Technical Note

MT9V022
Updated Recommendations and Settings

Introduction

This technical note provides updated recommendations and settings for use with Micron® MT9V022 image sensor. These changes apply to silicon Revision 3 and include:

- High dynamic range mode
- Minimum exposure and exposure overhead
- Binning mode settings
  - AEC and digital gain tile coordinate settings
- Slave mode timing
- Asynchronous stereoscopic mode
  - Latency between the master and slave sensor

For additional information on the MT9V022 silicon Revision 3, including changes in default register settings, refer to the MT9V022 Rev3 Errata.

High Dynamic Range Mode

Reduced FPN and increased dynamic range settings are:

- Setting R0x20[2]=1 simultaneously raises the knee points in high dynamic range mode and improves pixel knee point matching, therefore reducing FPN near the knee points.
- Setting R0xC2[8]=1 adds a 0.75V/V attenuation to the analog signal path allowing more of the well capacity of the pixels to be mapped to the input range of the ADC. This can substantially improve the MT9V022 dynamic range in high dynamic range mode.

Minimum Exposure and Exposure Overhead

The integration time for the MT9V022 (all revisions) is slightly longer than the row time times the total shutter width (R0x0B) or the current AEC exposure output (R0xBB). There is a short overhead of additional exposure time that is small but consequential under very short exposure settings.

The complete integration time can be given by:

•Integration time = row time * (R0x0B or R0xBB) + overhead

where:

•overhead = (row time – 255) (in MCLK periods)

For example, with a default row time of 846 MCLK periods (R0x04=752 + R0x05=94), the exposure overhead is (846 - 255), or approximately 70 percent of an additional row time. This additional 0.7 row of exposure time overhead is insignificant for long exposures, but should not be ignored for very short exposure settings.

- The minimum exposure setting that should be used for MT9V022 Rev2 devices is R0x0B=2. Including the exposure overhead, this results in an exposure time of 2.7 times the row time.
- The minimum exposure setting for MT9V022 Rev3 devices is R0x0B=1. Including the exposure overhead, this results in an exposure time of 1.7 times the row time.

Binning Mode Settings

For the best binning mode performance, the line current (R0x21) should be changed from the default value of 32 when row binning is enabled. The recommended settings (for both the MT9V022 Rev2 and Rev3 devices) are:

Row Binning Disabled :	R0x21=32
Row Bin by 2 :	R0x21=16
Row Bin by 4 :	R0x21=8

AEC and Digital Gain Tile Coordinate Settings

The AEC and digital gain tile coordinate settings behave differently for the X (R0x99–R0x9E) and Y (R0x9F–R0xA4) coordinates when binning is enabled. In general, the tile coordinate settings should be divided by the binning ratio to accommodate the output pixel range.

This is true for all cases except the column bin by four mode, where the X tile coordinates should only be divided by two instead of four.

Table 1 summarizes the tile coordinate ranges for each binning condition.

Table 1: Tile Coordinate Ranges

Column Bin Setting	R0x0D[3:2]	X Tile Coordinate Range (R0x99–R0x9E)
Normal operation	00	0 to 752
Bin by 2	01	0 to 376
Bin by 4	10	0 to 376
Row Bin Setting	**R0x0D[1:0]**	**Y Tile Coordinate Range (R0x9–R0xA4)**
Normal operation	00	0 to 480
Bin by 2	01	0 to 240
Bin by 4	10	0 to 120

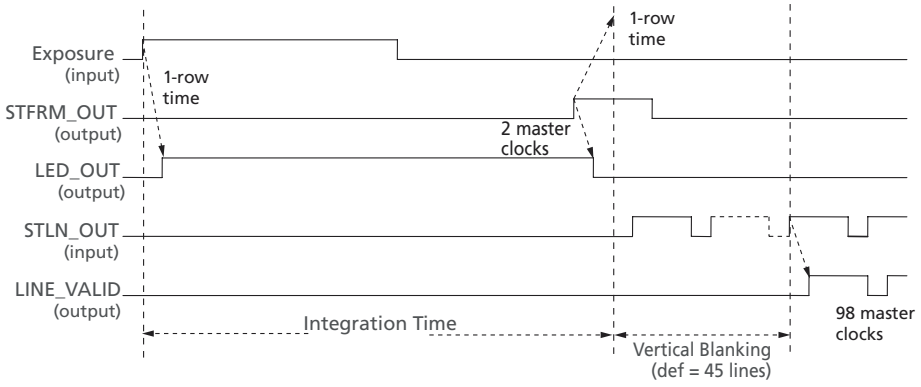
Slave Mode Timing

In slave mode, the exposure and readout are controlled using EXPOSURE, STFRM_OUT, and STLN_OUT. When the slave mode is enabled, STFRM_OUT and STLN_OUT become input pins.

The beginning and end of integration are controlled by EXPOSURE and STFRM_OUT pulses, respectively. While a STFRM_OUT pulse is used to stop integration, it is also used to enable the readout process.

After integration is stopped, the user should provide STLN_OUT pulses to trigger row readout.

Figure 1: Slave Mode Timing Diagram

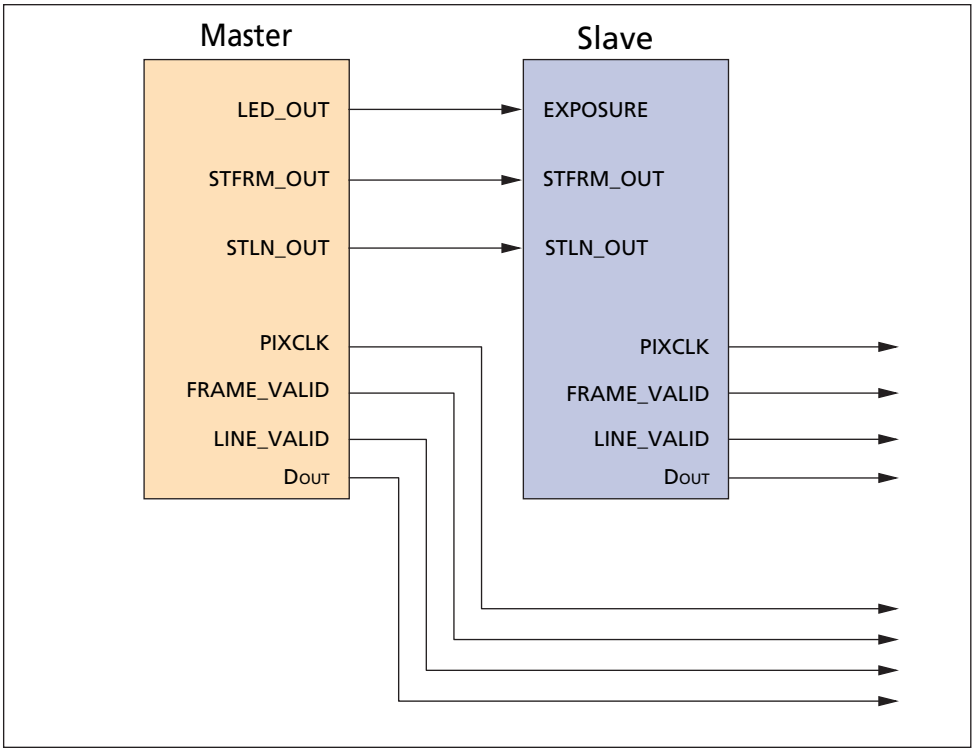


Asynchronous Stereoscopic Mode

In addition to lock-step LVDS and parallel stereoscopy operation as described in TN-09-12, two MT9V022 Rev3 sensors with different clock domains can be synchronized using the connections illustrated in Figure 2.

The LED_OUT, STFRM_OUT, and STLN_OUT signals from the master sensor control the EXPOSURE, STFRM_OUT, and STLN_OUT signals of the slave sensor.

Figure 2: Master and Slave Connection for Asynchronous Stereoscopic Mode



Latency Between the Master and Slave Sensors

In asynchronous stereoscopic mode, there is a one-row time latency between the master and slave sensors, i.e., the exposure of slave sensor begins one row time after the master sensor does; the readout of the slave sensor also begins one row time after the master sensor readout.

Conclusion

For further information on the MT9V022 Silicon Revision 3 operation, refer to the MT9V022 Rev3 Errata or refer to Micron's Web site at www.micron.com/imaging.

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Revision History

Rev A 8/05

- Initial release