



SOFTHARD

MR655

Camera Core Specification

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2 Revision History

Revision	Date	Who	What
0.10	20.11.2008	ML	Initial draft created
0.20	07.03.2009	ML	Binning modes added
0.30	08.03.2009	ML	Template updated

3 Disclaimers

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4 Privacy Information

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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 MR655 camera core parameters and their dependencies.

The generic name of the core is MR655xx_yy, where:

“xx” defines Color/Monochrome and Un-cooled/Cooled models, and can be one of the following:

- CU – Color Un-cooled
- CC – Color Cooled
- MU – Monochrome Un-cooled
- MC – Monochrome Cooled

“yy” defines housing, and can be one of the following:

- BH – Basic rectangular housing
- DP – Wankel shaped housing

8 Referenced Documents

- Sony: ICX655AQA Datasheet E07528
- Sony: ICX655ALA Datasheet PE07210-CR
- SHT: MR655 Validation and Verification plan (MR655VVP)
- SHT: MR655 Compliance Test Procedure (MR655CTP)

9 Parameter tables

9.1 Mechanical

9.1.1 BH housing

Description	Symbol	Value	Units
Height	H	32	mm
Width	W	60	mm
Depth	D	60	mm
Weight	M	100	g
Housing material and technology		Machined Aluminium alloy, no further surface treatments	
Lens adapter, material and technology		C-Mount, machined Aluminium alloy, anodized to black color	

9.1.2 DP housing

Description	Symbol	Value	Units
Height	H	26	mm
Width	W	62	mm
Depth	D	61	mm
Weight	M	85	g
Housing material and technology		Machined Aluminium alloy, no further surface treatments	
Lens adapter, material and technology		Flange to mate with OSIS C-mount ring part number K25-A007-00	

9.2 Sensors

Description	MR655Cx_yy	MR655Mx_yy	Units
Brand	Sony ICX655AQA	Sony ICX655ALA	
Sony Datasheet	E07528	PE07210-CR	
Type	Interline CCD image sensor		
Pixel resolution	2456 (H) × 2058 (V)		pixels
Chip size	9.93(H) × 8.70(V)		mm
Unit cell size	3.45(H) × 3.45(V)		µm
Color filter	RGB Bayer mosaic	None	
FWC (*), typical	12000		ē
Dark current (**), typical	12 (TBD)		ē/p/s

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

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

(**) – Dark current, limit specified by CCD chip vendor is ~380ē/p/s @ 60°C 110ms exposure. A typical value provided here is for informational purposes only, measured at room temperature, 110ms exposure. It can not be used as a unit qualification parameter.

9.3 Optical path

9.3.1 BH housing

Description	MR655Cx_BH	MR655Mx_BH	Units
Filter Brand	Hoya E-CM500S	Calflex-C	
Filter Thickness	1.0±0.1	1.0±0.1	mm
Filter Tilt	0.0	0.0	°
Specification	HOYA 8405E	Linos Calflex 04_127-130_e05	
Coating	NA	NA	
CCD Spot blemishes and stain specification	Sony E07527	Sony ?????	
Filter cleanness (spots, scratches)	±3 (*)	±3 (*)	%
Size of the cosmetics defects free aperture on filter	21.5	21.5	mm
Back focal distance in the air	17.52/+0.0/-0.2	17.52/+0.0/-0.2	mm

(*) – Filter cleanness is measured with the method and set of tools described in MR655CTP.

9.3.2 DP housing

Description	MR655Cx_BH	MR655Mx_BH	Units
Filter Brand	Hoya E-CM500S	Calflex-C	
Filter Thickness	1.0±0.1	1.0±0.1	mm
Filter Tilt	5.7 ± 0.3	5.7 ± 0.3	°
Specification	HOYA 8405E	Linos Calflex 04_127-130_e05	
Coating	NA	NA	
CCD Spot blemishes and stain specification	Sony E07527	Sony ?????	
Filter cleanness (spots, scratches)	±3 (*)	±3 (*)	%
Size of the cosmetics defects free aperture on filter	21.5	21.5	mm
Back focal distance in the air (**)	11.02/+0.0/-0.2	11.02/+0.0/-0.2	mm

(*) – Filter cleanness is measured with the method and set of tools described in MR655CTP.

(**) – Tolerances of Back focal distance for DP housing does not account for tolerances of K25-A007-00 part.

9.4 Camera core

Description	Symbol	Value	Units
Digitization		14	Bit
Supported bit resolutions		8, 10, 12 and 14	Bit/pix
Exposure time range	EXP	20µs ... 500sec	
Exposure time increment		1µs	
Variable Analog Gain Range	VGA	36	dB
Refresh rate	MRR	4.3	Fps
Trigger/sync input		Asynchronous, LVTTTL compatible, TTL tolerant internal pull up resistor of 100kΩ	
Trigger/sync output		LVTTTL compatible via internal serial resistor of 1kΩ	
Dynamic range, Typical	DR	~64	dB
Linearity (*)	Lin	<1	%
Acquisition Gain (12bit)	G	3.0 ±0.3	ē/ADU
External interface		IEEE1394A	

Acquisition noise (**), typical	AN _{typ}	3.0	ē
Acquisition noise (**), max	AN _{max}	5.0	ē
Readout noise (***), typical	RN _{typ}	8.0	ē
Readout noise (***), max	RN _{max}	NA	ē

Parameters in this table are subject to qualification measurements specified in MR655VVP and/or Sony data sheets E07528 and PE07210-CR and/or MR655CTP

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

(**) – Acquisition noise means noise generated by the camera with ADC input connected to ground via resistor equivalent to CCD output impedance of 200Ω.

(***) – Readout noise means noise generated by the camera with ADC input connected to CCD chip. Typical value provided here is for informational purposes only. It can not be used as a unit qualification parameter.

9.5 Power

Description	Symbol	Value	Units
Power supply, via IEEE1394 system connector	V _{nom}	12 ±10%	V
Consumption, typical no cooling	P _{nom}	1.8	W
Consumption, maximum no cooling	P _{max}	2.5	W
Consumption, typical cooling on (MR655xC_yy only)	P _{nom-cool}	3.5	W
Consumption, maximum cooling on (MR655xC_yy only)	P _{max-cool}	5.0	W

All parameters in this table are subject to qualification measurements specified in MR655CTP

9.6 Cooling performance (MR655xC_yy only)

Description	Symbol	Value	Units
Lowest possible temperature on the CCD chip	T _{chip}	10	°C
Housing temperature accuracy	T _{h-acc}	2	°C
CCD chip temperature accuracy	T _{c-acc}	3	°C
Maximum achievable temperature difference between housing and chip	T _{diff}	26	°C

All parameters in this table are subject to qualification measurements specified in MR655VVP

9.7 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 MR655VVP
 (*) – 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, cooling performance (MR655xC_yy only), durability.

9.8 Firmware/Host driver/API features

Description	Symbol	Value	Units
MCU firmware version		4.0.1	
FPGA build		20081110	
API DLL version		2.1.55	
Interpolation methods		9331, SHT_advanced	
White balance coefficients ranges		0.0 ... 3.9	x
Sharpness filter		0 ... 100	%
Gamma		0.1 ... 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		4.3	Frames/s

All parameters in this table are subject to qualification measurements specified in MR655VVP

9.9 Supported readout modes

Mode	Binning	Mode MR655C	Mode MR655B	Pixels	Frm/s Fld/s	Bits /pix
0	2x2 HS	Color	B/W	1228×1029	15	8
1	1x1	Color	B/W	2456×2058	4.3	14
2	2x2	Color	B/W	1228×1029	8.3	14
3	4x4 IL (*)	Color	B/W	614 × 514	16.5/33	14
4	6x6 (*)	Color Alt	B/W	408 × 343	25	14
5	2x2 (*)	B/W	B/W	1228×1029	9	14
6	2x2 HS (*)	B/W	B/W	1228×1029	18	8

HS – High Speed readout 49MHz pixel clock

IL – Interlace readout

PS – Progressive readout

All parameters in this table are subject to qualification measurements specified in MR655VVP

(*) – In development