Technical Note

MT9M113
Programming and Reading OTP Memory in Rev4 Silicon

Introduction

This technical note explains how to program and read back a 16-bit word of one-time programmable (OTP) memory in the MT9M113 Rev4 silicon. This memory can be used during module manufacturing to store specific information about the module. This feature provides system integrators and module manufacturers the ability to label and distinguish various module types based on lens, IR-cut filter, or other properties.

Programming Overview

During the programming process, a dedicated pin for high voltage needs to be provided in order to perform the anti-fusing operation. This voltage (VPP) must be 8.5V ±5%. Completion of the programming process will be communicated by a register through the two-wire serial interface.

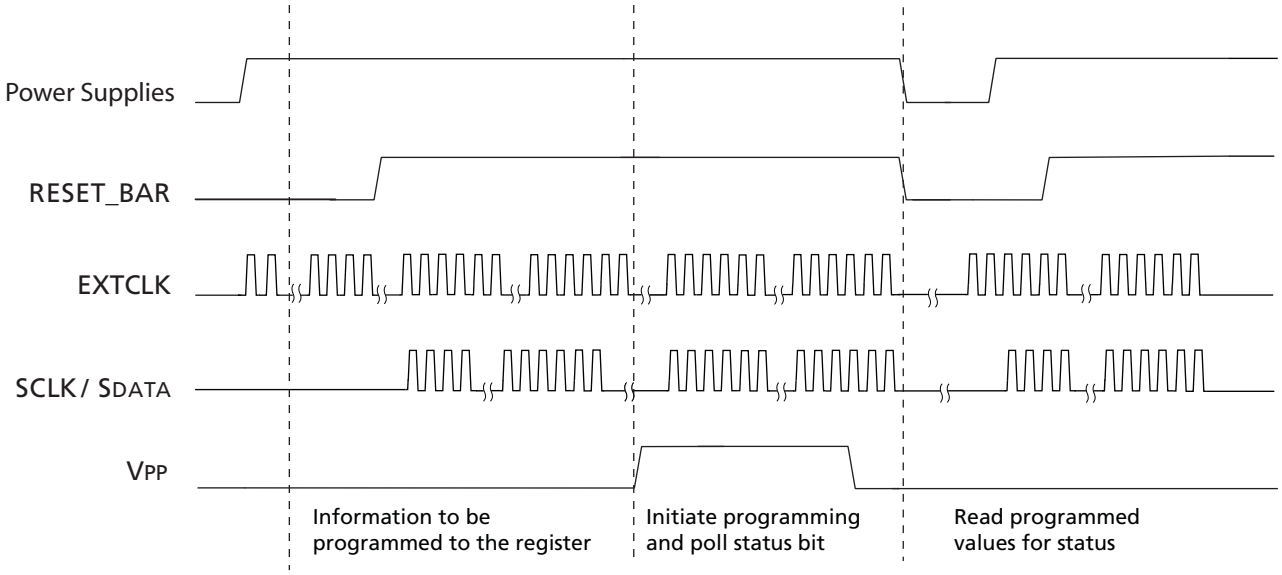
Since this programming pin needs to sustain a higher voltage than other input or output pins, having a dedicated high voltage pin (VPP) minimizes the design risk. If the module manufacturing process can probe the sensor at the die or PCB level (that is, supply all the power rails, clocks, and two-wire serial interface signals), then this dedicated high voltage pin does not need to be assigned to the module connector pinout. However, if the VPP pin needs to be bonded out as a pin on the module, the trace for VPP needs to carry a maximum of 200µA. This pin should be left floating, but may be connect to analog ground.

The programming of the OTP memory requires the sensor to be fully powered and remain in software standby with its clock input applied. See Figure 1 on page 2 for detailed timing information. The information will be programmed through the use of the two-wire serial interface. After the data are written to an internal register, the host machine programming the sensor will apply a high voltage to the programming pin. The host will then send a program command to initiate the anti-fusing process. After the sensor has finished programming the OTP memory, a status bit will be set to indicate the end of the programming cycle. Then the host machine can poll the status bit through the two-wire serial interface. Programming the 16-bit OTP memory can be performed only once.

Reading the OTP Memory

Reading the OTP memory data requires the sensor to be fully powered and operational with its clock input applied. The data can be read through a register from the two-wire serial interface.

Figure 1: Power Supplies and Timing Diagram



Programming and Verification of the OTP Memory

The steps below describe the operations required during the manufacturing process to both program the sensor and verify that the data was programmed correctly:

1. Apply power to all the power rails of the sensor (VDD, VDD_IO, VAA, VAA_PIX, VDD_PLL, VDDIO_TX). VAA must be set to 3.1V during the programming process. VPP must be initially floating. All other supplies must be at their nominal voltage.
2. Provide an 8 MHz EXTCLK clock input.
3. Perform the proper reset sequence to the sensor.
4. Place the sensor in soft standby (sensor's default state upon power-up).
5. VPP ramps to 8.5V in preparation for the programming step.
6. Set R0x3052 to 0xE0E7.
7. Set R0x3054 to 0xFD59.
8. Write the 16-bit word data by programming R0x304C.
9. Initiate the OTP memory programming process by setting R0x304A to 0x0001.
10. Poll the register bit R0x304A[2] until the bit is set to “1” (check for program completion).
11. Repeat steps 9 and 10 two more times.
12. Remove the high voltage (VPP) and float VPP pin.
13. Power down the sensor.
14. Apply power to all the power rails of the sensor (VDD, VDD_IO, VAA, VAA_PIX, VDD_PLL, VDDIO_TX). VAA must be set to 3.1V during the verification process. VPP must be floating. All other supplies must be at their nominal voltage.
15. Set EXTCLK to normal operating frequency or keep at 8MHz.
16. Perform the proper reset sequence to the sensor.
17. Set R0x3052 to 0xE0E7.
18. Set R0x3054 to 0xFD59.
19. Initiate the OTP memory reading process by setting R0x304A to the value 0x0010.
20. Poll the register bit R0x304A[6] until the bit is set to “1” to check for read completion.
21. Read the 16-bit word data from R0x304E.
22. Repeat steps 19 and 21 two more times.

Note: The slew rate of VPP and VAA should be slower than 1V/µs

Reading the OTP Memory

Reading the OTP memory data requires the sensor to be fully powered and operational with its clock input applied. The data can be read through a register from the two-wire serial interface. The steps below describe the operations required to read the programmed data:

1. Apply power to all the power rails of the sensor (VDD, VDD_IO, VAA, VAA_PIX, VDD_PLL, VDDIO_TX) at their nominal voltage.
2. Set EXTCLK to its normal operating frequency.
3. Perform the proper reset sequence to the sensor.
4. Set R0x3052 to 0xE0E7.
5. Set R0x3054 to 0xFD59.
6. Initiate the OTP memory reading process by setting R0x304A to 0x0010.
7. Poll the register bit R0x304A[6] until the bit is set to "1", to check for read completion.
8. Read the 16-bit word data from R0x304E.

Conclusion

This technical note describes the steps for programming and verifying the 16-bit word of OTP memory in Rev4 silicon of the MT9M113 sensor. For further information and assistance on this and other features, refer to Micron's Web site at www.micron.com/imaging.

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Revision History

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- Initial release