Technical Note

MT9V024

Internal Temperature Sensor

Introduction

This document describes the function and usage of the temperature calibration register and the thermal information register internal to the MT9V024. Monitoring these registers will assist users in keeping the imaging sensor within functional limits.

Temperature Calibration

Two registers are used for temperature monitoring. The Thermal Information register (R0xC1) reports the value of an internal temperature diode. Since the temperature response varies slightly from part to part, a temperature calibration value of the Thermal Information register is measured during manufacturing, with the sensor held at +100°C junction temperature. The resulting value is stored in a reserved register, the Temperature Calibration register. The calibration value of +100°C junction temperature corresponds to approximately +85°C ambient temperature.

Temperature Calibration Access

The Temperature Calibration register is accessed through the two-wire serial interface at

R0x60, using an indexed read.

To read the value:

1. Configure the sensor:
   Write a value of 0 to R0x07[9].
2. Read Calibration value:
   2a. Write a value of 0x12 to R0x60.
   2b. A subsequent read of R0x60 returns the +55°C calibration value.
   2c. To read the +100C calibration value, write a value of 0x13 to R0x60.
   2d. A subsequent read of R0x60 returns a +100°C calibration value

The following conditions should be noted:

- The index value (0x12 or 0x13) must be written to R0x60 immediately before each read from R0x60, otherwise the read results are indeterminate.
- It is only necessary to write R0x07[9] once; however, R0x07 is a shadowed register and one frame-time delay should be allowed before accessing R0x60.

Thermal Information Register Access

The Thermal Information register contains the current relative temperature, and is updated once per frame. This register can be accessed through the two-wire interface at R0xC1.

The sensor must be configured for reading the thermal information register:

1. VREF_ADC Control (R0x2C) must be left at default (4).
2. V_{AA} power supply must be at 3.3 VDC.
3. Companding must be disabled - set R0x1C to 0x02.
4. R0x25 must be left at its default value.

Note: The default value for R0x25 varies from part to part, so it should be left at its power-up value.

5. Digital Test Pattern (R0x7F) must be set to default (0x0).
6. HBlank (R0x05) must be set to a value of 400 or lower.

The Thermal Information register can then be read directly at R0xC1. As an approximate guide in determining temperature change, the internal temperature sensor has a response of about one count per 1C. There is approximately a 15C difference between ambient and junction temperatures for the MT9V024, depending on device mounting.

Using the calibration values and thermal register value, actual junction temperature can be calculated:

Letting CAL55 and CAL100 represent the temperature calibration values for +55C and +100C, respectively, the temperature response slope (mTemp) is:
mTemp = 45/(CAL100-CAL55)
then
Tjunct = mTemp (R0xC1 - CAL55) + 55

Thermal Circuit Location

The MT9V024 uses a proprietary thermometer that is designed into the imager. The location of the circuit in the chip is the corner of the first row and column. This facilitates isolating the circuit from any other circuits that might affect it or cause a localized hot spot. Additionally, the circuit is covered by black light block to prevent focused bright light from causing a temperature change.

Conclusion

The MT9V024's temperature calibration and thermal information registers provide a convenient means of monitoring the sensor's internal temperature. This temperature information may be used to operate the sensor within its specified limits. For more information on this sensor, refer to the data sheet on Aptina's Web site at www.aptina.com.

Revision History

Rev. A 5/28/10

- Initial release

10 Eunos Road 8 13-40, Singapore Post Center, Singapore 408600 prodmktg@aptina.com www.aptina.com