
- XPWM + XASC + XSSC + XI2C + XRTC
- 512K FLASH - 5 volt
- 320K XFLASH - 5 volt
- 3 volt core, 5 volt peripherals
- 3 volts is internally generated
- 2K internal RAM (IRAM)
- 66K extension RAM (XRAM)
- 10 bit A/D Conv. - 16 + 8 channel
- Idle and Power-Down modes
- 144 pin PQFP/TQFP package
- Temperature -40 to +125 C
- EXISEL register selects external interrupt sources.

Two Chip Emulation

The ST10-R201 50 MHz bondout does not have all the XBUS peripherals that need to be emulated, so a two chip emulation system is used. One chip is the bondout and the other is a production chip in emulation mode.

A daughtercard containing a production F276 is plugged into the emulator board of the EMUL-ST10. Figure 2 shows the F276 daughtercard. Figure 3 shows it installed in the emulator.

Figure 2

This F276 chip will provide access to all of its XBUS peripherals to the emulator. This F276 is placed in a special emulation mode. This disables the CPU and the XBUS peripherals are then available to the bondout controller through the address and data bus.

Nohau provides the latest XBUS modules by using all XBUS peripherals from the daughtercard rather than from the bondout controller. The F276 card provides the two CAN, XPWM, XASC, XSSC, XI2C, XRTC, XFLASH and XRAM XBUS peripherals.

The daughtercard is user installable. To activate the F276 daughtercard and to configure the emulator, select F276 in the Configuration screen during the Seehau Configuration process.

Figure 3

Nohau also has cards for the 167, the 168, the 269 and the 280. They are activated in the same manner.

EXISEL and ODP4 Registers

These are new registers on the F276 that are not supported by the current ST10-R201 bondout controller. Nohau does an electronic replacement of these registers with the F276 daughtercard.

S1 sets the EXISEL register. JP3, JP4, JP7 and JP8 takes the P2.8 to P2.11 signals from the S1 settings or directly from the target adapter and sends them to the bondout controller.

JP5 and JP6 selects P4.6 (CAN1_TxD) and P4.7 (CAN2_TxD) to the open drain or push-pull mode.

EXISEL Register Recreation

EXISEL means *External Interrupt Source Selection*. This 16 bit R/W register determines how interrupts coming from the CAN X-Peripheral modules are combined with the Fast External Interrupts on Port 2.8 through Port 2.11.

The EXISEL register is not located on the ST10-R201 bondout microcontroller. It must be recreated by the emulator hardware or more specifically, by the F276 daughtercard.

EXISEL is located at F1DA in the ESFR space. There are 8 "sub-registers" each two bits called EXI0SS to EXI7SS. EXI4SS to EXIS7SS are not used.

EXI0SS to EXI3SS are programmed by setting the dip switch S1 and setting JP3, JP4, JP7 and JP8 on the F276 daughter card.

S1 Bit	Ext Int	Selection Source
0, 1	EXI0SS	P2.8, CAN1_RxD
2, 3	EXI1SS	P2.9, CAN2_RxD
4, 5	EXI2SS	P2.10, XRTC_SecIT
6, 7	EXI3SS	P2.11, XRTC_AlarmIT

S1 Bit Settings for each EXIxSS	
00	input from associated P2.x
01	input from alternate source
10	Input P2.x OR alternate source
11	Input P2.x AND alternate source

For more information please see the STMicroelectronics F276 data sheet.

The FPGA on the F276 daughtercard uses the setting of S1 to provide the AND and OR function of the EXISEL register.

JP3, JP4, JP7 and JP8 select whether the Fast Interrupts are fed to the bondout from the target adapter or from the FPGA. If P2.8 to P2.11 are used as general purpose ports, then the appropriate jumper must be set to 1-2, lower position, (P2.8 - P2.11). To enable the EXISEL recreation by sending the FPGA outputs to the bondout, the appropriate jumpers must be on 2-3, upper position, (Alt Src).

If the EXISEL register is read, all zeroes will be returned.

ODP4 Register Recreation

The 2 bit ODP4 register sets P4.6 and P4.7 output pads to either push-pull or open drain. P4.6 has an alternate function as CAN1_TxD and P4.7 as CAN2_TxD. If the bit is set to 0, the line is set to push-pull and a 1 sets it to open drain.

The ODP4 register is not located on the ST10-R201 bondout microcontroller. It also must be recreated by the emulator hardware or more specifically, by the F276 daughtercard.

JP5 selects P4.6 as open drain (upper position) or push-pull (lower position) and JP6 sets P4.7 similarly *only when they are configured as CAN outputs.* These jumpers are clearly marked "push-pull" or "open-drain".

If P4.6 and P4.7 are used as segment lines, JP5 and JP6 must be set to push-pull to enable these signals to go directly from the bondout to the target.

Emulator Jumper Settings and Emulation of the two CAN and XI2C

There are four jumpers (JP16 to JP20) on the end of the emulator.

CAUTION: They must be set to the lower position (P4.x) when the F276

daughtercard is used. The F276 daughtercard is automatically configured by the application software thanks to the XPEREMU register and the XMISC register, the user doesn't have anything to do.

CAUTION: Whenever the XPEN bit of the SYSCON register is set, the register XPEREMU must be written with the same content of XPERCON: this is mandatory in order to allow a correct emulation of the new set of features introduced on X-BUS for the new ST10 generation.

Emulation of the XSSC, XASC and XPWM

The F276 daughtercard is automatically configured by the application software thanks to the XPEREMU register, the user doesn't have anything to do.

CAUTION: Whenever the XPEN bit of the SYSCON register is set, the register XPEREMU must be written with the same content of XPERCON: this is mandatory in order to allow a correct emulation of the new set of features introduced on X-BUS for the new ST10 generation.

P5DIDIS Register Recreation

The P5DIDIS register is provided for additional disturb protection support on analog inputs for port P5. If the bit is set to 0 then the digital input is enabled. If the bit is set to 1 the digital input is disabled.

The P5DIDIS register is not located on the ST10-R201 bondout microcontroller. It also must be recreated by the emulator hardware or more specifically, the F276 daughtercard.

JP12 selects P5DIDIS (P5DIDIS.15...P5DIDIS.0) as "0" or "1". When JP12 is off, JP12 selects P5DIDIS (P5DIDIS.15...P5DIDIS.0) as "0". When JP12 is on, JP12 selects P5DIDIS (P5DIDIS.15...P5DIDIS.0) as "1".

Emulation of A/D Converter

The XP1DIDIS register is provided for additional disturb protection support on analog inputs for port P1L. If the bit is set to 0 then the digital input is enabled. If the bit is set to 1 then the digital input is disabled.

In order to configure the port P1L as analog inputs, the register must be set properly. The XP1DIDIS register is not located on the ST10-R201 bondout microcontroller. It also must be recreated by the emulator hardware, or more specifically, the F276 daughtercard. The F276 is automatically configured by the application software thanks to the XPEREMU register, the XMISC register and the XP1DIDIS register, the user doesn't have anything to do.

CAUTION: Whenever the XPEN bit of the SYSCON register is set, the register XPEREMU must be written with the same content of XPERCON: this is mandatory in order to allow a correct emulation of the new set of features introduced on X-BUS for the new ST10 generation.

Emulation of PLL Factors 16, 10 and 8

There are new PLL factors 16, 10 and 8 on the F276 that are not supported by the current ST10-R201 bondout controller. Nohau implements the emulation of PLL factors 16, 10 and 8 with the EMUL-ST10 emulator board (revision C). The user must edit the clock field in the configuration screen such that the value in the clock field exactly equals 16, 10 or 8 times the value of XTAL1. This can be done either from the on-emulator-board oscillator or from the target board oscillator/crystal.

Emulation of the XRTC

There is a new XRTC prescaler on the F276 that is not supported by the current ST10R201 bondout controller. It also must be recreated by the emulator hardware, more specifically, the F276 daughtercard. JP1 selects the clock oscillator to be used by the XRTC as the main oscillator (lower position) or the low power 32KHz oscillator (upper position). JP2 selects the low power 32KHz oscillator as the 32KHz oscillator on the F276 daughtercard (lower position) or the 32KHz oscillator on the user's target (upper position).

Since these are jumpers, it is not possible to switch dynamically from the main oscillator to the low power 32KHz oscillator as the jumpers must be physically moved.

Emulation of the new CLKOUT prescaler

There is a new CLKOUT prescaler on the F276 that is not supported by the current ST10R201 bondout controller. It also must be recreated by the emulator hardware, more specifically, the F276 daughtercard. JP11 selects P3.15 as a standard I/O (lower position) or CLKOUT (upper position). Since it is a jumper, it is not possible to switch dynamically from standard I/O to CLKOUT as the jumper must be physically moved.

Some Limitations

There are a few limitations with this setup but none are serious.

- ST10R201 bondout chip's ADC is lower performances than ST10F276's one.

- ST10R201 bondout chip's maximum CPU frequency (50 MHz) is lower than the ST10F276's maximum CPU frequency (64 MHz).

- ST10R201 bondout chip's program memory (RAM for IFLASH emulation) can not support the write access to IFLASH done by the application.

- ST10F276 daughtercard's E_XFLASH (RAM for XFLASH emulation) can not reproduce the XFLASH access restriction and other features like protection accesses.

- The use of the 0xE800~0xEFFF (2Kbyte) XPER window for external access can not be emulated.

- P4.6 and P4.7 open-drain choice is static and limited to CAN TXD alternate function. Using P4.6 and P4.7 as I/O in open drain is not provided (same feature as the device itself).

- As the EXISEL register doesn't exist in the bondout, its value is static and cannot be changed during code execution.

- The use of port P1L as ADC channels and in the same time Port P5 as Standard I/O can not be emulated.

- Bit ADOFF in the ADCCON register is not supported.

- Bits RTOFF, OSC, OFF32 in the RTCCON register are not supported.

- Bits SWR, SHWR, LHWR and PONR in the WDTCON register are always read at value 0, because they are not implemented in the bondout.

Summary

Follow these quick steps to provide F276 support to your emulator:

- EMUL-ST10-PC (revision C) 50MHz is required.

- Install the daughtercard in Figure 3.

- Select F276 in Seehau config menu or by editing the startup .bas file.

- Set the switches and jumpers as to the information in the red headings.

Part Numbers

EMUL-ST10-PC/XP276- daughtercard

Other STMicroelectronics Devices Nohau Supports

Nohau supports all ST10 devices to their current speeds. Nohau supports the "one-clock-per-instruction" Super10 family to 100 MHz and has an 80 (90) MHz ST10 emulator EMUL-ST10/FA in addition to the 50 MHz emulator.

Conclusion

STMicroelectronics F276 support is now available from Nohau worldwide. For pricing or the latest information on this or any Nohau products, consult your local Nohau rep or contact Ice Technology in the USA.