Technical Note

MT9T013

One-Time Programmable (OTP) Memory

Introduction

This document describes how to program a two-byte, one-time programmable (OTP) memory with Micron's MT9T013 CMOS digital image sensor.

How OTP Memory Works

The MT9T013 has a two-byte OTP memory that 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.

During the programming process, a dedicated pin for high voltage needs to be provided in order to perform the OTP memory programming operation. This voltage (V_{PP}) would need to be 8.5V ±3%. Instantaneous V_{PP} cannot exceed 9V at any time. 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/output pins, having a dedicated high voltage (V_{PP}) pin minimizes the design risk. If the module manufacturing process can probe the sensor at the die or PCB level (that is, supply all of 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 V_{PP} pin needs to be bonded out as a pin on the module, the trace for V_{PP} needs to be able to carry a maximum of 1mA for programming only. This pin should be left floating when not programming the OTP memory.

Programming the OTP memory requires the sensor to be fully powered and to remain in software standby with its clock input applied. The information will be programmed through the use of the two-wire serial interface after V_{PP} power is applied. Once the data is written to an internal register, send a program command to initiate the process. After the sensor has finished programming the OTP memory, a status bit will be set to indicate the end of the programming cycle, and the host machine can poll the setting of the status bit through the two-wire serial interface. Only one programming cycle for the two-byte OTP memory can be performed.

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.
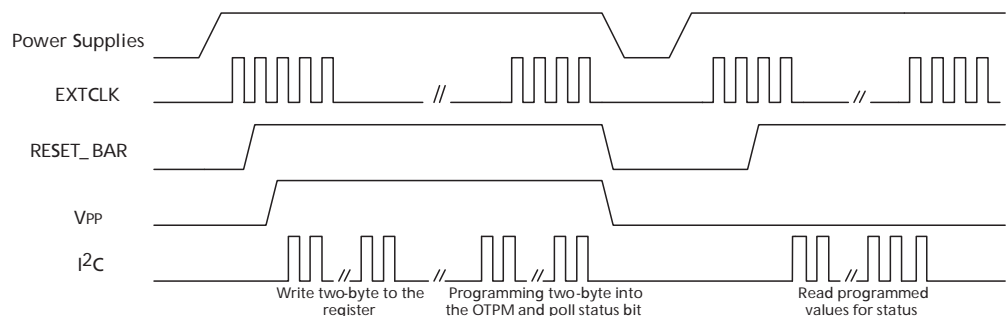
Programming and Verification Procedure

The following steps describe the process to program and verify the programmed data in the OTP memory:

1. Apply power to all of the power rails of the sensor (VDD, VDD_IO, VAA, VAA_PIX and VDD_PLL).
   1a. VAA needs to be set to 3.1V during OTP memory programming phase.
   1b. VPP needs to be floated during this phase.
   1c. Other supplies at nominal.
2. Provide 8 MHz EXTCLK clock input (valid for PLL bypass only). If PLL is active, ensure OP_PIX_CLK is at a low value (8 MHz).
3. Perform the proper reset sequence to the sensor.
4. Place the sensor in soft standby (sensor default state upon power-up) or ensure streaming is turned OFF when the part is in active mode.
5. VPP ramps to 8.5V in preparation to program. Power supply (VPP) slew rate should be slower than 1V/μs.
6. Program R0x3052 to the value 0x044C.
7. Program R0x3054 to the value 0x50B6.
8. Write the 16-bit word data by programming R0x304C.
9. Initiate the OTP memory programming process by programming R0x304A to the value 0x01.
10. Poll the register bit R0x304A: [2] until bit is set to "1" to check for program completion.
11. Repeat steps 9 and 10 two more times.
12. Remove high voltage and float VPP pin.
13. Power down the sensor.
14. Apply nominal power to all the power rails of the sensor (VDD, VDD_IO, VAA, VAA_PIX, and VDD_PLL). VPP must be floated.
15. Set EXTCLK to normal or customer defined operating frequency.
16. Perform the proper reset sequence to the sensor.
17. Initiate the OTP memory reading process by setting register R0x304A to the value 0x0010.
18. Poll the register bit R0x304A:[6] until bit is set to "1" to check for read completion.
19. Read the 16-bit word data from R0x304E.

Figure 1:   Sequence for Programming the MT9T013

Conclusion

This technical note describes the steps for OTP memory programming and verification. For further information and assistance on these features, refer to Micron's Web site at www.micron.com/imaging.

Revision History

Rev. A **07/20/2007**

- Initial release