



SOFTHARD

MU9PC and MU9PM

Camera Core

Specification

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2 Revision History

Revision	Date	Who	What
0.10	11.03.2008	ML	Initial draft created
0.20	27.07.2008	ML	Video modes updated
0.21	27.07.2008	ML	Typo fixed
0.30	12.03.2009	ML	Style updated
0.40	07.04.2009	ML	Mini mechanical updated
0.50	02.05.2009	ML	Mode 7 added
0.60	05.05.2009	ML	FPS values updated
0.70	01.10.2009	ML	FPS values updated

3 Disclaimers

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This document contains information of a sensitive nature. This information should not be given to persons other than those who are involved in the MU9P project or who will become involved during the lifecycle.

5 Trademarks

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6 Glossary of Terms, Acronyms and Abbreviations

ADU	Analog to Digital Units
API	Application Program Interface
CCD	Charge Coupled Device
CTP	Compliance Test Procedure
DDRAM	Dual Data rate Random Access Memory
DLL	Dynamic Link Library
FPGA	Field Programmable Gate Array
FWC	Full Well Capacity
GUI	Graphical User Interface
OHCI	Open Host Controller Interface
PC	Personal Computer
PCB	Printed Circuit Board

7 Document Scope and Purpose

The purpose of this document is to specify MU9P camera core parameters and their dependencies.

8 Referenced Documents

- Micron Datasheet MT9P031_DS_1.fm - Rev. C 9/07 EN
- SHT: MU9P Validation and Verification plan (MU9P-VVP)
- SHT: MU9P Compliance Test Procedure (MU9P-CTP)

9 Parameter tables

9.1 Mechanical

9.1.1 BH, Basic Housing

Description	Symbol	Value	Units
Height	H	29.5	mm
Width	W	26.5	mm
Depth	D	26.5	mm
Weight	M	25	g
Housing material and technology		Machined Aluminum alloy, no further surface treatments	
Lens adapter, material and technology		C-Mount, machined Aluminum alloy, anodized to black color	

9.1.2 MH, Mini Housing

Description	Symbol	Value	Units
Height	H	8.5	mm
Width	W	15.0	mm
Depth	D	15.0	mm
Weight	M	4.0	g
Housing material and technology		Machined Aluminum alloy, black anodized	
Lens adapter, material and technology		M12x0.5 thread, machined Aluminum alloy, anodized to black color	

9.2 Sensors

Description	MU9PC	MU9PM	Units
Brand	MT9P031I12STC	MT9P031I12STM	
Micron Datasheet	Rev. C 9/07 EN	?????	
Type	Rolling shutter, Global Reset Release		
Pixel resolution (H × V)	2592 × 1944		pixels
Chip size (H × V)	5.70 × 4.28		mm
Unit cell size (H × V)	2.2 × 2.2		µm
Color filter	RGB Bayer mosaic	None	
FWC (*), typical	TBD		ē
Dark current (**), typical	TBD		ē/p/s

All parameters in this table, except FWC and Dark current, are reprinted from respective Micron datasheet

(*) – FWC, no limits specified by CMOS chip vendor, typical value provided here is for informational purposes only. It can not be used as a unit qualification parameter.

(**) – A typical value provided here is for informational purposes only. It can not be used as a unit qualification parameter.

9.3 Optical path

Description	MU9PC	MU9PM	Units
IR Filter Brand	Hoya E-CM500S	BK7 AR2x	
Thickness	1.0±0.1	1.0±0.1	mm
Specification	HOYA 8405E	NA	
Coating	NA	Antireflex both sides	
CCD Spot blemishes and stain	MT9P031_ODS.fm -	MT9P031_ODS.fm -	

specification	Rev. A 9/07 EN	Rev. A 9/07 EN	
Filter cleanliness (spots, scratches)	±3 (*)	±3 (*)	%
Size of the cosmetics defects free aperture on filter	21.5	21.5	mm

(*) – Filter cleanliness is measured with the method and set of tools described in MU9P-CTP.

9.4 Camera core

Description	Symbol	Value	Units
Digitization		12	Bit
Supported bit resolutions		8, 10, 12	Bit/pix
Exposure time	EXP	20µs ... 500sec	
Variable Gain Range	VGA	18	dB
Refresh rate	MRR	8 TBD	Fps
Trigger/sync input (r)		Asynchronous CMOS 3.3V	
Trigger/sync output (rr)		CMOS 3.3V	
Pixel Dynamic range, Typical	DR	~70	dB
SNR, max	SNR	~38	dB
Linearity (*)	Lin	<1	%
Responsivity @550nm	R	1.4	V/lux-sec
External interface		USB 2.0	

Parameters in this table are subject to qualification measurements specified in MU9P-VVP and/or Micron data sheet Rev. C 9/07 EN and/or MU9P-CTP

(r) – Pull up resistor of 100kΩ

(rr) – Serial resistor of 1kΩ

(*) – Linearity of 1% guaranteed in the range of exposures 1ms to 16s.

9.5 Power

Description	Symbol	Value	Units
Power supply, via USB 2.0 system connector	V _{nom}	5 ±10%	V
Consumption, typical no cooling	P _{nom}	0.6 TBD	W
Consumption, maximum no cooling	P _{max}	1.2 TBD	W

All parameters in this table are subject to qualification measurements specified in MU9P-CTP

9.6 Environment

Description	Symbol	Value	Units
Optimal ambient temperature operation	T _{opt}	+10 ... +25	°C
Ambient temperature operation (*)	T _{max}	+5 ... +60	°C
Ambient temperature for storage and transportation	T _{storage}	-25 ... +70	°C
Relative Humidity, non condensing	RH	80	%

All parameters in this table are subject to qualification measurements specified in MU9P-VVP
 (*) – Housing temperature shall not exceed +65°C, also beyond of the optimal range the following parameters are not guaranteed:

Dark current, Dynamical Range, Linearity, Acquisition and readout noise, S/N ratio, durability.

9.7 Firmware/Host driver/API features

Description	Symbol	Value	Units
Interpolation methods		9331, SHT_advanced	

White balance coefficients ranges		0.0 ... 3.9	x
Sharpness filter		0 ... 100	%
Gamma		0.3 ... 1.0	
Full color correction matrix (3+1)x3 coefficients ranges		-3.9 ... 3.9	x
Partial readout granularity @ (1x binning)		2 (H) x 2 (V)	pixels
Max refresh rate x1 binning		5.8	Frames/s

All parameters in this table are subject to qualification measurements specified in MU9P-VVP

9.8 Supported readout modes

Mode	Binning/Skipping	Mode MU9PC	Mode MU9PM	Pixels	Frm/s	Bit/pix
0	1x1	Color	B/W	2592x1944	5.8	12
1	2x2 bin	Color	B/W	1296x972	17	12
2	4x4 bin	Color	B/W	648x486	36	12
3	2x2 skip	Color	B/W	1296x972	22	12
4	4x4 skip	Color	B/W	648x486	83	12
5	6x6 skip	Color	B/W	430x324	163	12
6	7x7 skip	Color	B/W	368x276	200	12
7	7x7 skip/clip	Color	B/W	320x240	232	12

All parameters in this table are subject to qualification measurements specified in MU9P-VVP
 (*) – In development