

CAMERA MODULE SPECIFICATION

Customer: _____

Customer project name: VD55G1CCB0 Module

Product Description: ZS1320-A-160.3°

Last update: 2023/11/27

制作 (Drawn)	审核 (Check)	批准 (Approval)
Yongjian Chen	Yuan Lu	Qian Lu

客户确认: <input type="checkbox"/> 合格 <input type="checkbox"/> 不合格 <input type="checkbox"/> 其它 Customer Approval: Qualifiwd / Failure / Other		客户意见 (Customer Opinions)
批准日期 (DATE)	承认日期 (DATE)	



Revision History

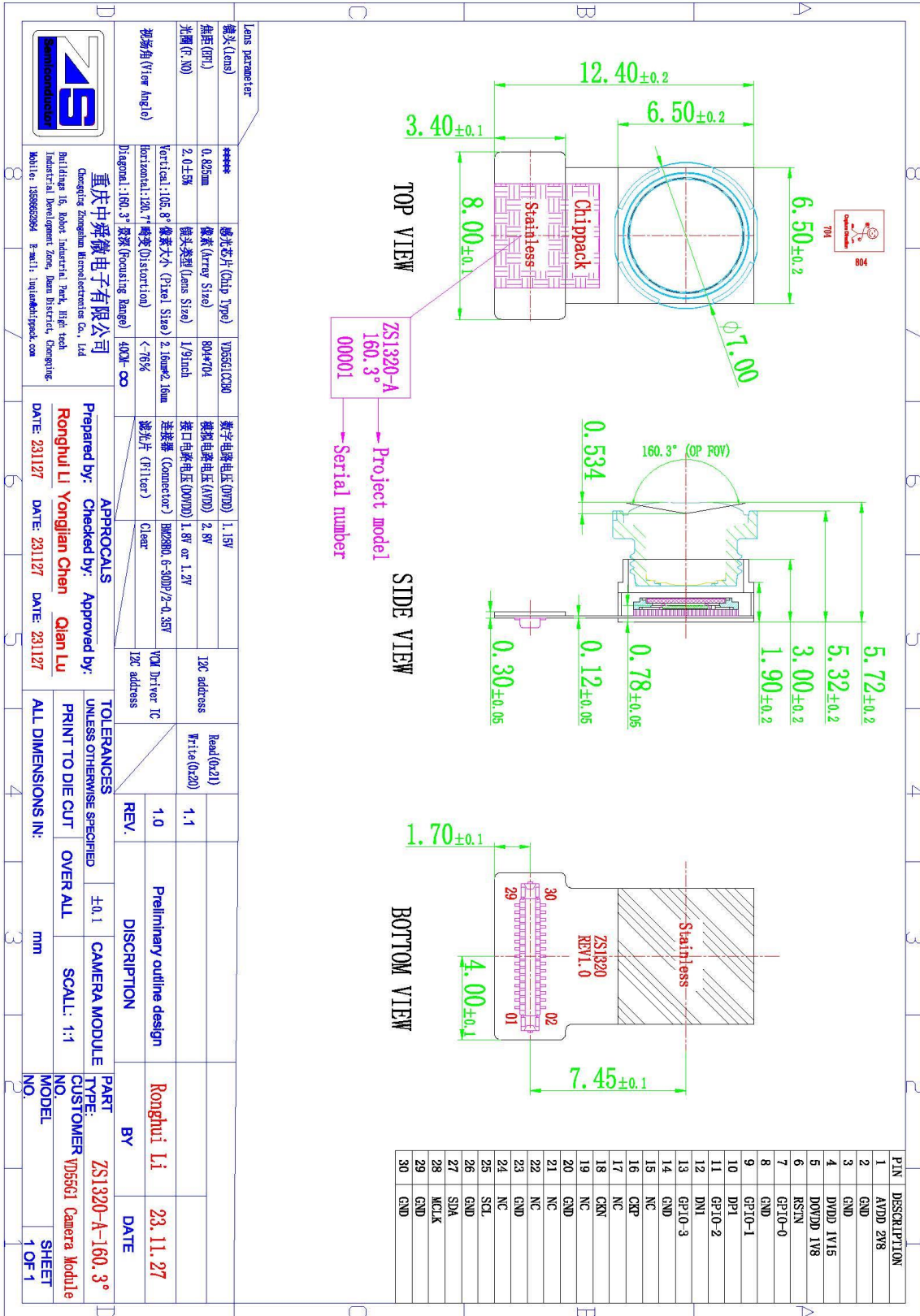
Version	Date [Y/M/D]	Notes	Writer
1.0	23/11/27	Initial released	Yongjian Chen



Table of Content

1、 Mechanical Specifications(unit: mm).....	4
2、 Specifications.....	5
2.1 Features.....	5
2.2 Description.....	5
2.3 Acronyms and abbreviations.....	6
2.4 Overview.....	7
2.5 Functional description.....	7
2.5.1 Interfaces.....	8
2.5.2 Power supplies.....	8
2.5.3 Clock.....	8
2.6 Video pipe.....	8
2.7、 Schematic.....	9
3、 Connector specifications.....	10
4、 Lens Specification.....	11
4.1 Overview.....	11
4.2.Optical Figure.....	12
4.3.Optical Data.....	14
4.4.Depth of Field.....	15
4.5.Filter specifications.....	15
8、 Pin Specifications.....	17
9、 Appearance Specification.....	18
10、 Image Specification.....	19
11、 Reliability Specification.....	20
12、 Packing specification.....	21

1、Mechanical Specifications(unit: mm)



2、 Specifications

2.1 Features

- Compact global shutter technology (65 nm/40 nm)
- High performance 2.16 μm x 2.16 μm BSI pixel
- Smallest global shutter 804x704 pixels with a 5.9 mm² footprint
 - Small pixel array size of 1.75 mm x 1.53 mm
 - Optical format 1/10" with 600x600 crop
 - Small die size: 2.73 mm x 2.16 mm
- Full resolution: 10 mW at 10 fps, 20 mW at 30 fps, 40 mW at 60 fps (target)
- Power consumption scaling with features/framerate and software standby
- 1.2Gb/s single lane transmitter MIPI CSI-2, with support down to 400 Mb/s
- Control interface supporting I3C (12 Mb/s) and I2C fast mode+ (1 Mb/s)
- Integrated temperature sensor with $\pm 2^\circ\text{C}$ accuracy [25 $^\circ\text{C}$ to 85 $^\circ\text{C}$]
- Up to three adjacent pixels with different integration times on the same frame (no defect correction)
- Dynamic defective pixel correction
- Adaptive Gaussian noise reduction (up to 3 dB to 9 dB noise reduction)
- Embedded auto exposure
- Piece wise linear (PWL), one setup per context, 4 points x/y per setup
- Image difference and ambient removal modes
- Auto wake-up mode, ultralow power mode where the sensor sends a pulse with scene changes, to wake up the host for further image analysis (target)
- Programmable sequences of 4-frame contexts, including illumination control
- Up to 4-LED control outputs, synchronized on sensor integration periods with flexible timings and PWM (pulse-width modulation) control
- Master/slave with external frame start
- Mirror/flip readout
- 1024 bits OTP available for the user/host
- Crop, binning (x2 and x4) and subsampling (x2 and x4)
- 43 IO pads (only three IO pad rows, no pads on top side)
- Operating junction temperature: -30 $^\circ\text{C}$ to 85 $^\circ\text{C}$
- High optical performance:
 - Total full well 10000e⁻, full well 7500e⁻ and temporal noise < 5e⁻ leading to a native dynamic range of 63.5 dB
 - PLS \leq -80 dB at 940 nm
 - QE940nm \geq 22% with MTF940nm \geq 34% at Nyquist
 - QE550nm \geq 83%

2.2 Description

The VD55G1 is an advanced global shutter with 2.16 μm pixel. It has a small die size of 2.73 x 2.16 mm².

2.3 Acronyms and abbreviations

Table 1. Acronyms and abbreviations

Acronym/abbreviation	Definition
AWU	auto wake-up
BSI	backside illumination
CCI	camera control interface
CRA	chief ray angle
CSI	camera serial interface
FoV	field of view
fps	frames per second
GPIO	general-purpose input/output
I2C	inter-integrated circuit (bus)
ISL	intelligent status line
ISP	image signal processor
LUT	look-up-table
MIPI	mobile industry processor interface
MTF	modulation transfer function
OIF	output interface
OTP	one-time programmable
PWL	piece-wise linear
PWM	pulse-width modulation
ROM	read-only memory
STBY	standby
SW	software

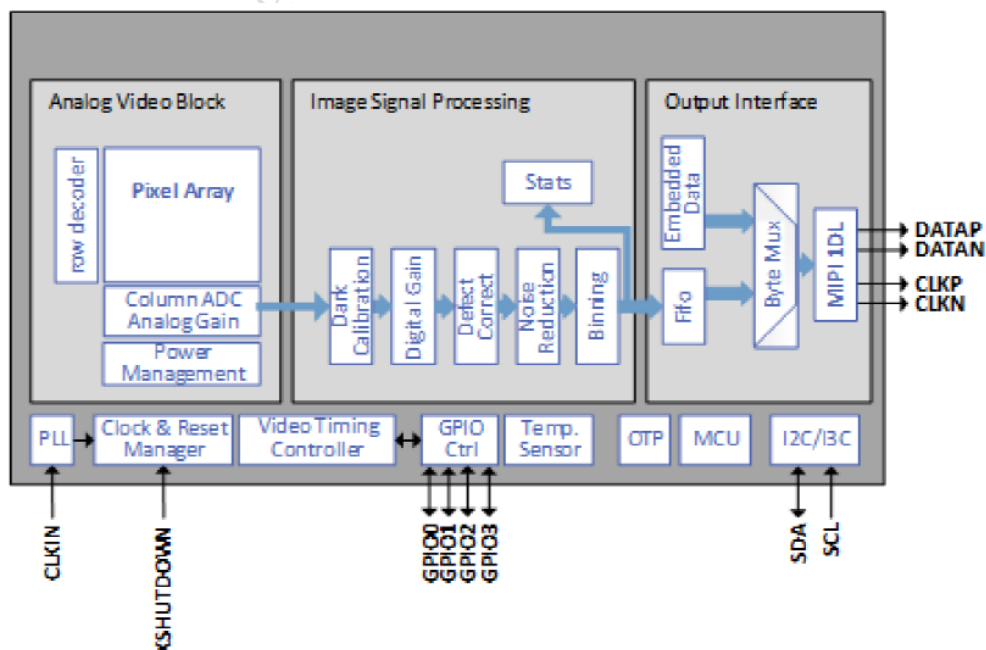
2.4 Overview

Table 2. Technical specifications

Feature	Detail
Resolution	Full output resolution 804 x704 - 0.57 megapixel
Sensor technology	3D stacked (65/40 nm)
Sensor control interface	I3C @ 12.5 MHz in SDR I2C @ 1 MHz Fast + mode
Power supplies	Analog: 2.8 V Digital core: 1.15 V IOs (exc MIPI): 1.8 V or 1.2 V
Input clock	6 to 27 MHz
Maximum frame rate	Maximum frame rate
Power consumption	40 mW typical @ 60 fps
HW ISP	DarkCal, dynamic defect correction, noise reduction
Image data interface	MIPI CSI-2 single lane with up to 1.2 Gbps per lane
Macros	1k-bit OTP, Temp sensor
Firmware	ROM based embedded firmware 32 bits CPU

2.5 Functional description

Figure 1. Block diagram



2.5.1 Interfaces

Inter-integrated circuit (I2C)

The VD55G1 is configured and controlled via an I²C interface. It operates in either Fast mode (up to 400 kHz) or Fast+ mode (up to 1 MHz) at 1.8 V. After the CPU boot sequence, the default I²C configuration is fast mode plus with a sink capability set to 20 mA. Drive capability can be decreased to 4 mA (Fast mode) by writing a dedicated register once the system has booted.

Device addressing uses a CCI protocol with 2 byte sub addresses.

The default sensor address, 0x20 (including R/W bit), can be overridden:

- Permanently if a non-null value is stored in the OTP dedicated register
- Dynamically with a CPU command when the CPU state is SW STBY

Camera serial interface (CSI)

The sensor is ready to connect via a single lane mobile industry processor interface (MIPI) CSI-2 serial interface.

The single lane MIPI CSI-2 serial interface supports up to 1.2 Gbps. Resolution is scalable between RAW8 and RAW10.

2.5.2 Power supplies

The power supplies required by the sensor are:

- 2.8 V for the analog blocks
- 1.8 V or 1.2V for the digital I/Os
- 1.15 V for the core digital logic and MIPI CSI-2 output drivers

The pixel array requires different positive and negative voltages, all internally generated by charge pumps and regulators. Two voltage references, internally generated, need external decoupling capacitors.

The internal CPU handles the entire power management of the sensor to guarantee the lowest power consumption at any given time.

2.5.3 Clock

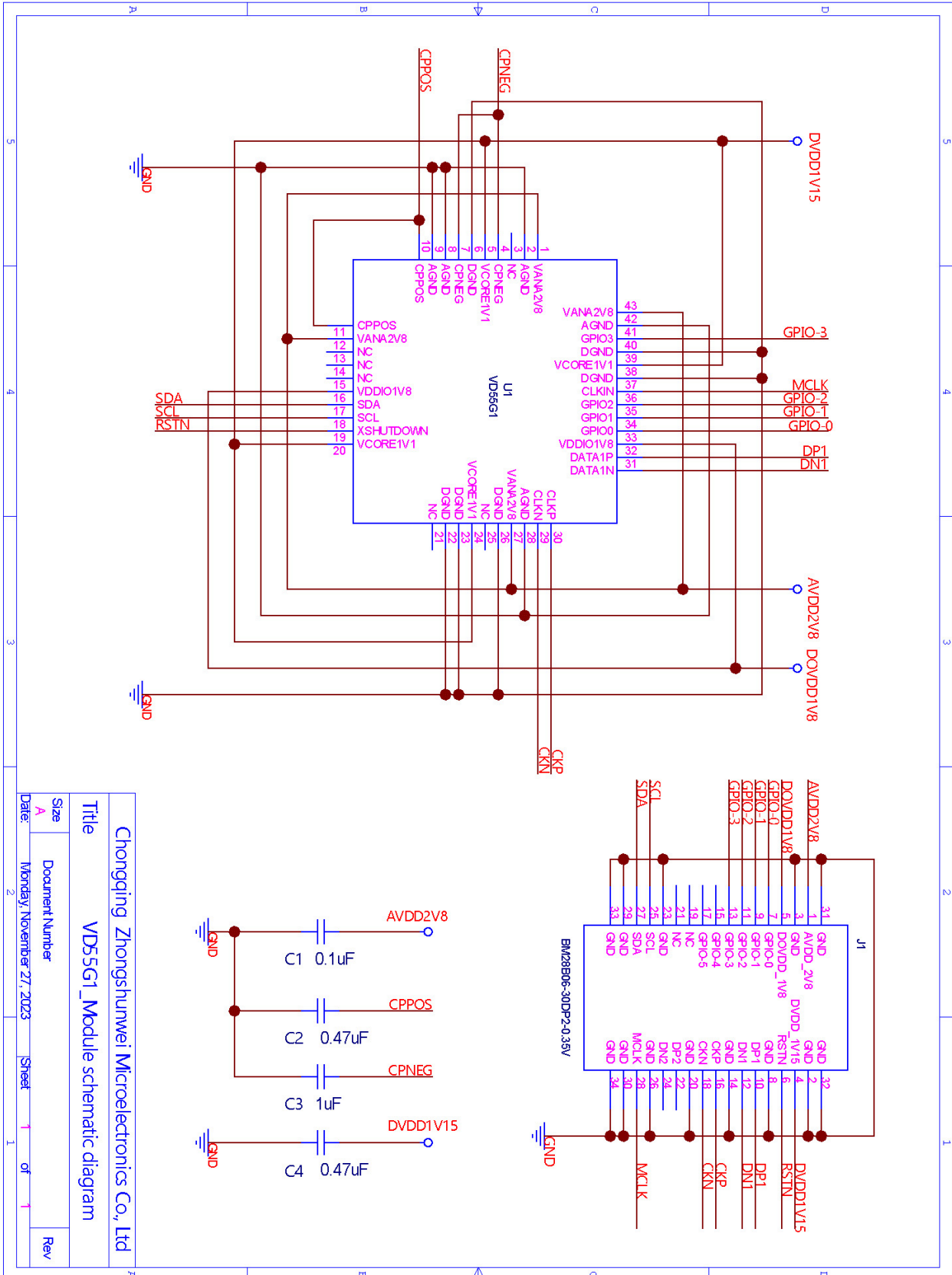
An input clock is required from an external digital clock source in the range of 6 MHz to 27 MHz.

2.6 Video pipe

The video pipe performs a number of functions designed to ensure an image of high quality. These functions include:

- Analog sub sampling
- Pattern generation
- Defective pixel correction
- Dark calibration
- Auto exposure
- Binning
- Embedded status lines
- Output interface
- Context
- Crop

2.7、Schematic



Chongqing Zhongshunwei Microelectronics Co., Ltd	
Title	VDS5G1_Module schematic diagram
Size	A
Document Number	
Date	Monday, November 27, 2023
Sheet	1 of 1
Rev	

3、Connector specifications

NOTE 1. ALL LEAD CO-PLANARITY SHALL BE 0.08mm MAX.

2 CONTACT PLATING SPECIFICATIONS
 CONTACT AREA : GOLD 0.05 μ m MIN
 SMT LEAD : GOLD 0.05 μ m MIN
 UNDER PLATING : NICKEL 1 μ m MIN
 (SURFACE : SEALING)

3 A PART OF THE WALL COULD BE NOTCHED.
4 PAV NO. AND HRS MARK EXIST IN THE INDICATED POSITION.

RECOMMENDED PGB LAYOUT (CALLOUTION AROUND CONNECTOR)
 NO COMPONENTS, AND NO CONDUCTIVE TRACES AND VIAS FOR OTHER COMPONENTS, WHICH WOULD INTERFERE WITH REPEATABL

RECOMMENDED PGB LAYOUT

RECOMMENDED METAL MASK DIMENSIONS
 METAL MASK THICKNESS : 80 μ m

RECOMMENDED REFLOW TEMPERATURE PROFILE USING LEAD-FREE SOLDER PASTE.

REFLOW METHOD: IR REFLOW
 NUMBER OF REFLOW CYCLES: 2 CYCLES MAX.
 1) REFLOW TIME
 DURATION ABOVE 220°C: 60 SEC MAX.
 PEAK TEMPERATURE: 250°C MAX
 2) PRE-HEAT TIME
 PRE-HEAT TEMPERATURE (CAIN): 150°C
 PRE-HEAT TEMPERATURE (MAX): 180°C
 PRE-HEAT TIME: 90-120 SEC.

NO.	UNITS	SCALE	COUNT	DESCRIPTION OF REVISIONS	DESIGNED	CHECKED	DATE
1	mm	10:1	1	DIS-H-00002470	RT. SHIMIZU	TS. MIYAZAKI	17.01.18
2	mm	10:1	1	DIS-H-00002470	RT. SHIMIZU	TS. MIYAZAKI	17.01.18
3	mm	10:1	1	DIS-H-00002470	RT. SHIMIZU	TS. MIYAZAKI	17.01.18
4	mm	10:1	1	DIS-H-00002470	RT. SHIMIZU	TS. MIYAZAKI	17.01.18

REVISIONS

NO.	UNITS	SCALE	COUNT	DESCRIPTION OF REVISIONS	DESIGNED	CHECKED	DATE
1	mm	10:1	1	DIS-H-00002470	RT. SHIMIZU	TS. MIYAZAKI	17.01.18
2	mm	10:1	1	DIS-H-00002470	RT. SHIMIZU	TS. MIYAZAKI	17.01.18
3	mm	10:1	1	DIS-H-00002470	RT. SHIMIZU	TS. MIYAZAKI	17.01.18
4	mm	10:1	1	DIS-H-00002470	RT. SHIMIZU	TS. MIYAZAKI	17.01.18

REVISIONS

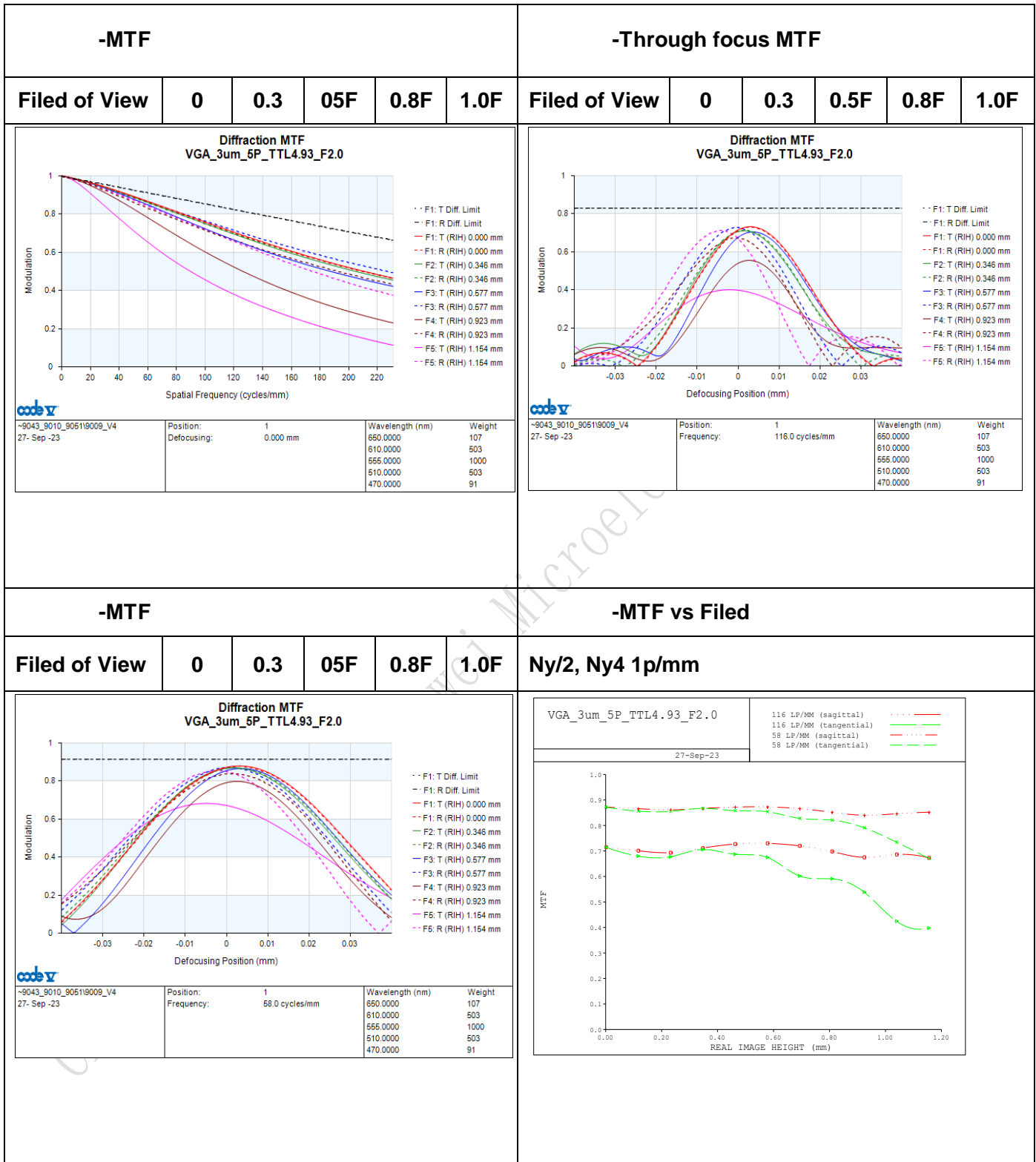
NO.	UNITS	SCALE	COUNT	DESCRIPTION OF REVISIONS	DESIGNED	CHECKED	DATE
1	mm	10:1	1	DIS-H-00002470	RT. SHIMIZU	TS. MIYAZAKI	17.01.18
2	mm	10:1	1	DIS-H-00002470	RT. SHIMIZU	TS. MIYAZAKI	17.01.18
3	mm	10:1	1	DIS-H-00002470	RT. SHIMIZU	TS. MIYAZAKI	17.01.18
4	mm	10:1	1	DIS-H-00002470	RT. SHIMIZU	TS. MIYAZAKI	17.01.18

4、Lens Specification

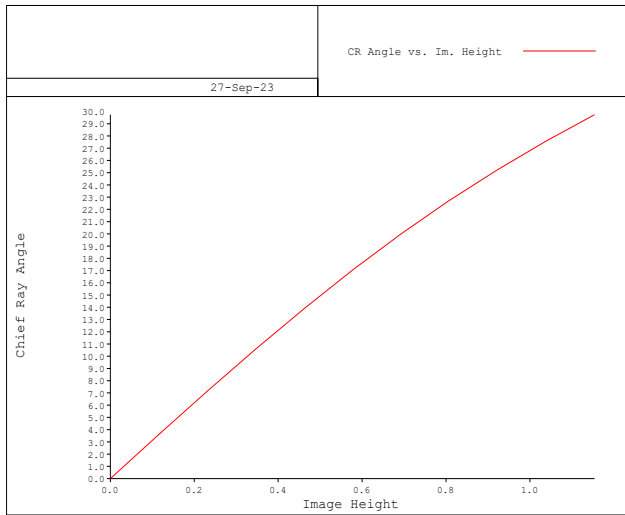
4.1. Overview

1. Lens Specification				
Item		Specification		Note
Product No.				
Sensor Size	Horizontal	804		VD55G1CCB0
	Vertical (pixels)	704		
Sensor Pixel Pitch (um)		2.16		
Image diagonal		Φ2.308 mm		
Effective Focal Length (EFL)		0.825		
F-number		2		+/- 5%
Object Distance		35		cm
Field of View	Vertical	105.8		deg (y=0.76 mm)
	Horizontal	120.7		deg (y=0.868 mm)
	Diagonal	160.3		deg (y=1.154 mm)
Wavelength Weighting		650:610:555:510:470=107:503:1000:503:91		
MTF	On Axis	0.47	0.47	@231 lp/mm , Ny
	0.3x Field (T/S)	0.45	0.47	
	0.5x Field (T/S)	0.42	0.50	
	0.8x Field (T/S)	0.23	0.44	
	1.0x Field (T/S)	0.11	0.38	
	On Axis	0.72	0.72	@116 lp/mm , Ny/2
	0.3x Field (T/S)	0.71	0.71	
	0.5x Field (T/S)	0.68	0.73	
	0.8x Field (T/S)	0.54	0.68	
	1.0x Field (T/S)	0.40	0.67	
	On Axis	0.87	0.87	@58 lp/mm , Ny/4
	0.3x Field (T/S)	0.87	0.87	
	0.5x Field (T/S)	0.85	0.87	
	0.8x Field (T/S)	0.79	0.84	
	1.0x Field (T/S)	0.67	0.85	
Distortion	Optical Distortion	< -76%		
Relative Illumination (Ref.)		54.0%		At Image Diagonal
Chief Ray Angle		<29.7		deg
Total Track Length		4.95		#REF!
Flange Back Length		0.96		#REF!
Max. Image Circle		Φ2.6		
Barrel Thread		M5.5 X 0.35P		(reference)
Construction		5P		

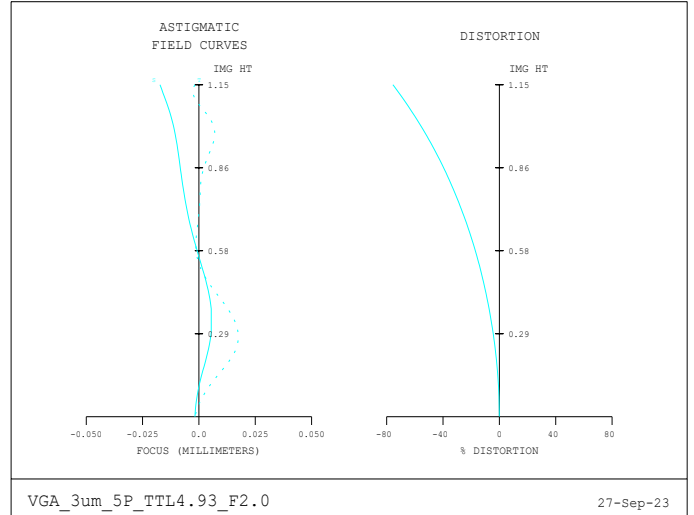
4.2.Optical Figure



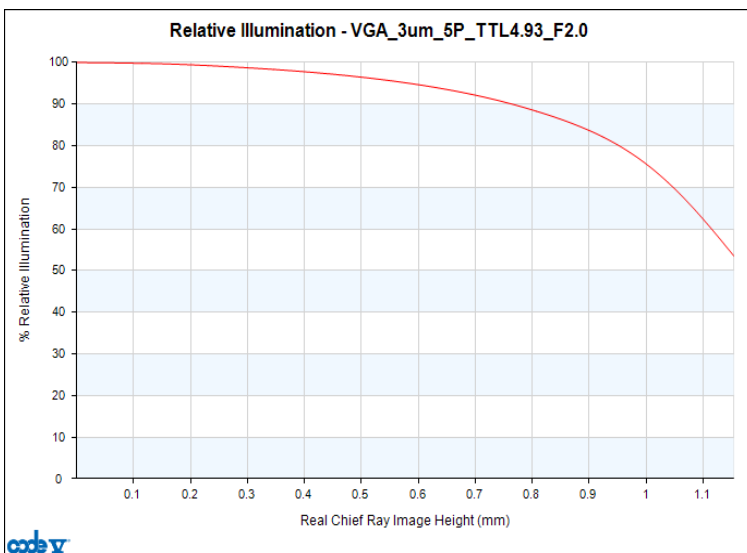
-Chief Ray Angle



-Field Curvature



-Relative Illumination

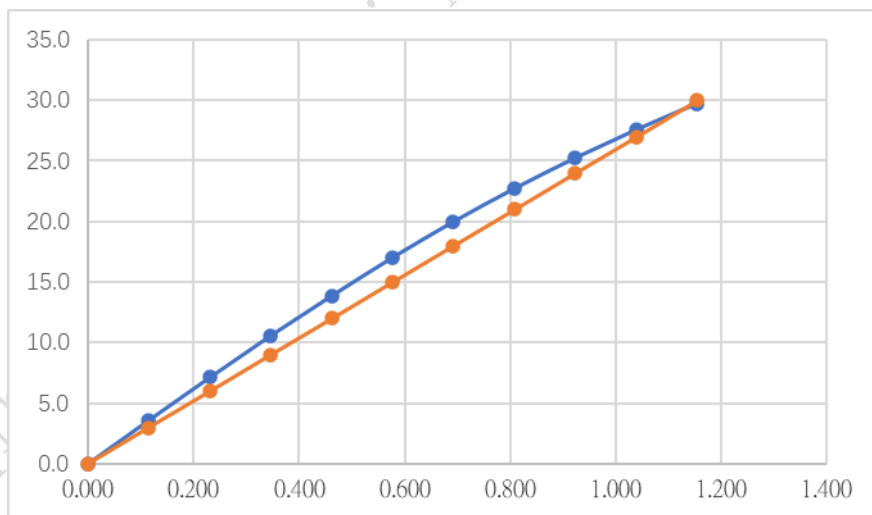


4.3.Optical Data

-Optical and TV Distortion Visible	
Filed	Optical Distotion
0	0.00
0.1	-0.73
0.3	-2.85
0.3	-6.26
0.4	-10.96
0.5	-17.09
0.6	-24.81
0.7	-34.21
0.8	-45.55
0.9	-59.27
1	-75.60

-Relative Illumination	
Filed	Optical Distotion
0	100.0
0.1	99.8
0.3	99.3
0.3	98.3
0.4	97.0
0.5	95.1
0.6	92.4
0.7	88.3
0.8	82.2
0.9	71.2
1	53.6

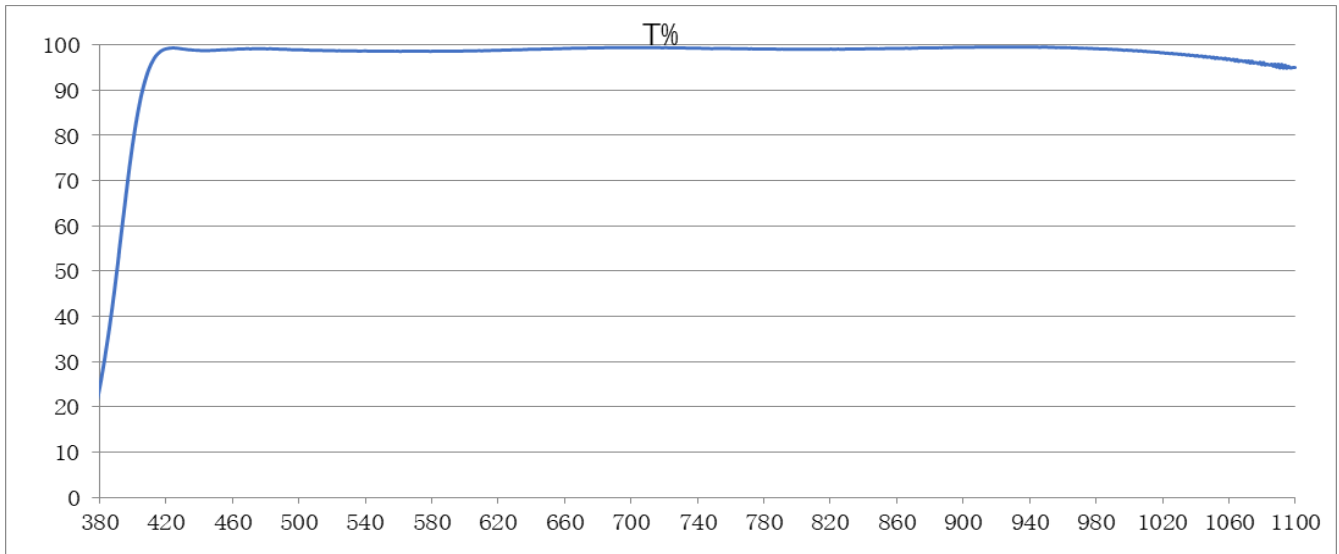
-Chief Ray Angle		
Filed	Optical Distotion	VD55G1
0.000	0.0	0.0
0.115	3.6	3.0
0.230	7.1	6.0
0.346	10.6	9.0
0.461	13.9	12.0
0.576	17.0	15.0
0.691	20.0	18.0
0.807	22.7	21.0
0.922	25.3	24.0
1.307	27.6	27.0
1.152	29.7	30.0



4.4.Depth of Field

Object Distance	Limit Near Field	Limit Far Field	Deviation of Focus
Infinity	-	-	0
10000	78	INF	0.000
5000	78	INF	0.000
4000	77	INF	0.000
3000	77	INF	0.000
2000	76	INF	0.000
1900	76	INF	0.000
1800	76	INF	0.000
1700	75	INF	0.000
1600	75	INF	0.000
1500	75	INF	0.000
1400	75	INF	0.000
1300	74	INF	0.001
1200	74	INF	0.001
1100	74	INF	0.001
1000	73	INF	0.001
900	72	INF	0.001
800	72	INF	0.001
700	71	INF	0.001
600	70	INF	0.001
500	68	INF	0.001
450	67	INF	0.002
400	66	INF	0.002
350	64	INF	0.002
300	63	INF	0.002
250	60	INF	0.003
200	57	INF	0.003
150	52	INF	0.005
140	51	INF	0.005
130	49	INF	0.005
120	48	INF	0.006
110	46	INF	0.006
100	44	INF	0.007
90	42	INF	0.008
80	40	INF	0.009
70	37	574	0.010
60	34	241	0.012
50	31	133	0.014

4.5. Filter specifications



Filter: Clear	
Wavelength	Spec
420-680nm	Tave ≥ 98%
700-1100nm	Tave ≥ 95%
Glass size	3.7*3.7mm
Glass thick	0.21mm

8、Pin Specifications

PIN No.	NAME	Type	Description
1	AVDD	Power	Analog 2.8V power supply
2	GND	Ground	Ground
3	GND	Ground	Ground
4	DVDD	Power	Digital Core 1.15V Power
5	DOVDD	Power	IO 1.8V Power
6	RSTN	I/O	Reset active low
7	GPIO-0	I/O	General purpose I/O and strobe light control-0
8	GND	Ground	Ground
9	GPIO-1	I/O	General purpose I/O and strobe light control-1
10	DP1	Output	MIPI data lane 1 positive
11	GPIO-2	I/O	General purpose I/O and strobe light control-2
12	DN1	Output	MIPI data lane 1 negative
13	GPIO-3	I/O	General purpose I/O and strobe light control-3
14	GND	Ground	Ground
15	NC	-	-
16	CKP	Output	MIPI clock lane positive
17	NC	-	-
18	CKN	Output	MIPI clock lane negative
19	NC	-	-
20	GND	Ground	Ground
21	NC	-	-
22	NC	-	-
23	GND	Ground	Ground
24	NC	-	-
25	SCL	Input	SCCB interface input clock
26	GND	Ground	Ground
27	SDA	I/O	SCCB interface data pin
28	MCLK	Input	Input clock
29	GND	Ground	Ground
30	GND	Ground	Ground

9、Appearance Specification

Exterior				
NO.	Test Item	Test Conditions	Detection method	Judge standard
1	Module appearance	No dirt, no visible scratches on the surface of the module, no impurities in the plastic	8X magnifier	Pass
2	Lens	There should be no visible scars or dirt when inspected under 800±100Lux intensity head-up and 45-degree reflected light.	8X magnifier	Pass
3	UV Glue	The dispensing length is 1/3-1/2 of the circumference, and the glue cannot overflow to the lens end surface and the lens base	8X magnifier	Pass
4	Sealant	Fill the sealant evenly between the base and the FPC. There should be no gaps or uneven thickness, and there should be no glue overflowing the edge of the FPC to cause the appearance of oversize.	8X magnifier	Pass
5	FPC	1) There is no dirt on the surface, and the printed fonts are clear; 2) The length of the edge burr is less than 1mm, and the width is less than 0.3mm; 3) The length of the edge notch is less than 1mm, the width is less than 0.1mm, each side does not exceed 2 points, and no sharp corners tearing inward are allowed	40X microscope (continuous zoom)	Pass
6	Connector	1) Lack of tin is not allowed, and short circuit with multiple tins is not allowed 2) No foreign matter is allowed in the connector slot 3) PIN feet are not allowed to be lifted	40X microscope (continuous zoom)	Pass
7	Reinforcing steel plate	(1) The surface must not be dirty, rusted or scratched; (2) The height of the positioning column beyond the board surface is ≤0.1mm	Visually	Pass
8	Accessories	The paste direction is correct, the paste should not exceed the edge of the steel plate, no protrusions, double-sided tape When the protective film is torn off, there must be no glue detachment, deformation, or damage	Visually	Pass
Size				
NO.	Test Item	Test Conditions	Detection method	Judge standard
1	High	Meet the requirements of the drawings	Caliper	Pass
2	Length	Meet the requirements of the drawings	Caliper	Pass
3	Width	Meet the requirements of the drawings	Caliper	Pass

10、Image Specification

Optical performance testing requirements				
NO.	Test Item	Test Conditions	Detection method	Judge standard
1	Dust	Under the white field, take the image and visually observe the entire screen without any visible foreign objects.	Test Fixture. Light box. 6500K white backlight	Pass
2	Imaging direction	Meet the requirements of the drawings	Test Fixture.	Pass
3	Dead & Wound Pixel	1) Under dark field: the total number of bright spots is less than 400 pixels; 2 adjacent pixels The aggregated bright spots are less than 20; there are no aggregated bright spots with more than 3 pixels. 2) Under the white field: the total number of dark spots is less than 400 pixels; 2 adjacent pixels The accumulated dark spots are less than 20; there are no accumulated dark spots above 3 pixels.	Test Fixture. Light box. 6500K white backlight	Pass
4	TV Line	0.5M pixels: the center is not less than 350LW/PH, and the four corners are equal to or equal to 250LW/PH	ISO12233	Pass
5	FOV	Diagonal: 160.3°	Angle test card	Pass
6	TV distortion	Pincushion distortion (positive number) or barrel distortion (negative number) is not more than < -76%	Distortion test card	Pass

11、Reliability Specification

NO.	Test Item	Test Conditions	Judge standard
1	Low Temperature Storage Test	Keep in $-20\pm 3\text{ }^{\circ}\text{C}$ duration for 24 hrs	After the test, the function and appearance should be normal after 2H at room temperature.
2	High Temperature Storage Test	Keep in $+60\pm 3\text{ }^{\circ}\text{C}$ duration for 24 hrs	After the test, the function and appearance should be normal after 2H at room temperature.
3	Low temperature operating	Temperature : $-20\text{ }^{\circ}\text{C}\pm 2\text{ }^{\circ}\text{C}$ Time :24 hours	After the test, the function and appearance should be normal after 2H at room temperature
4	High temperature operating	Temperature : $60\text{ }^{\circ}\text{C}\pm 2\text{ }^{\circ}\text{C}$ Time :24 hours	After the test, the function and appearance should be normal after 2H at room temperature
5	Drop test Free fall (Package State)	Surface (floor): Concrete or steel Number of drops: 18 Positions: Random Height: 30cm	After the test, the test function is normal, and there is no obvious abnormality in appearance.
6	Vibration (Package State)	Frequency range: 10—50 Hz amplitude: 2mm Duration 1 h for each position. Test all 3 axes (X, Y, Z)	After the test, the function and appearance should be normal after 1H at room temperature.
Test Conditions: Illumination: $150\pm 10\%$ LUX Color temperature: $6500\pm 150\text{K}$ Headlight Box $600\pm 10\%$ LUX			

12、 Packing specification

