PRODUCT	:	CAMERA MODULE
MODEL NO.	:	CM3587-O130BF-E
SUPPLIER	:	TRULY SEMICONDUCTORS LTD.
DATE	:	April 28, 2009

CERT. No. 946535
ISO9001
TL9000

SPECIFICATION

Revision: 1.4

CM3587-O130BF-E

If there is no special request from customer, TRULY SEMICONDUCTORS Co., Ltd will not reserve the tooling of the product under the following conditions:
1.There is no response from customer in two years after TRULY SEMICONDUCTORS Co., Ltd submit the samples;
2.There is no order in two years after the latest mass production.
And correlated data (include quality record) will be reserved one year more after tooling was discarded.

TRULY SEMICONDUCTORS LTD: **CUSTOMER:**

Quality Assurance Department:_____
Approved by:

Technical Department:_____

Approved by:

REVISION RECORD

REV NO.	REV DATE	CONTENTS	REMARKS
1.0	2008-12-29	First release	
1.1	2009-03-05	Update drawing	
1.2	2009-03-16	Add Lens/Holder spec, Part list	
1.3	2009-04-10	Add Reliability Specification	
1.4	2009-04-28	Modify the tolerance of holder flute	

CONTENTS

WRITTEN BY	CHECKED BY	APPROVED BY
HUANG WEI NA	WEI YOUXING	LIU TIE NAN

Key Information

Module No.		CM3587-O130BF-E
Module Size		6.50mm x 6.50mm x 3.80mm
Image Quality		≥400 TV line
Sensor Type		MT9M113
Array Size		1280 X 1024(SXGA)
Power supply	Digital	1.70~1.95V
	Analog	2.50~3.10V
	I/O	1.70~3.10V
Lens		1/6 inch 3Plastic+IR
Focus(F.NO)		2.8
View Angle		60.4°
Active pixel array area		2.28mm x 1.83mm
Object distance		50cm-infinity
Responsivity		0.54V/(Lux-sec)
Pixel size		1.75μm x1.75μm
IR Cutter		650+/-10nm
Sensor Operation Temperature Range		-30° C to 70° C
Output Formats		YCbCr .RGB 565/555/444 .Processed Bayer; .Raw8-and Raw10-bit
MAX Frame rate		15 fps at full resolution 24 fps at preview mode 30 fps in video mode
SNR MAX		38.5dB
Dynamic Range		66dB
IC Package		COB
Substrate		PCB
ADC resolution		10Bit
Power consumption per mode	Full resolution	222mW 15 fps
	Standby	50μW
Package		Antistatic Plastic

Pin Assignment

No.	Name	Pin type	Description
1	AGND	Supply	Analog Ground
2	AVDD	Supply	Analog power
3	D1	Output	Image data output bit[1]
4	SDA	I/O	Two-wire serial interface data
5	SCL	Input	Two-wire serial interface clock
6	STANDBY	Input	Controls sensor's standby mode, active high 0: Normal mode 1: Standby mode
7	MCLK	Input	Input clock signal 8-54 MHz
8	DVDD	Supply	Digital power
9	RESET	Input	Master reset signal ,active LOW
10	D7	Output	Image data output bit[7]
11	D6	Output	Image data output bit[6]
12	D5	Output	Image data output bit[5]
13	STROBE	Output	Flash control
14	NC		
15	D4	Output	Image data output bit[4]
16	PCLK	Output	Pixel clock
17	D3	Output	Image data output bit[3]
18	D2	Output	Image data output bit[2]
19	NC		
20	DGND	GND	Digital I/O Ground
21	DOVDD	Supply	I/O power supply
22	D0	Output	Image data output bit[0]
23	HSYNC	Output	Identifies pixels in the active line
24	VSYNC	Output	Identifies rows in the active image

Electrical Characteristics

1. Absolute Maximum Ratings

Symbol	Parameter	Rating		Units
		Min	Max	
VDD_MAX	Core digital voltage	–0.3	2.4	V
VDD_IO_MAX	I/O digital voltage	–0.3	4.0	V
VAA_MAX	Analog voltage	–0.3	4.0	V
VAA_PIX_MAX	Pixel supply voltage	–0.3	4.0	V
VDD_PLL_MAX	PLL supply voltage	–0.3	4.0	V
VIH_MAX	Input HIGH voltage	–0.3	VDD_IO + 0.3	V
VIL_MAX	Input LOW voltage	–0.3	–	V
T_OP	Operating temperature (measure at junction)	–30	75	°C
T_STG	Storage temperature	–40	85	°C

2. Digital Processing

Readout Options

The sensor core supports different readout options to modify the image before it is sent to the IFP. The readout can be limited to a specific window of the original pixel array.

For preview modes, the sensor core supports both skipping and pixel averaging in x and y directions.

By changing the readout direction the image can be flipped in the vertical direction and/or mirrored in the horizontal direction.

Window Size

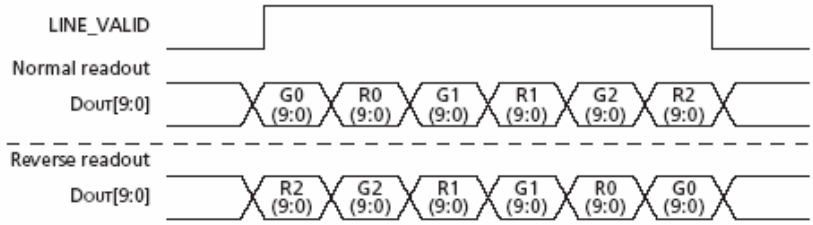
The image output size is set with registers x_addr_start, x_addr_end, y_addr_start, and y_addr_end. The edge pixels in the 1300 x 1044 array are present to avoid edge defects and should not be included in the visible window. Binning will change the image output size.

Readout Modes

Horizontal Mirror

When the sensor is configured to mirror the image horizontally, the order of pixel readout within a row is reversed, so that readout starts from x_addr_end and ends at x_addr_start. Figure 6 shows a sequence of 6 pixels being read out with normal readout and reverse readout. The SOC corrects for this change in sensor core output.

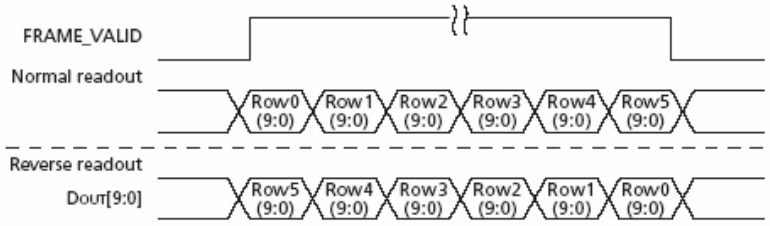
Figure 6: 6 Pixels in Normal and Column Mirror Readout Modes



Vertical Flip

When the sensor is configured to flip the image vertically, the order in which pixel rows are read out is reversed, so that row readout starts from y_addr_end and ends at y_addr_start. Figure 7 shows a sequence of 6 rows being read out with normal readout and reverse readout. The SOC corrects for this change in sensor core output.

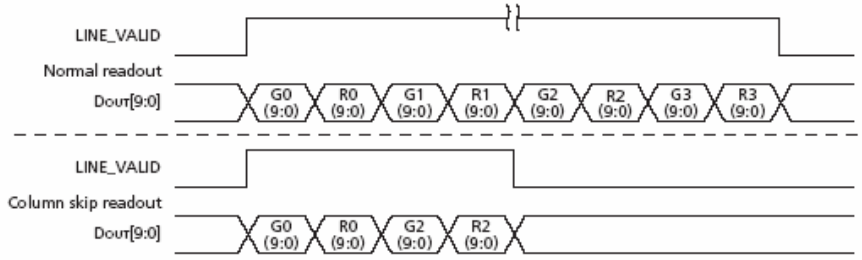
Figure 7: 6 Rows in Normal and Row Mirror Readout Modes



Column and Row Skip

The sensor core supports subsampling. Subsampling reduces the amount of data processed by the analog signal chain in the sensor and thereby allows the frame rate to be increased. This reduces the amount of row and column data processed and is equivalent to the skip2 readout mode provided by earlier Micron image sensors. Set the proper image output and crop sizes before enabling subsampling.

Figure 8: 8 Pixels in Normal and Column Skip 2X Readout Modes



3.Camera Control

General Purpose I/Os

The five GPIOs of the MT9M113 can be configured in multiple ways. Each of the I/Os can be used as a simple input/output that can be programmed from the host. The status of the GPIO is read at power up and can be used as a module ID to separate different module suppliers. In addition, module ID can be stored in the one-time programmable memory of the sensor. Information on the OTP memory can be found in "One-Time Programmable Memory."

If 10-bit RAW output is required, GPIO[1:0] can be configured as bit 1 and bit 0 (the LSBs) of a 10-bit data bus.

GPIO[4] can be configured to output a flash pulse to trigger an external Xenon or LED flash or a shutter pulse to control an external shutter.

GPIO[2] can also be configured as inputs to be used as an OE_BAR signal for the data bus.

The general purpose inputs are enabled or disabled through register settings. Once enabled, all five inputs must be driven to valid logic levels by external signals. The state of the general purpose inputs can be read from a register.

Output Enable Control

When the parallel pixel data interface is enabled, its signals can be switched asynchronously between being driven and High-Z under signal or register control.

One-Time Programmable Memory

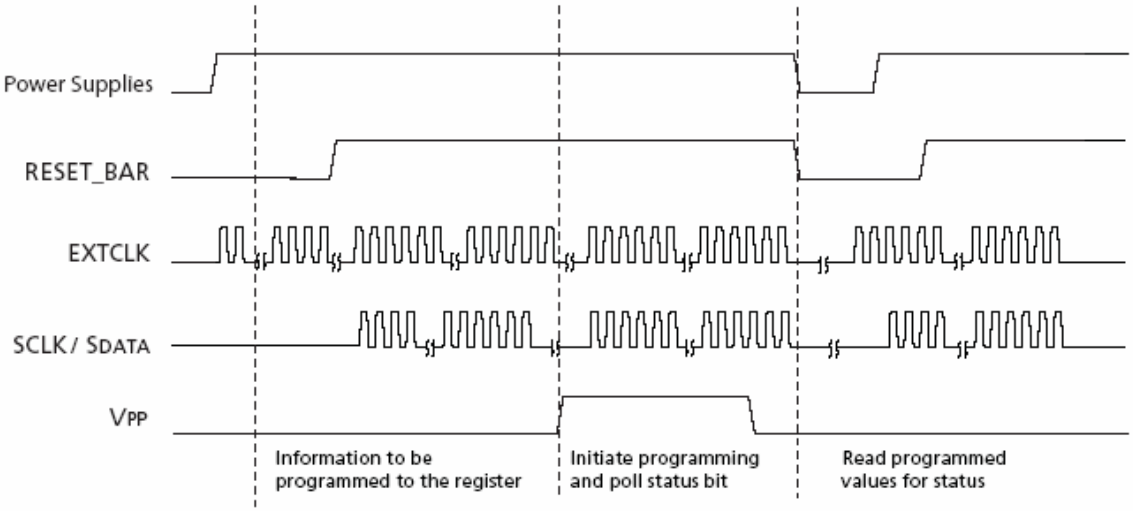
The MT9M113 contains two bytes of OTP memory, suitable for storing module identification that can be programmed during the module manufacturing process. Programming the OTP memory requires the use of a high voltage (7–8V) at the VPP pin. During normal operation, the VPP pin should be left floating. The OTP memory can be accessed through the two-wire serial interface.

Programming the OTP Memory

The programming of the OTP memory requires the sensor to be fully powered and remain in software standby with its clock input applied. The steps below describe the programming process:

1. Apply power to all the power rails of the sensor (VDD, VDD_IO, VAA, VAA_PIX, and so on).
2. Provide the EXTCLK clock input.
3. Perform the proper reset sequence to the sensor.
4. Place the sensor in software standby (sensor default state upon power-up).
5. Write the information to be programmed to the Program_Value register through the two-wire serial interface.
6. Supply a high voltage (7-8V) to the VPP pin.
7. Write to the Program_Value register to indicate the high voltage is applied at the VPP pin in order to start the programming process.
8. Poll the status bit from the Program_Value register for the completion of the programming process.
9. Remove the high voltage at VPP pin.
10. Verify the data at the OTP memory by performing a normal read procedure.

Figure 21: Sequence of Signals for OTP Memory Operation



Reading the OTP Memory

The content of the OTP memory can be read through the two-wire serial interface, and it is available for access after power-up.

Note: For more information of sensor please refer to the MT9M113 specification.

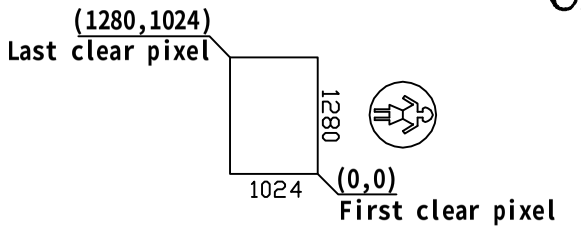
Mechanical Drawing

RoHS

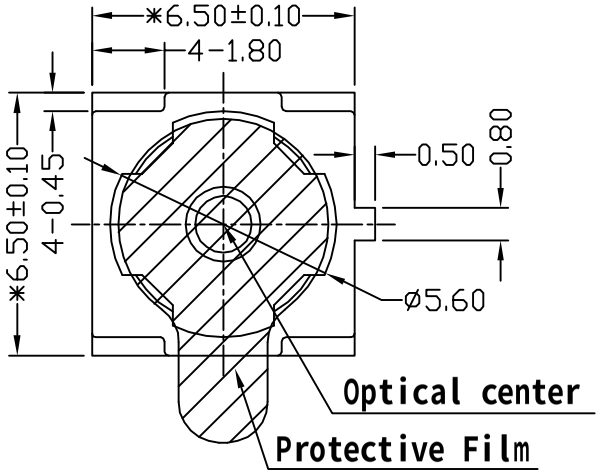
Customer No.:

CM3587-0130BF-E Camera Module

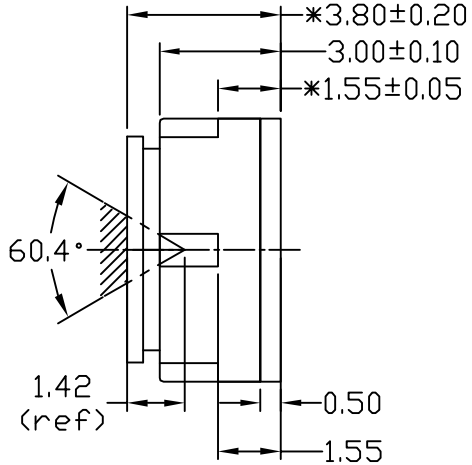
Image direction



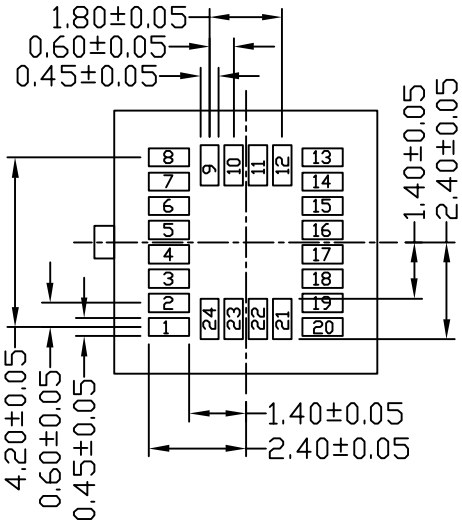
TOP VIEW



SIDE VIEW



BOTTOM VIEW



PIN NO	NAME
1	AGND
2	AVDD_2.8V
3	D1
4	SDA
5	SCL
6	STANDBY
7	MCLK
8	DVDD_1.8V
9	RESET
10	D7
11	D6
12	D5
13	STROBE
14	NC
15	D4
16	PCLK
17	D3
18	D2
19	NC
20	DGND
21	IOVDD_1.8/2.8V
22	DO
23	HSYNC
24	VSYNC

主要参数(Module Specification)	
焦距(EFL)	2.44mm
光圈(F.NO)	2.8
视场角(View Angle)	60.4°
畸变(Distortion)	< 1 %
解象力(Image Quality)	≥400 TV line
景深(Focusing Range)	50 cm~Infinity
感光芯片(Chip Type)	MT9M113
象素(Array Size)	1.3M
镜头类型(lens Size)	1/6 INCH 3P+IR

Maker: SMK socket
Part NO: CLE9124-6901F

CUSTOMER APPROVE		AMEND		
Mechanical	Electrical	NO.	CONTENT	DATE
		4	Modify Module height	2009.2.18
		3	Modify holder structure	2009.1.12
		6	Modify the tolerance of holder flute	2009.4.27
		5	Add view angle deepness	2009.3.05

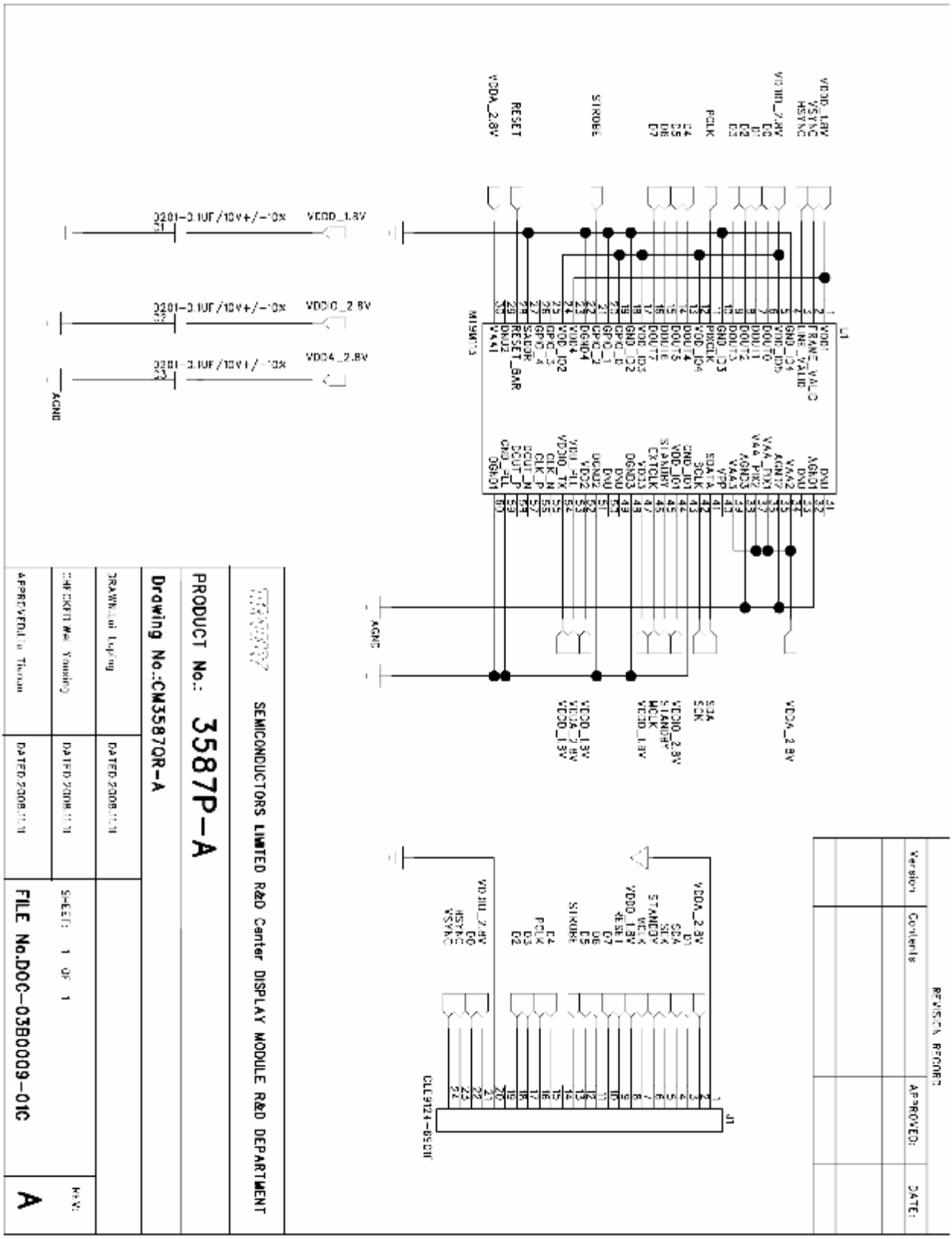
手机摄像模组

TOLERANCE
DECIMAL
.x ± .30
.xx ± .20
∠ ± 1/4°

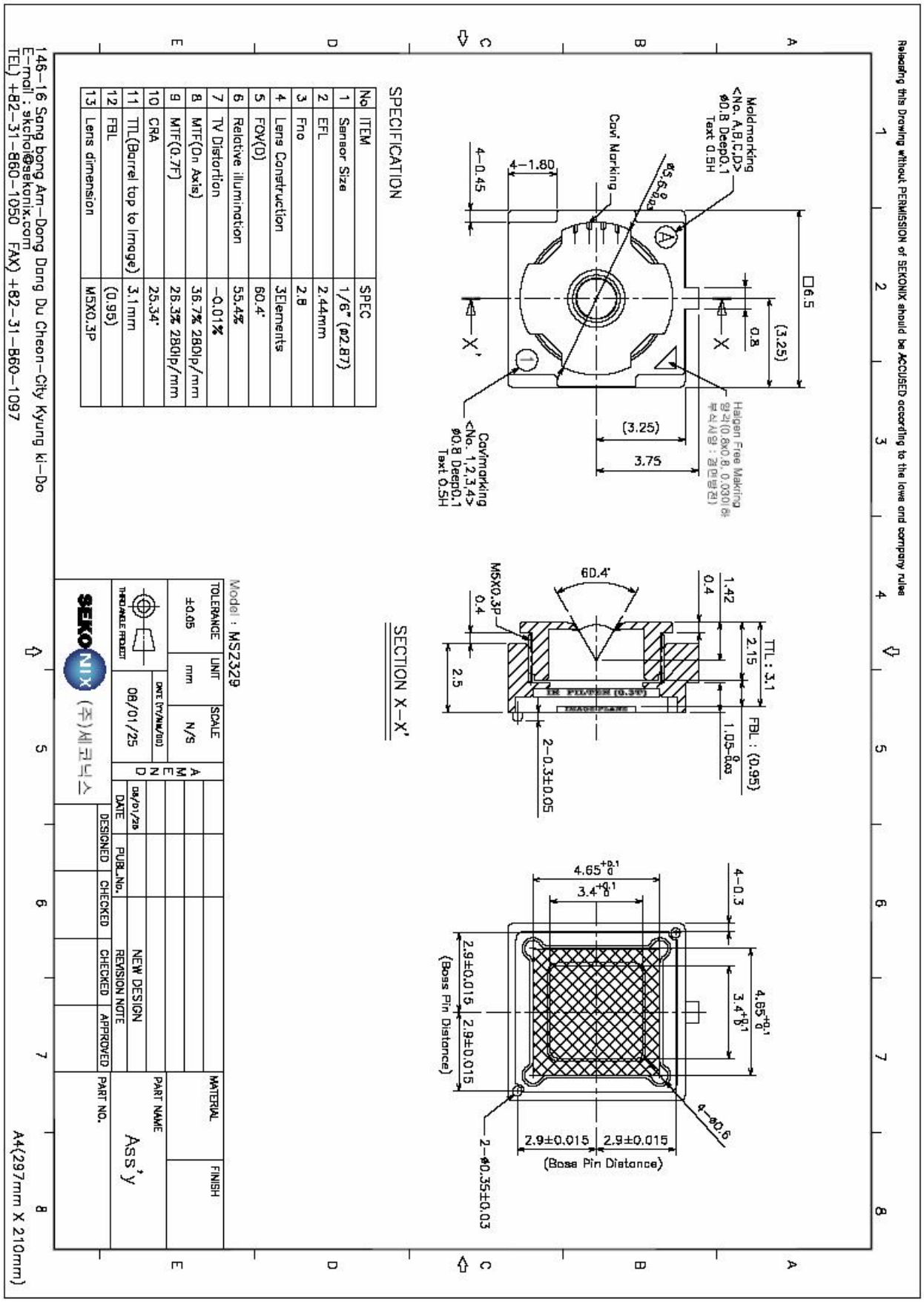
TRULY SEMICONDUCTORS LTD.

PRODUCT NO.	DRAW NO.	REV
CM3587-0130BF-E		H
DWN Luping Lai 20090427	DSN Luping Lai 20090427	
CHKD Bruce Ma 20090427	APPD Laurence Liu 20090427	
NOT IN SCALE	UNIT mm	SHEET:

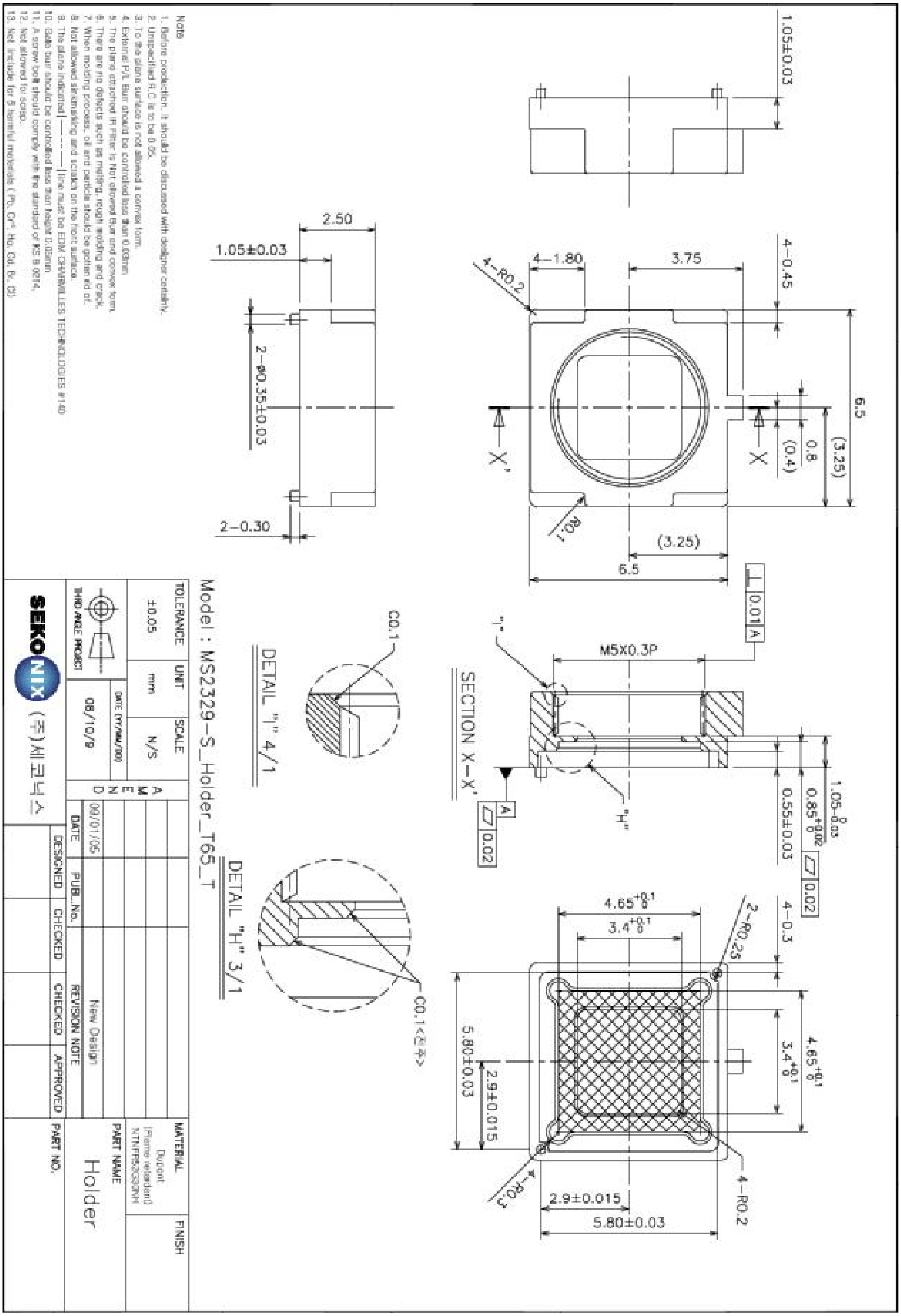
Module Schematic



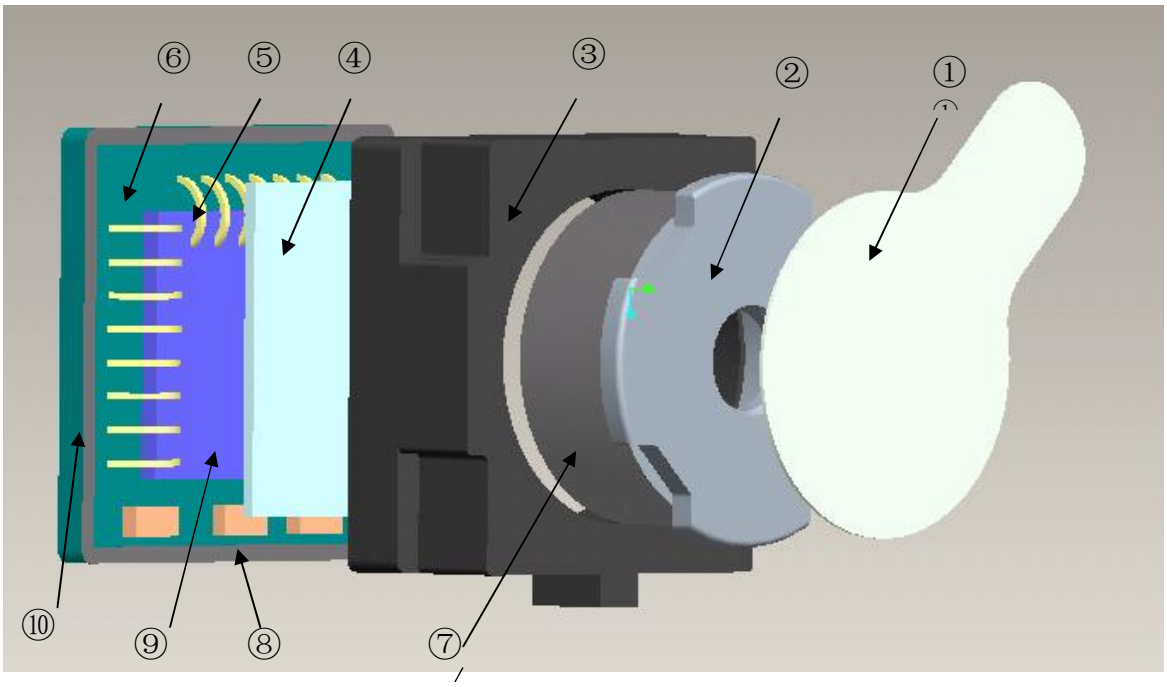
Lens Specification



Holder Specification


Model : MS2329-S_Holder_T65_T
SECTION X–X'
DETAIL "I" 4/1
DETAIL "H" 3/1
M5X0.3P
6.5
(3.25)
3.75
2.50
1.05±0.03
2–0.30
5.80±0.03
2.9±0.015
TOLERANCE
±0.05
UNIT
mm
SCALE
N/S
08/10/9
New Design
MATERIAL
FINISH
PART NAME
Holder
PART NO.
SEKONIX

Part List



	Name	Material	Ver.	Qty	Vendor	Spec
①	Lens Tape	BHM5.2*5.2(MM)	New	1 pc	Ke Mei	T=0.06mm, Diameter＝5.2mm
②	Lens	3 PLASTIC	New	1 pc	SEKONIX	MS2329_LENS_T67
③	Holder	PPA	New	1 pc	SEKONIX	MS2329-S_HOLDER_T65
④	IR-Filter	Glass+IR	New	1 pc	O-File	4.5*4.5*0.3mm,T=50%.@650±8nm
⑤	Au wire	Au	New	0.18M	Tanaka	1.0mil
⑥	PCB	FR4	New	1 pc	ASSUNNY	4 layer
⑦	UV Epoxy	Epoxy	New	0.01g	Aton	8111,Using for lens fixing and glass fixing
⑧	Capacitor	0201(0.1uf)	New	3 pc	Muruta	0.6*0.3*0.3mm
⑨	Sensor Chip	MT9M113DOOSTC-K24AC1-Rev4	New	1 pc	Aptina	Sensor size 1/6”, 1280*1024 pixel
⑩	Heat Cure Epoxy	Epoxy	New	0.008g	Loctite	Loctite 3220, Using for Holder attach

Appearance Specification

NO.	Item	Standard	Importance Class
1	Top side of Lens	No obvious impurity and oil impurity on the front of lens within the half area; The defect(unfeeling) limitation: width≤1mm, length≤2mm, the defect number≤2; No feeling defect; The width of defects and gaps on the outside of Lens≤0.3mm. Others are unlimited.	A
2	Screw glue	Normally screw glue shall be symmetrical distributed around lens circle side. Particular circs, glue distribution must not disturb customer's assembly operation.	A
3	L1 Glass	No defect and dust check from 45° angle under the reflexing light and from 0° under the highlight	A
4	Holder	No obvious impurity and distortion of outline. The width and length of defect is unlimited, the depth≤0.1mm and ≤1/4 of the thickness of Holder.	B
5	Sealed glue	Sealed glue distributing between holder and FPC must be symmetrical and smooth. Not allow glue leakage and asymmetric thickness. After holder assembly, the thickness distance between one side and its opposite side shall be less than 0.2mm. Excess glue over the holder shall not make the outside dimension be out of control.	A
6	FPC/PCB	Edge defect limitation: width≤1/2H (H is minimum.)、length≤1mm、defect numbers per edge≤2(No tearing gap inby edge for FPC); Edge outshoot limitation (width≤0.3mm, length≤1mm). No obvious impurity and crease on the surface. If there was shield film on the surface, the spot size of the film shall be less than 0.3mm×1mm and no line is exposed. If it was not be cleaned and did not influence the total thickness, it would be permitted. Label and mark shall be clear enough to be discerned.	A
7	Connector	No dust, fingerprint, and not allows to turning colors, distortion; Solder must be well; No open circuit or short circuit	A

8	Gold finger	No dust, fingerprint, and not allows to turning colors, burned, unsmoothed and peeled; No open circuit or short circuit; The defect width shall be smaller than 20% of gold finger's width. No copper/nickel exposed in defect. Numbers of defected pin shall be less than 3. The defect limitation:width≤0.08mm,length≤5mm.	A
9	Stiffener	Holder anchor pole length overtopping the steel plate shall be less than 0.2mm. No dust, rust and deep scratch on the steel surface without Double coated tapes.	B
10	Double coated tapes	Adhered direction shall be right. Not allows to excess steel plate edge. No alveoli and stick. Not allows to peel glue and rip protective paper when tear the protective paper.	B
11	Protective film	No dust in the glue side. Not allows to float or drop. Adhered direction shall be right.	B

Remark:

1. The definition of the appearance importance class

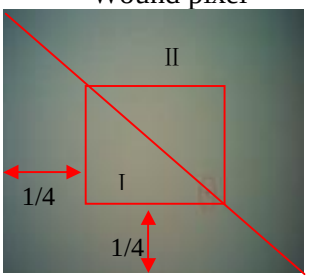
A: The defect can be found in the finished product, or have obvious visual differences from good products, such as crack, defect and dust, or influence image quality, or are appointed by the customer. We will emphasize these items and check all products.

B: The defect can be found in the finished product and has visual difference from the good one, but will not affect customer's aesthetic judgement. Or the defect can not be found in the finished product and will not generate functional problem, but will slightly influence sequential manufacture process or condition. We will supervise these items in the manufacturing process and check products selectively.

2. Sampling standard

Referenced standard: GB/T 2828.1-2003/ISO 2859-1:1999 and ANSI/ASQC.4-1993 Ⅱ

Image Specification

NO.	Item	Standard	Important Class
1	TV Line	Center≥500 8 point of 0.7 viewing field ≥400	A
2	Shading	The lighteness of 90% viewing area ≥ 40% of center lighteness(Lens correction Shading [Turn off]); The lighteness of 90% viewing area ≥ 60% of center lighteness(Lens correction Shading [Turn on])	A
3	Dust	No dust in the center viewing area; Border area according to the limit samples	A
4	Dead pixel	No in the viewing area.	A
5	Wound pixel 	Ⅰ area：Blemish number≤2 Ⅱ area：Blemish number≤6	B
6	Color	Color distortion ratio of center±15%	B
7	Gray Scale	Margin of two near scales' brightness≥ 6	B
8	Distortion	＜**1**%	B
9	Flare	No flare in 45° viewing angle; No ghost in full viewing angle	B

QA Plan

NO.	Item	Sampling frequency	Measure	Remark
Image and reliability item				
1	TV Line	AQL 0.65 Ⅱ Class	Same as production	100% Inspection
2	Shading	AQL 0.65 Ⅱ Class	Same as production	100% Inspection
3	Dust	AQL 0.65 Ⅱ Class	Same as production	100% Inspection
4	Dead pixel	AQL 0.65 Ⅱ Class	Same as production	100% Inspection
5	Wound pixel	AQL 1.5 Ⅱ Class	Same as production	100% Inspection
6	Color	AQL 1.5 Ⅱ Class	Same as production	100% Inspection
7	Gray Scale	AQL 1.5 Ⅱ Class	Same as production	100% Inspection
8	Distortion	N=5,c=0 per batch	Same as production	Sampling by QA
9	Flare	N=5,c=0 per batch	Same as production	Sampling by QA
Appearance Check Items				
1	Top side of Lens	AQL 1.0 Ⅱ Class	Same as production	100% Inspection
2	Screw glue	AQL 1.0 Ⅱ Class	Same as production	100% Inspection
3	L1 Glass	AQL 1.0 Ⅱ Class	Same as production	100% Inspection
4	Holder	AQL 1.5 Ⅱ Class	Same as production	100% Inspection
5	Sealed glue	AQL 1.0 Ⅱ Class	Same as production	100% Inspection
6	FPC/PCB	AQL 1.0 Ⅱ Class	Same as production	100% Inspection
7	Connector	AQL 1.0 Ⅱ Class	Same as production	100% Inspection
8	Gold finger	AQL 1.0 Ⅱ Class	Same as production	100% Inspection
9	Stiffener	AQL 1.5 Ⅱ Class	Same as production	100% Inspection
10	Double coated tapes	AQL 1.5 Ⅱ Class	Same as production	100% Inspection
11	Protective film	AQL 1.5 Ⅱ Class	Same as production	100% Inspection

Sample:

Referenced standard: GB/T 2828.1-2003/ISO 2859-1:1999 and ANSI/ASQC.4-1993 Ⅱ

Reliability Specification

No.	Test item	Test condition
1	Temperature strike cycle [Power off]	Low temperature:-30°C±2℃ for 30 min High temperature:+80°C±2℃ for 30 min Cycle:10 times
2	High temperature and high humidity operating	Temperature:40°C Humidity:90%RH Time:48 hours
3	High temperature and high humidity storage	Temperature:60°C Humidity:90%RH Time:120 hours
4	Low temperature operating	Temperature:-20°C±2℃ Time:120 hours
5	High temperature operating	Temperature:70°C±2℃ Time:120 hours
6	Low temperature storage	Temperature:-30°C±2℃ Time:120 hours
7	High temperature storage	Temperature:80°C±2℃ Time:120 hours
8	ESD test [Power off]	C:150pF R:330Ω Voltage:±2KV Air discharge: Cycle:10 times
9	Vibration Test [Packaged]	Frequency:10Hz~55Hz~10Hz Amplitude:1.5 mm Times: each X,Y,Z directions for 60mins
10	Dropping test [Packaged]	Product dropping from 150cm height to smooth marble Drop style:1 coner,3 arris,6 faces Test times:10
11	Cyclic salt mist	22h,45℃,95%RH;2h,35℃,5%NaCL;3cycles

PRECAUTIONS FOR USING CCM MODULES

Handing Precautions

—DO NOT try to open the unit enclosure as there is no user-serviceable component inside. To prevent damage to the camera module by electrostatic discharge, handling the camera module only after discharging all static electricity from yourself and ensuring a static-free environment for the camera module.
—DO NOT touch the top surface of the lens.
—DO NOT press down on the lens.
—DO NOT try to focus the lens.
—DO NOT put the camera module in a dusty environment.
—To reduce the risk of electrical shock and damage to the camera module, turn off the power before connect and disconnect the camera module.
—DO NOT drop the camera module more than 60 cm onto any hard surface.
—DO NOT expose camera module to rain or moisture.
—DO NOT expose camera module to direct sunlight.
—DO NOT put camera in a high temperature environment.
—DO NOT use liquid or aerosol cleaners to clean the lens.
—DO NOT make any charges or modifications to camera module.
—DO NOT subject camera module to strong electromagnetic field.
—DO NOT subject the camera module to excessive vibration or shock.
—DO NOT Impact or nip CCM module with spiculate things
—DO NOT alter, modify or change the shape of the tab on the metal frame.
—DO NOT make extra holes on the printed circuit board, modify its shape or change the positions of components to be attached.
—DO NOT damage or modify the pattern writing on the printed circuit board.
—Absolutely DO NOT modify the zebra rubber strip (conductive rubber) or heat seal connector
—Except for soldering the interface, DO NOT make any alterations or modifications with a soldering iron.
—DO NOT twist FPC of CCM.

Apply indication

Correct

Incorrect

Other precautions

For correct using please refer to the relative criterions of electronic products.

Limited Warranty

Unless agreed between TRULY and customer, TRULY will replace or repair any of its CCM modules which are found to be functionally defective when inspected in accordance with TRULY CCM acceptance standards for a period of one year from date of shipments. Cosmetic/visual defects must be returned to TRULY within 90 days of shipment. Confirmation of such date shall be based on freight documents. The warranty liability of TRULY limited to repair and/or replacement on the terms set forth above. TRULY will not be responsible for any subsequent or consequential events.

Return CCM under warranty

No warranty can be granted if the precautions stated above have been disregarded. The typical examples of violations are:

-Holder is apart from module.
-Holder or Connector is anamorphic.
-Connector is turnup.
-FPC is lacerated or discon-nexion, and so on.

Module repairs will be invoiced to the customer upon mutual agreement. Modules must be returned with sufficient description of the failures or defects. Any connectors or cable installed by the customer must be removed completely without damaging the PCB eyelet, conductors and terminals.

Package Specification

Packaging Design One

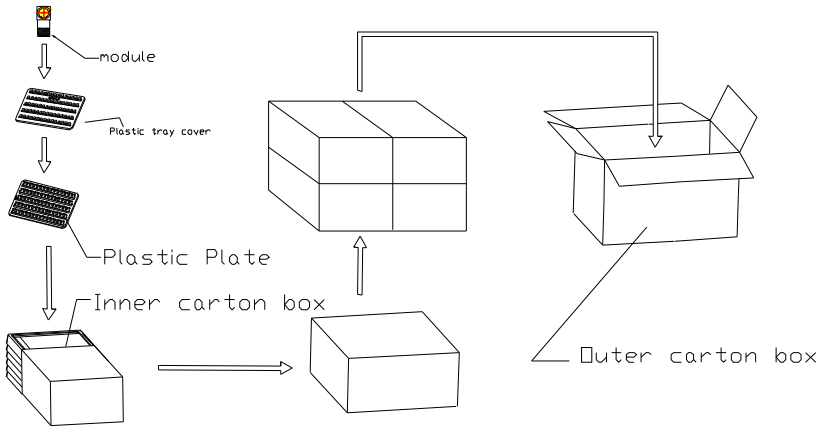
Product No.	CM3587-O130BF-E	Release date			
Product name	Compact Camera Module	Releaser			
Supplier	TRULY SEMI CONDUCTORS LTD	Recycle		☐YES ■ NO	
Quantity/ each box	TBD	Material for box		■ paper ☐ plastic	
Outer carton box size	405mm*290mm*290mm	Box type		■ new ☐ update	
Quantity / inner box * Quantity / outer box	TBD	Weight	g / pcs Kg / outer box	BOX=TYPE Record of SRF Dept.	TBD Kg(Max)

Packing Standards:

There are TBD modules each plastic plate.

There are TBD modules each inner carton box..

There are 4 each outer carton box.



Requirements of outer carton box :

1. Weight(Max): TBD Kg
2. Height (Max): 0.29 M
3. Prohibition: Box made by log

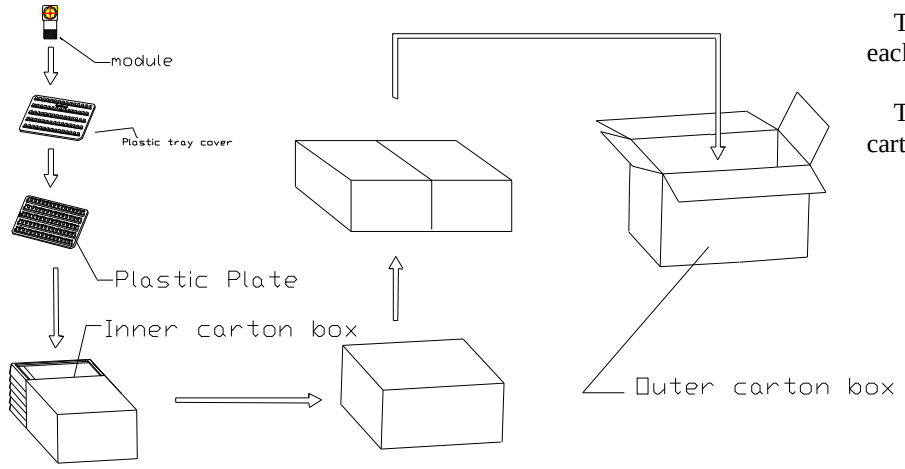
Material for Plastic tray

It is made of antistatic polystyrene which has no chemical pollution. Surface resistivity : 10^6 ohm/sq

Packaging Design Two

Product No.	CM3587-O130BF-E	Release date			
Product name	Compact Camera Module	Releaser			
Supplier	TRULY SEMI CONDUCTORS LTD	Recycle		☐YES	■ NO
Quantity/ each box	TBD	Material for box		■ paper	☐ plastic
Outer carton box size	405 mm *290 mm *170 mm	Box type		■ new	☐ update
Quantity / inner box * Quantity / outer box	TBD	Weight	g / pcs Kg / outer box	BOX=TYPE Record of SRF Dept.	TBD Kg(Max)

Packing Standards:



There are TBD modules each plastic plate.

There are TBD modules each inner carton box..

There are 2 each outer carton box.

Requirements of outer carton box :

4. Weight(Max): TBD Kg
5. Height (Max): 0.17 M
6. Prohibition: Box made by log

Material for Plastic tray

It is made of antistatic polystyrene which has no chemical pollution. Surface resistivity : 10^6 ohm/sq

PRIOR CONSULT MATTER

1.①For Truly standard products, we keep the right to change material, process for improving the product property without notice on our customer.
②For OEM products, if any change needed which may affect the product property, we will consult with our customer in advance.
2. If you have special requirement about reliability condition, please let us know before you start the test on our samples.

FACTORY CONTACT INFORMATION

FACTORY NAME: TRULY SEMICONDUCTORS LTD.
FACTORY ADDRESS: Truly Industrial Area, ShanWei City, GuangDong, China
FACTORY PHONE: 86-0660-3380061 FAX: 86-0660-3371772