ST9 FAMILY

Evaluation Board

GETTING STARTED

Release 1.7

October 2002

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ST9 FAMILY

EVALUATION BOARD GETTING STARTED

1 OVERVIEW

The aim of this Evaluation Board is to provide the user with a ready-to-use hardware environment for ST9 general purpose microcontrollers. The kit contains the hardware required for testing the principal peripherals, such as timers, SPI and SCI interfaces, A/D converters and I/O Ports. This kit, however, does not cover CAN and J1850 devices, but a wire-wrap area, available for connecting specific components, is included and can be used to connect CAN or J1850 transceivers. If the same peripheral is present several times on the MCU (e.g. the multi-function timer on the ST92F120/F124/F150/F250) the board may be used to test at least one of them, but not always all of them.

1.1 HARDWARE

Two kits are available: the ST9GP-EVAL and the ST92F150-EVAL. Three boards are included in each kit. The motherboard contains the entire hardware environment.

The ST90158 daughterboard (ST9GP-EVAL only) is used to support the ST90158 PQFP80 microcontroller or the ST90158 emulator with a PQFP80 connector (supplied with the Emulator Kit).

The ST92F120 daughterboard is used to support the ST92F120/F124/F150/F250 PQFP100 microcontrollers or the ST92F120 and ST92F150 emulators with a PQFP100 connector (supplied with the Emulator Kit).

The ST92F150-TQFP64 daughterboard (ST92F150-EVAL only) is used to support the ST92F124/F150 TQFP64 microcontroller.

Rev. 1.7

Table of Contents

2 GETTING STARTED

2.1 KIT CHECKLIST

The ST9 Evaluation Board Kits contain the following material:

■ Motherboard for the ST9 Evaluation Board

■ ST90158-PQFP80 Daughterboard (ST9GP-EVAL only)

■ ST92F120-PQFP100 Daughterboard

■ ST92F150-TQFP64 Daughterboard (ST92F150-EVAL only)

■ AD/DC Adaptor

■ RS232 Serial Cable (male-male)

2.2 MOTHERBOARD

2.2.1 Power Supply

Carry out the following procedure to power-on the ST9 Evaluation Board:

– Connect the jack of the AC/DC adaptor to connector J3 on the motherboard. If the evaluation board is being used with an emulator, the emulator should always be switched ON first, and the motherboard afterwards. To switch OFF the evaluation board, first switch OFF the motherboard, and the emulator afterwards.

The output voltage of the AC/DC adaptor is aproximately 12 V. A voltage regulator is used to control the voltage supply to all board components. The voltage can be adjusted between 2.5 and 6 V. Each time the V_{CC} value is changed, the voltage must be monitored to ensure that the maximum supply voltage allowed for board components (5.5 V) is not exceeded. The 7-segment displays may not work properly if voltage V_{CC} is less than 3.5 V. Refer to Section 2.2.5 "Direct 7-segment Display" to configure them correctly.

Memory Information

When using the board at low voltage, all board components will work, except for the memories. In order to use the board at low voltage, a memory that supports low voltages must be installed. Refer to Section 2.2.6 "Memories" for more information.
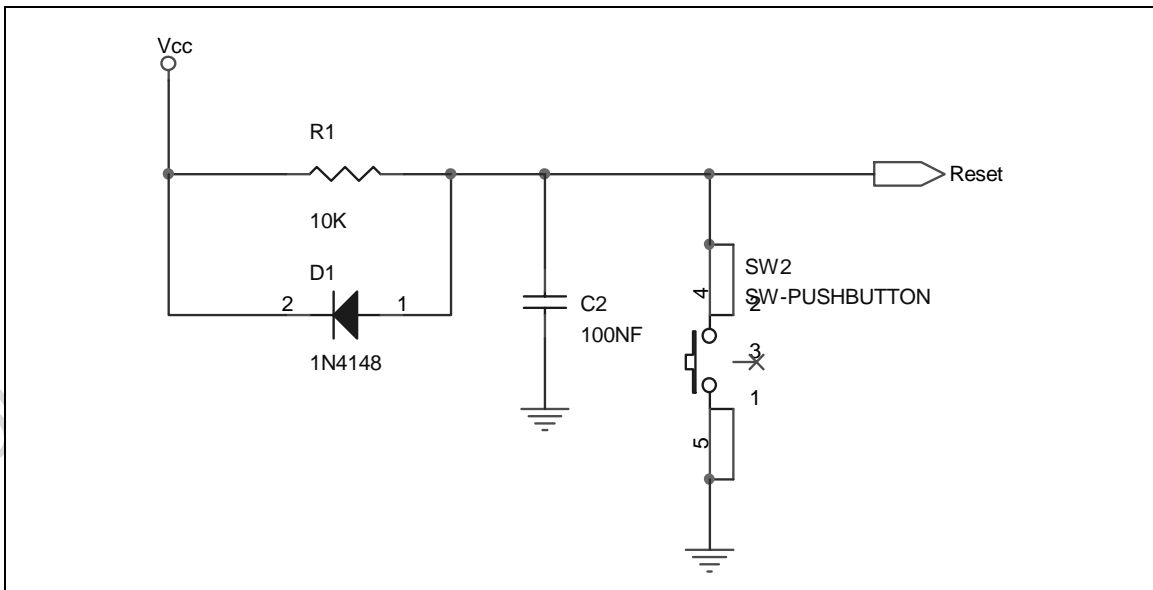
Figure 1. Power Supply Diagram
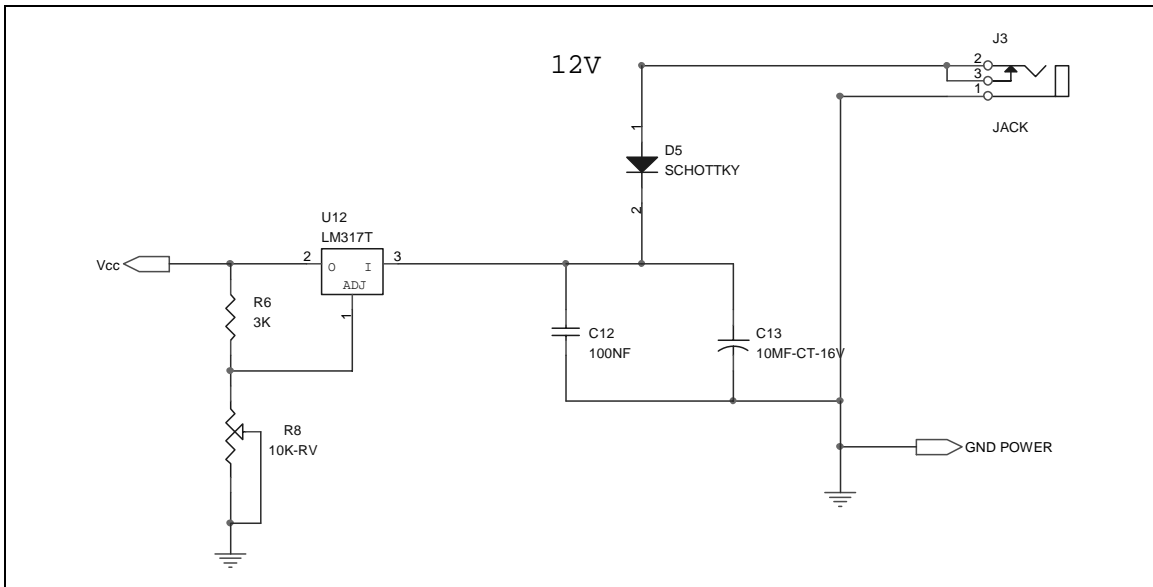
2.2.2 Reset Circuit

A reset circuit located on the motherboard (R1, D1 and C2) is used to guarantee that the reset pin is pulled LOW until the voltage supply is stabilized at the correct level. A push-button switch (SW2) is provided to manually reset the device (MCU or emulator) being evaluated.

**Figure 2. Reset Diagram**

2.2.3 Connector Layout

Most of the MCU pins can be monitored or controlled by using the connectors located on the motherboard. Connectors are directly linked to parallel I/O ports P0, P1, P4, P5, P6 and P7, as well as to 3 other ports connected to PA, PB and PC. To know which port is connected to PA, PB or PC, refer to Section 2.3.5 "I/O Port Connection". In addition, an 8-bit connector is available for specific signals such as RW, AS, DS, I²C data and clock SCI transmission and reception signals.

The schematic diagrams for all connectors are available in the appendix.

2.2.4 Push-button Switch

The motherboard has a push-button switch (SW1) that can be used to toggle an I/O pin, create an interrupt, or wake up the microcontroller (wake up is not available on ST90158). The pin that is controlled by the push-button switch is selected by removing or placing jumpers on connectors TP14, TP15 and TP16 as shown in Figure 3. "Switch 1 Configuration".

Figure 3. Switch 1 Configuration
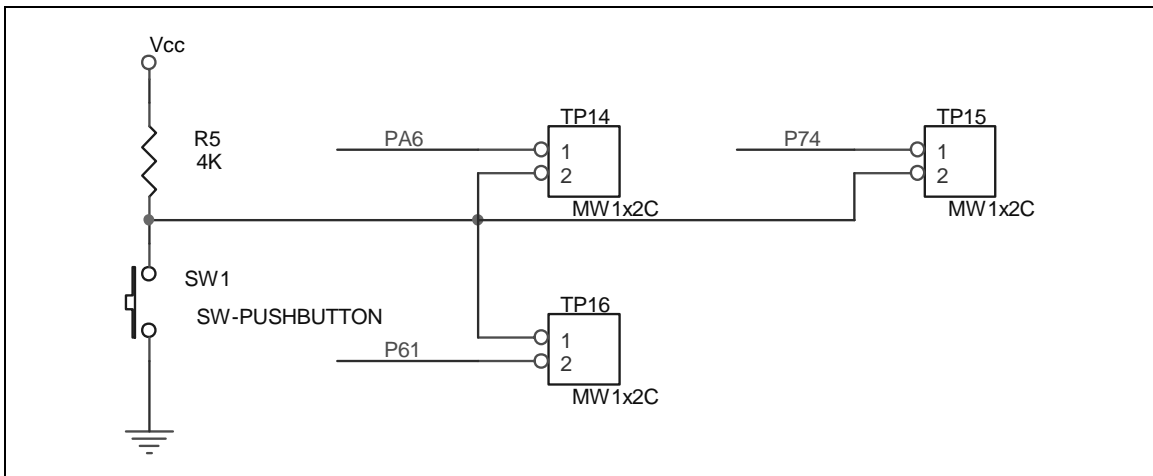
2.2.5 Direct 7-segment Display

The 7-segment display can be use to show the I/O port configuration or to display the different statements of the user application. The display is connected to I/O port 4. When the application is running with a supply voltage of less than 3.5 V, a jumper should be installed in connector TP10 in order to increase the lighting level of the display. This jumper should be removed whenever a supply voltage greater than 3.5 V is used.

A remote 7-segment display controlled via the I²C interface is also provided. Please refer to Section 2.2.7 "I²C Interface".

Figure 4. 7-segment Display Configuration
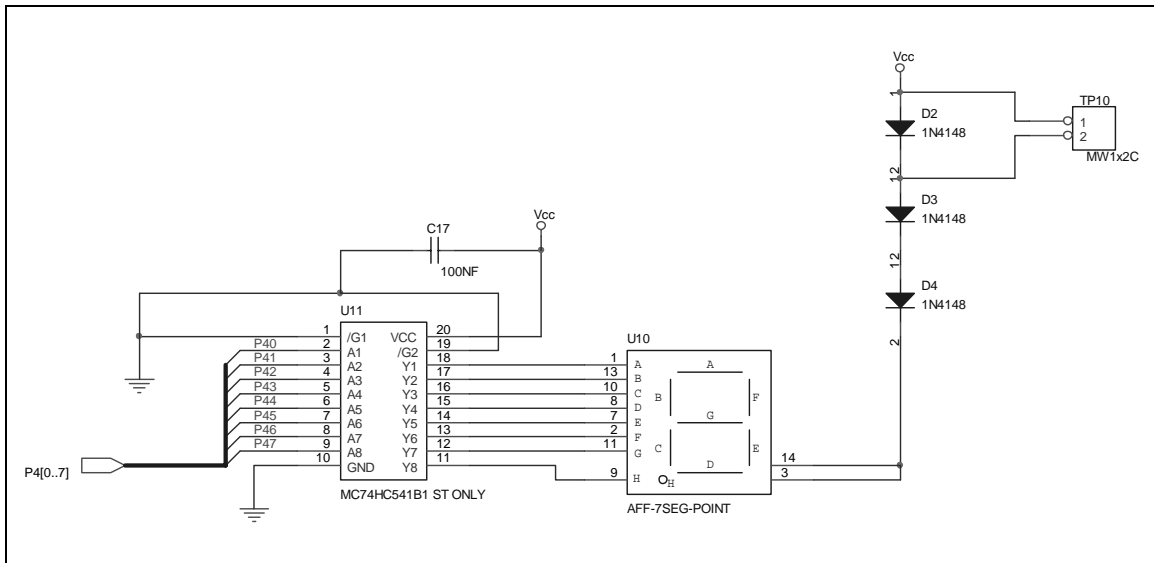
2.2.6 Memories

The motherboard has three memories; an M27C1001, which is an 128-Kbyte EPROM, an M48Z128Y, which is an 128-Kbyte Zeropower® SRAM and an M29F040B, which is a 512-Kbyte single-supply FLASH memory. The datasheets for these devices are available on the on ST web site, www.st.com. Ports P0, P1 and PC are used for addressing the various memories. The microcontroller addresses the devices using the 6 most significant bits (PC) of the 22 addresses which may be set automatically or manually via the I/O port. For instance, on the ST90158 MCU, the segment number must be output on port P2. Each memory part is located as follows.

Figure 5. Memory Map
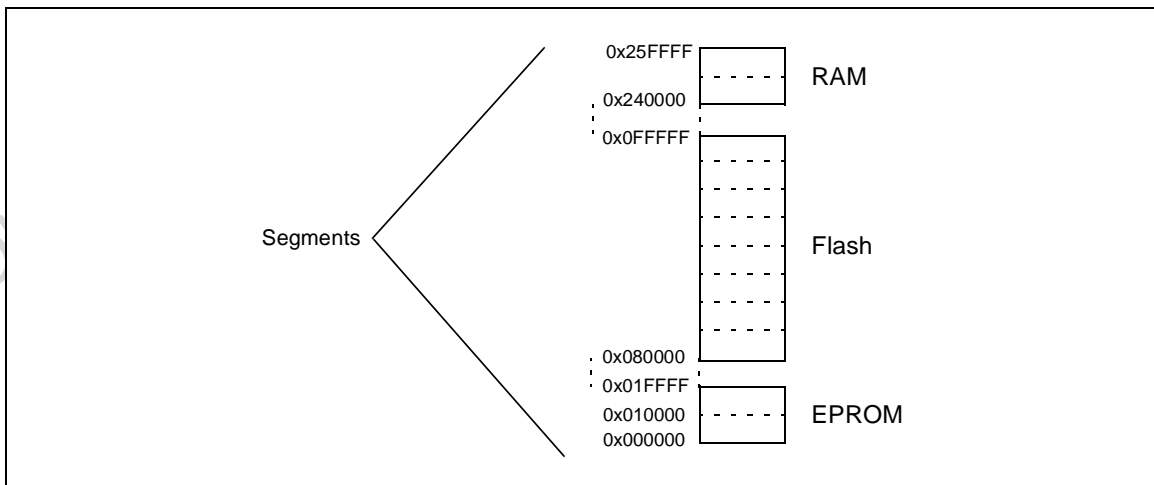
– EPROM: segments 0x00 and 0x01.

– Flash: segments 0x08, 0x09, 0x0A, 0x0B, 0x0C, 0x0D, 0x0E and 0x0F.

– RAM: segments, 0x24 and 0x25.

For segment definitions, refer to any ST9 datasheet.

The comparator (74HC688) is used to select the memories. When the ST92F150-TQFP64 daughter board is used, the 5 Most Significant Address Bits A[15:11] must be connected directly on the board to a High or a Low level by hardware as port P1 is limited to P1[2:0].

When using a low voltage power supply (i.e. less than 4.5 V) the memories used by the motherboard must be replaced as follows:

– Replace M27C1001 (5 V ± 10%) with M27V101 (3 to 3.6 V),

– Replace M29F040B (5 V ± 10%) with M29W040B (2.7 to 3.6 V),

– Replace M48Z128Y (5 V ± 10%) with M48Z128V (2.8 to 4.6 V).

Note: M27V101, M29W040B and M48Z128V are not supplied.

2.2.7 I²C Interface

An external EEPROM and a remote 8-bit I/O expander (PCF8574) connected to a 7 segment display can both be accessed via an I²C bus.

The EEPROM address is 0101 000R/W in binary, where R/W is a single bit that is set to 1 in order to read the EEPROM, and reset to zero in order to write to the EEPROM. Connector TP20 is use to protect the EEPROM in write mode.

The address of the remote 7-segment display is 0x07. When the application is running with a 3.5 V power supply, a jumper must be installed in connector TP21 in order to increase the lighting level of the display. This jumper must be removed when using a supply voltage greater than 3.5 V.

Figure 6. I²C Interface Diagram
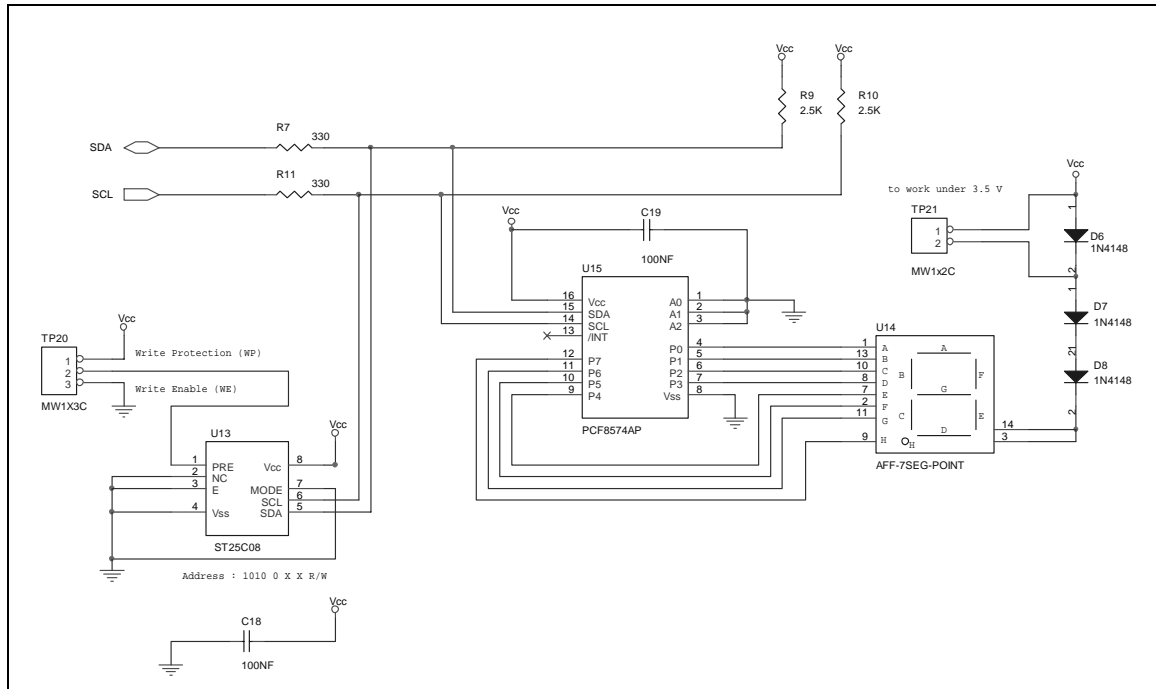
2.2.8 A/D Trimmer

When testing the analog-to-digital convertor (ADC) peripheral, two trimmers must be connected to channels 6 and 7 of the ADC0. Make sure that the analog voltage never exceeds the supply voltage. Two different jumpers must be used to connect analog inputs AD6 and AD7 to the trimmer via connector TP17. Connector TP17 can also be used to connect analog inputs AD6 and AD7 to any other external voltage source.
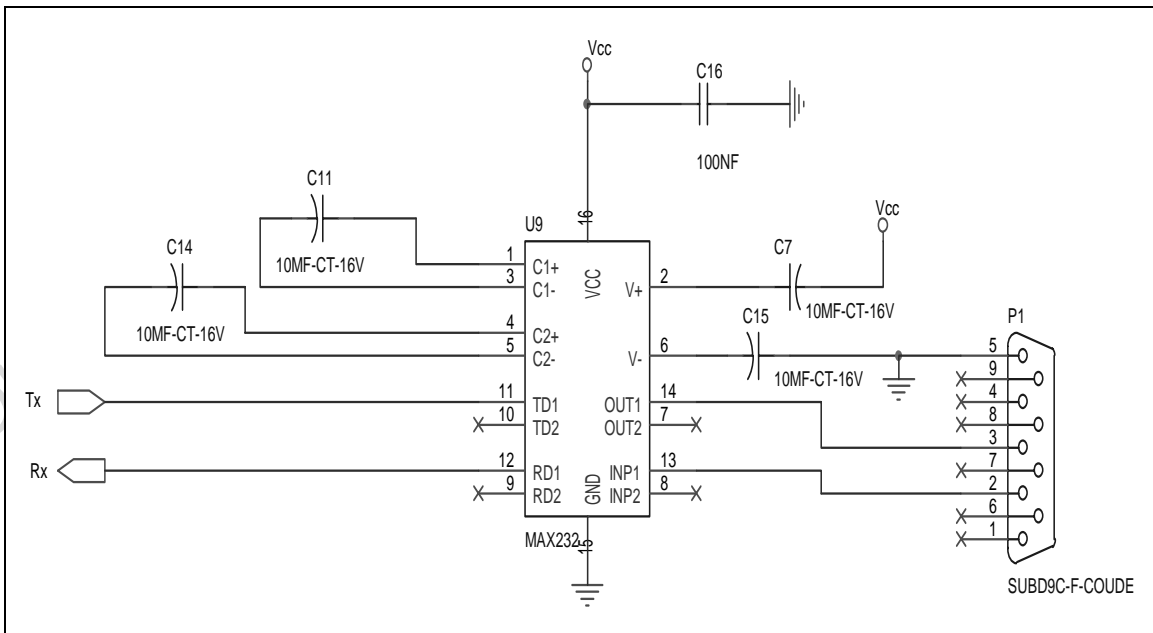
Figure 7. A/D Trimmer Diagram
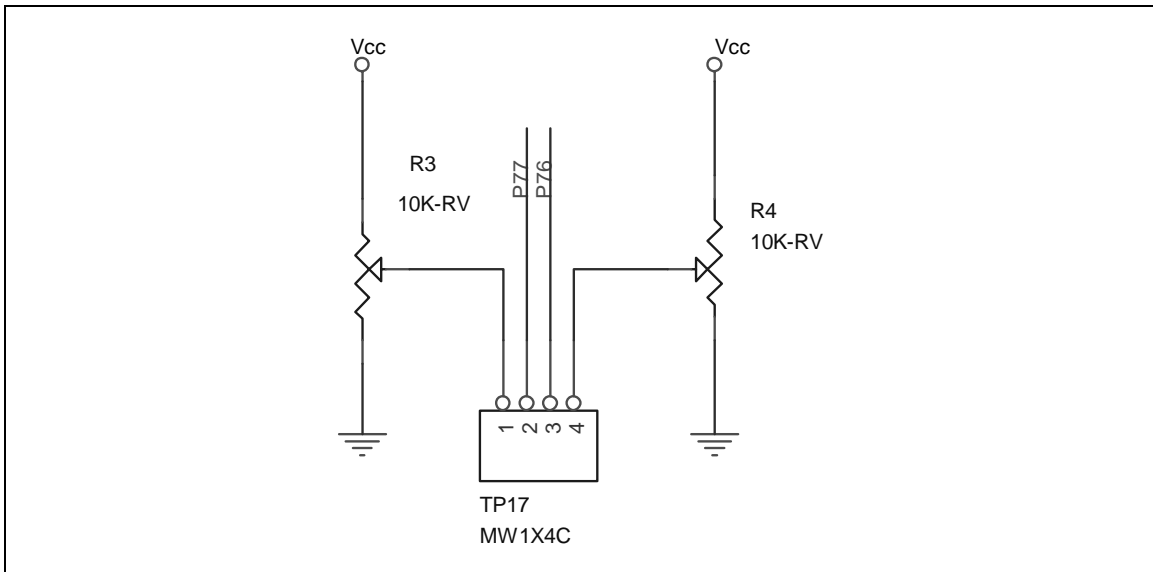
2.2.9 SCI Interface

A female RS232 connector is connected to pins RX and TX of the SCI0 of the microcontroller via the MAX232 driver/receiver. Pins RTS and DCD are not connected. This connection can be used to link the ST9 microcontroller to a personal computer using the cable supplied with the kit.

Figure 8. SCI Interface Diagram

2.3 ST90158 DAUGHTERBOARD

The ST90158 daughterboard is connected to the motherboard by two 50-pin connectors which are used to transmit signals and the power supply to or from the ST90158 microcontroller.

2.3.1 I²C Interface

An I²C peripheral is not included in the ST90158, but the SPI block is able to handle some I²C functions and can fully generate the I²C communication protocol in master or multimaster mode (no slave). In order for the SPI to be able to emulate I²C communication protocol, the SPI input and output pins must be connected to the SDA signal. This is done by placing jumpers on connectors TP6 and TP4.

Figure 9. I²C Interface Diagram
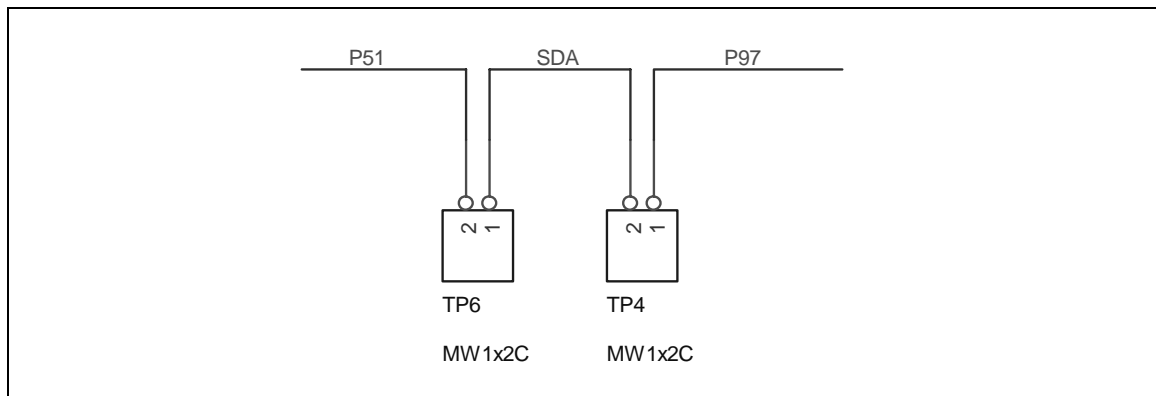
2.3.2 Current Measurement and Power Supply

A jumper must be installed in the power supply connector TP5 even when only using the emulator, and not the microcontroller. This jumper must be installed in order for the device to operate. This jumper connector can also be used to measure the current consumption of the microcontroller.

Figure 10. Connector TP5 Diagram
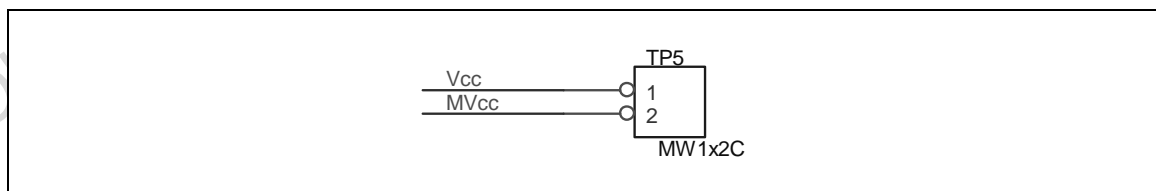
2.3.3 Analog Supply Voltage

A jumper must be applied to analog supply connector TP2 which is used to select the power supply source between MVcc (same as the MCU) or an external power supply. Refer to the

datasheet of your device to get information on the maximum gap between the power supply voltage (VDD) and the analog supply voltage (AVDD) of your device. Usually AVDD must be contained between -0.3 V and +0.3 V VDD. Connector TP2 can also be used to measure the consumption of the analog part of the device.

Figure 11. Analog Supply Voltage Diagram
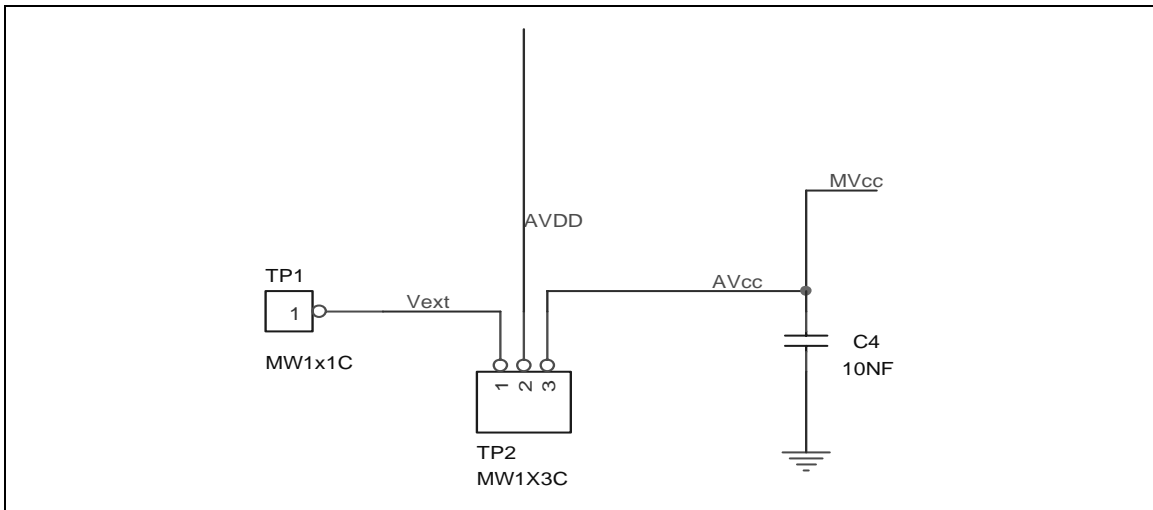
2.3.4 Watchdog

The ST90158 watchdog can be enabled either by hardware or by software. Pin HW0SW1 is used to define the selection mode. If pin HW0SW1 is connected to ground, the watchdog is selected by hardware. If pin HW0SF1 is connected to Vcc, the watchdog is selected by software if the application needs it.

Figure 12. Watchdog Selection Mode Diagram
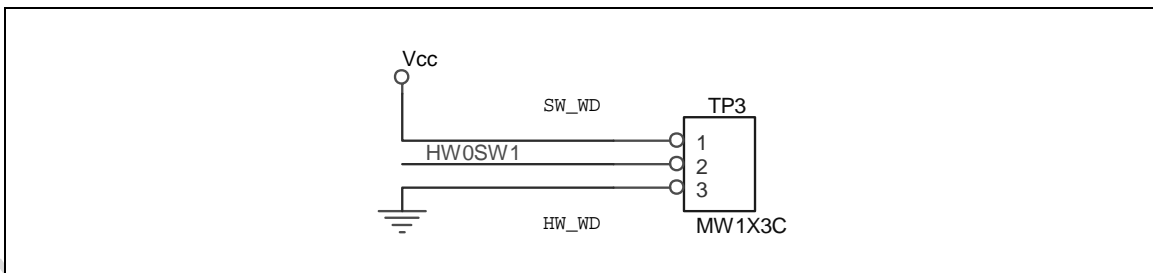
Note: SW_WD means Software Watchdog and HW_WD means Hardware Watchdog.

2.3.5 I/O Port Connection

Ports PA, PB and PC are connected to ports P8, P9 and P2, respectively, of the ST90158.

2.4 ST92F120/F124/F150/F250 DAUGHTER BOARDS

The ST92F120/F124/F150/F250 daughter boards are connected to the motherboard by two 50-pin connectors which are used to transmit signals and the power supply to or from the microcontroller. The ST92F120 board is compatible with ST92F124/F150/F250 microcontrollers and emulators. The ST92F150-TQFP64 board limited to the ST92F124/F150-TQFP64 devices.

2.4.1 Current Measurement and Power Supply

A jumper must be installed in the power supply connector TP5 even when only using the emulator, and not the microcontroller. This jumper must be installed in order for the device to operate. This jumper connector can also be used to measure the current consumption of the microcontroller.

Figure 13. TP6 Connector Diagram
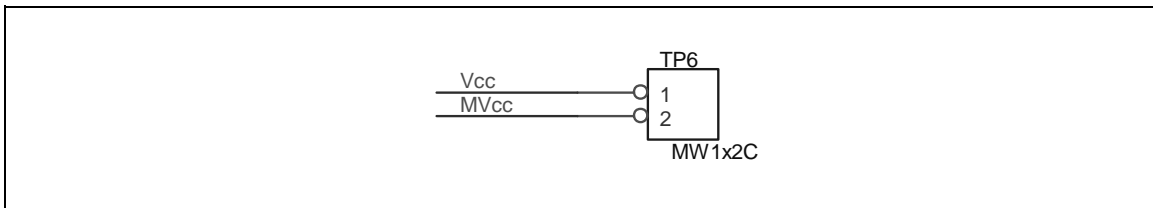

2.4.2 Analog Supply Voltage

A jumper must be installed to the TP5 analog supply connector which is used to select the power supply source between MVcc (same as the MCU) or an external power supply. Refer to the datasheet of your device to get information on the maximum gap between the power supply voltage (VDD) and the analog supply voltage (AVDD). Usually AVDD must be contained between -0.3 V and +0.3 V VDD. Connector TP5 can also be used to measure the consumption of the analog part of the device.

Figure 14. Analog Supply Voltage Connector TP5
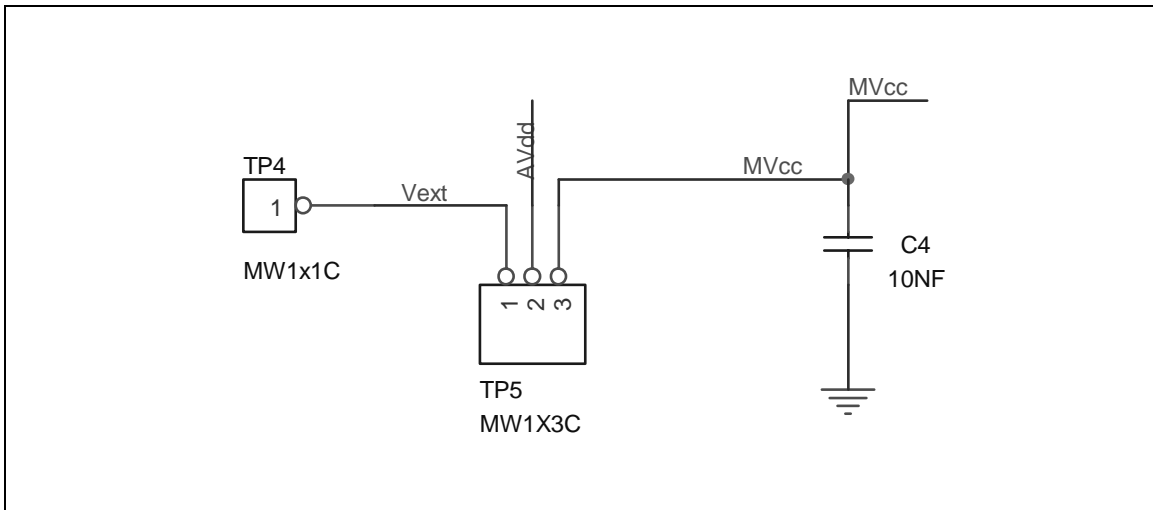
2.4.3 Watchdog

The ST92F120/F124/F150/F250 watchdog can be enabled either by hardware or by software. Pin HW0SW1 is used to define the selection mode. If pin HW0SW1 is connected to the ground, the watchdog is selected by hardware. If pin HW0SF1 is connected to the Vcc, the watchdog is selected by software if the application needs it.

Figure 15. Watchdog Selection Mode Diagram
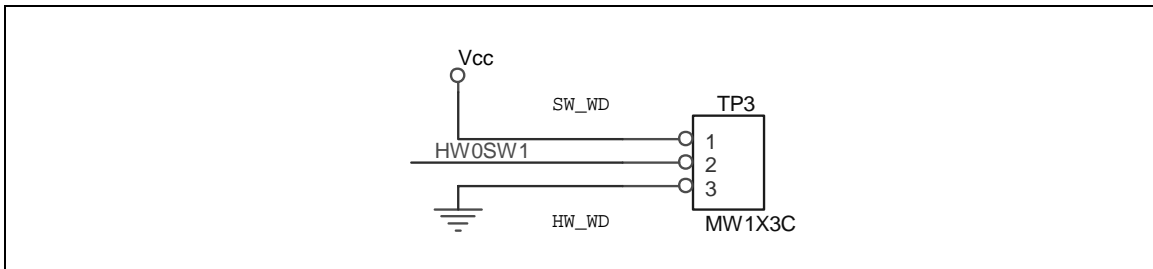
Note: SW_WD means Software Watchdog and HW_WD means Hardware Watchdog.

2.4.4 I/O Port Connection

ST92F120 Daugther board:

Ports PA, PB and PC are connected to ports P3, P2 and P9, respectively, of the ST92F120/F124/F150/F250.

ST92F150-TQFP64 Daugther board:

Ports PA and PC are connected to ports P3 and P2, respectively, of the ST92F124/F150.

Port PB is not connected to the ST92F124/F150.

2.4.5 ISP Connector

Connector TP1 is used for programming the microcontrollers in ISP (In-Situ Programming) mode.

**Figure 16. TP1 ISP Connector**
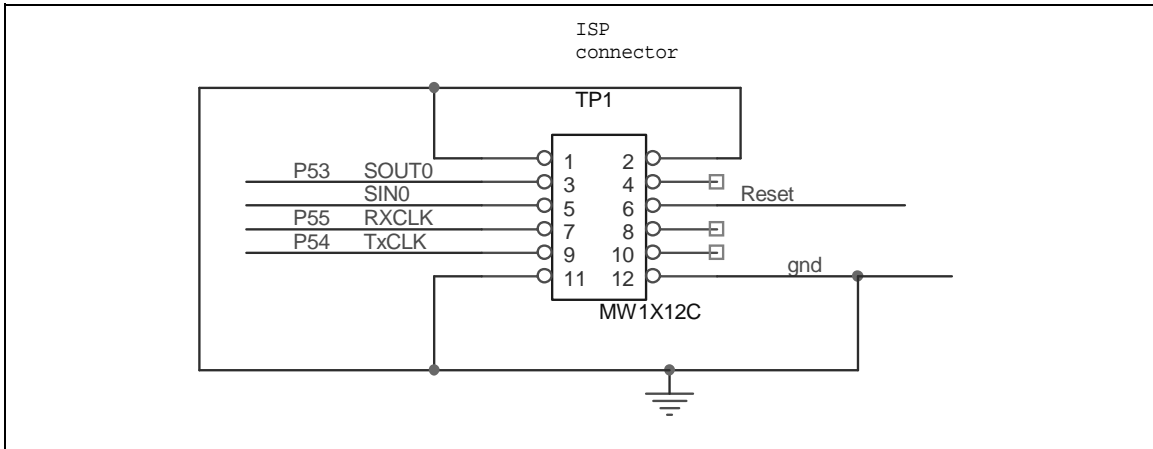
To enable ISP programming, carry out the following instructions:

– Remove the power supply from the motherboard.

– Connect the ST92F120/F150 daughterboard to the motherboard.

– Check that the power jumper on TP6 is connected.

– Place the jumper on TP2 between pins Sin and P5.2.

– Connect the ST92F120/F150 daughterboard to the ST92F120/F150 using a ribbon cable. Check that pin number one of both the Evaluation kit and the EPB ISP (programming board) connector are connected together.

– Power up the ST92F120/F150 EPB programming board.

– Power up the ST9 Evaluation Board.

– Launch the STVP9 Visual Programmer and set it to ST92F120/F124/F150/F250 ISP (In-Situ Programming) mode.

For additional support, follow the instructions displayed on the screen.

You can now program, erase.... your device.

Figure 17. TP1 ISP Connector
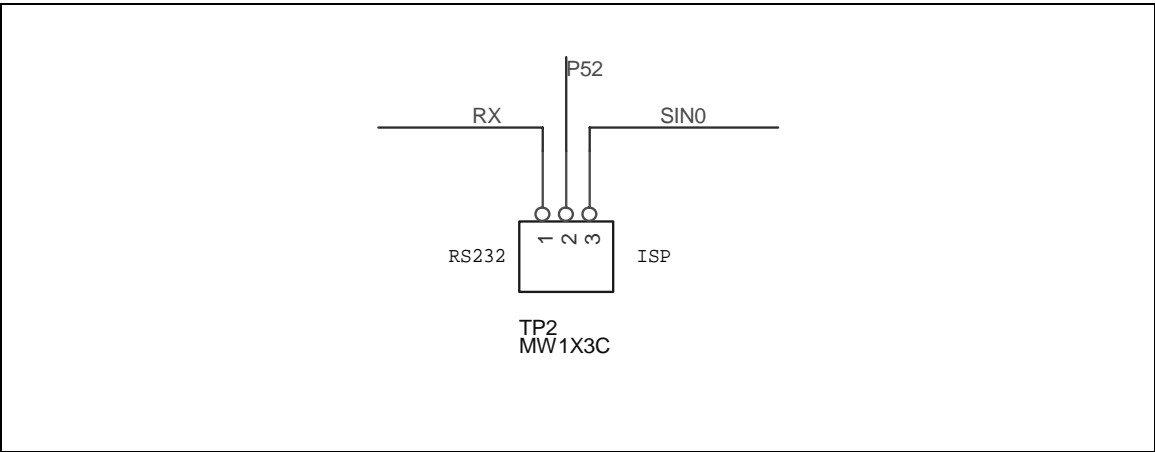
3 TROUBLESHOOTING

3.1 CONTINUOUS RESET

The following symptoms may be caused by the MCU being continuously reset:

– The emulator does not stop by itself after a "step" command,

– If the program is stopped using the "STOP" command, and the program counter is set to the value that indicates the software start address.

In these cases, make sure that the jumper on pin TP5 is properly in place.

If a specific function cannot be obtained while the program is being executed, check whether the hardware watchdog is selected. If the hardware watchdog is selected, the microcontroller will be cyclically reset.

3.2 MEMORY MALFUNCTION

1/ Make sure that the correct voltage supply (V_{CC}) is provided to the memories. Refer to the following table.

Table 1. Memory Voltage Supplies

Memory Set	Voltage Supply (V_{CC})
M27C1001 M29F040B M48Z128Y	5 V ± 10%
M27V101 M29W040B M48Z128V	3 to 3.6 V 2.7 to 3.6 V 2.8 to 4.6 V

2/ With some NVRAM lots, the memory cannot be accessed with the external memory access mode used on the Motherboard (MC=0, refer to the product datasheet). This mode is not compatible with all memory types as the DS signal is pulled down by the microcontroller during a WRITE Operation. In this case, the U1 component (74HC04) must be removed, and pins 3 and 4 must be connected together. Then the memory can be accessed using MC=1 mode (refer to the product datasheet). In this mode the OEN signal is pulled down only during the READ operation.

4 APPENDIX

Figure 18. MB308 Connector

Figure 19. MB308 Memories

Figure 20. DB461

Figure 21. DB462

Figure 22. DB570

EVALUATION BOARD GETTING STARTED