

PRODUCT : CAMERA MODULE
MODEL NO. : CM4541-O130SF-E
SUPPLIER : TRULY OPTO-ELECTRONICS LTD.
DATE : September 14, 2009



CERT. No. 946535

ISO9001

TL9000

SPECIFICATION

Revision: 1.0

CM4541-O130SF-E

If there is no special request from customer, TRULY OPTO-ELECTRONICS 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 OPTO-ELECTRONICS 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 OPTO-ELECTRONICS LTD.: CUSTOMER:

Quality Assurance Department: _____

Approved by:

Technical Department: _____

Approved by:

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WRITTEN BY	CHECKED BY	APPROVED BY
LI JING	WEI YOU XING	LIU TIE NAN

Key Information

Module No.		CM4541-O130SF-E
Module Size		6.0mm x 6.0mm x 4.30mm
Image Quality		≥400 TV line
Sensor Type		OV9665
Array Size		1280 X 1024(SXGA)
Power supply	Analog	2.45 to 3.0 VDC
	I/O	1.71V to 3.0V
Lens		1/5.5inch 3Plastic+ IR
Focus(F.NO)		2.8
View Angle		71°
Image Area		2608μm x 2072μm
Object distance		50cm-infinity
Sensitivity		450 Mv/(Lux.sec)
Pixel size		2.0μm x 2.0μm
IR Cutter		640+/-10nm
Temperature Range	Operation	-20° C to 70° C
	Stable Image	0° C to 50° C
Output Formats(8-bit)		.YUV/YCbCr 4:2:2 .RGB565/555/444 .Raw RGB Data
Maximum Image Transfer Rate	SXGA	15 fps
	VGA, CIF and down scaling	30 fps
S/N Ratio		40 dB
Dynamic Range		55 dB
IC Package		CSP
substrate		FPC
Power requirement	Active	80 mW typical(15fps)
	Standby	15 μA typical
Fixed Pattern noise		1% of V _{peak-to-peak}
Dark current		3 Mv/sec@60° C
Package		Antistatic Plastic

Pin Assignment

No.	Name	Pin type	Description
1	NC		
2	AGND	Power	Ground for analog circuit
3	SIO_D	I/O	SCCB serial interface data I/O
4	AVDD	Power	Power for analog circuit
5	SIO_C	Input	SCCB serial interface clock input without internal pull-up/pull-down resistor
6	RESET	Input	Resets function with internal pull-up resistor
7	VSYNC	Output	Vertical sync output
8	PWDN	Input	Power down function(active high)with internal pull-down resistor
9	HREF	Output	Horizontal reference output
10	NC		
11	DOVDD	Power	Power for digital /video port
12	Y7	Output	video output bit[7]
13	XCLK	Input	System clock input without internal pull-up/pull-down resistor
14	Y6	Output	video output bit[6]
15	DGND	Power	Ground for digital circuit
16	Y5	Output	video output bit[5]
17	PCLK	Output	Pixel clock output
18	Y4	Output	video output bit[4]
19	Y0	Output	video output bit[0]
20	Y3	Output	video output bit[3]
21	Y1	Output	video output bit[1]
22	Y2	Output	video output bit[2]
23	NC		
24	NC		

Electrical Characteristics

1. Absolute Maximum Ratings

Ambient Storage Temperature		-40°C to +95°C
Supply Voltages (with respect to Ground)	V _{DD-A}	4.5 V
	V _{DD-IO}	4.5 V
All Input/Output Voltages (with respect to Ground)		-0.3V to V _{DD-IO} +0.5V
Lead-free Temperature, Surface-mount process		245°C

NOTE: Exceeding the Absolute Maximum ratings shown above invalidates all AC and DC electrical specifications and may result in permanent device damage.

2. DC Characteristics (-30°C < Ta < 70°C)

Symbol	Parameter	Condition	Min	Typ	Max	Unit
V _{DD-A}	DC supply voltage – analog	–	2.45	2.8	3.0	V
V _{DD-IO}	DC supply voltage – I/O	–	1.71	1.8	3.0	V
I _{DDA}	Active (operating) current	See Note ^a		17 + 18 ^b	50	mA
I _{DDS-SCCB}	Standby current	See Note ^c		1	2	mA
I _{DDS-PWDN}	Standby current			15	30	μA
V _{IH}	Input voltage HIGH	CMOS	0.7 x V _{DD-IO}			V
V _{IL}	Input voltage LOW				0.3 x V _{DD-IO}	V
V _{OH}	Output voltage HIGH	CMOS	0.9 x V _{DD-IO}			V
V _{OL}	Output voltage LOW				0.1 x V _{DD-IO}	V

a. At 25°C, V_{DD-A} = 2.8V, V_{DD-IO} = 1.8V

I_{DDA} = Σ(I_{DD-A} + I_{DD-IO}), f_{CLK} = 24MHz at 15 fps YCbCr output with typical loading

b. I_{DD-IO} = 17mA, I_{DD-A} = 18mA, with typical loading

c. At 25°C, V_{DD-A} = 2.8V, V_{DD-IO} = 1.8V

I_{DDS-SCCB} refers to a SCCB-initiated Standby, while I_{DDS-PWDN} refers to a PWDN pin-initiated Standby

3. Functional and AC Characteristics (-30°C < Ta < 70°C)

Symbol	Parameter	Min	Typ	Max	Unit	
Functional Characteristics						
	A/D Differential non-linearity		$\pm 1/2$		LSB	
	A/D Integral non-linearity		± 1		LSB	
Inputs (PWDN, XVCLK and RESETB)						
f _{CLK}	Input clock frequency	With PLL	10	24	27	MHz
		Without PLL	10	24	54	MHz
t _{CLK:DC}	Clock duty cycle	45	50	55	%	
t _{S:RESETB}	Setting time after software/hardware reset			1	ms	
t _{S:REG}	Settling time for register change			300	ms	
SCCB Timing (see Figure 4)						
f _{SIO_C}	Clock frequency			400	KHz	
t _{LOW}	Clock low period	1.3			μs	
t _{HIGH}	Clock high period	600			ns	
t _{AA}	SIO_C low to data out valid	100		900	ns	
t _{BUF}	Bus free time before new START	1.3			μs	
t _{HD:STA}	START condition hold time	600			ns	
t _{SU:STA}	START condition setup time	600			ns	
t _{HD:DAT}	Data in hold time	0			μs	
t _{SU:DAT}	Data in setup time	100			ns	
t _{SU:STO}	STOP condition setup time	600			ns	
t _R , t _F	SCCB rise/fall times			300	ns	
t _{DH}	Data out hold time	50			ns	
Outputs (VSYNC, HREF, PCLK, and D[9:0] (see Figure 5, Figure 6, and Figure 7)						
t _{PDV}	PCLK[↓] to data out valid			5	ns	
t _{SU}	D[9:0] setup time	15			ns	
t _{HD}	D[9:0] hold time	8			ns	
t _{PHH}	PCLK[↓] to HREF[↑]	0		5	ns	
t _{PHL}	PCLK[↓] to HREF[↓]	0		5	ns	
AC Conditions:	<ul style="list-style-type: none"> • V_{DD}: V_{DD-A} = 2.8V, V_{DD-IO} = 1.8V • Rise/Fall Times: I/O: 5ns, Maximum SCCB: 300ns, Maximum • Input Capacitance: 10pf • Output Loading: 20pF • f_{CLK}: 24MHz 					

Note: For more information of sensor please refer to the OV9665 specification.

Mechanical Drawing

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 \leq 1mm, length \leq 2mm, the defect number \leq 2; No feeling defect; The width of defects and gaps on the outside of Lens \leq 0.3mm. Others are unlimited.	A
2	Screw glue	Glue homogeneous distributing around lens circle side .Not allows to excess glue over the height of Lens and Holder outside.	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 \leq 0.1mm and \leq 1/4 of the thickness of Holder.	B
5	Sealed glue	Glue distributing between holder and FPC must be homogeneous and smooth. Not allows to excess glue over the width of holder.	A
6	FPC/PCB	Edge defect limitation: width \leq 1/2H(H is minimum.)、 length \leq 1mm、 defect numbers per edge \leq 2(No tearing gap inby edge for FPC); Edge outshoot limitation (width \leq 0.3mm,length \leq 1mm); No obvious impurity on the surface, label and mark shall be recognizable and Clear	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 \leq 0.08mm,length \leq 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

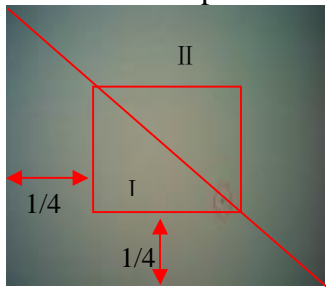
A: The defect can be found in the finished product, or have obvious visual differences from good products, such as crack, defect and dust, or influence image quality, or are appointed by the customer. We will emphasize these items and check all products.

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 \geq 500 8 point of 0.7 viewing field \geq 400	A
2	Shading	The lightness of 90% viewing area \geq 40% of center lightness(Lens correction Shading [Turn off]); The lightness of 90% viewing area \geq 60% of center lightness(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 \leq 1 II area: Blemish number \leq 4	B
6	Color	Color distortion ratio of center \pm 15%	B
7	Gray Scale	Margin of two near scales' brightness \geq 6	B
8	Distortion	$<$ 2%	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

PRECAUTIONS FOR USING CCM MODULES

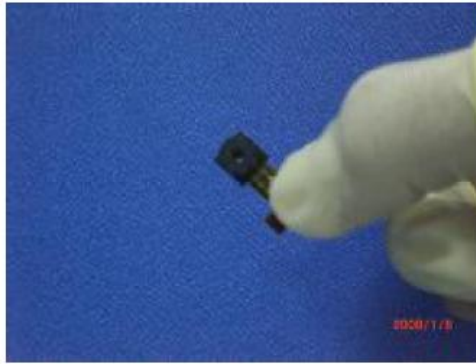
Handling Precautions

- 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.

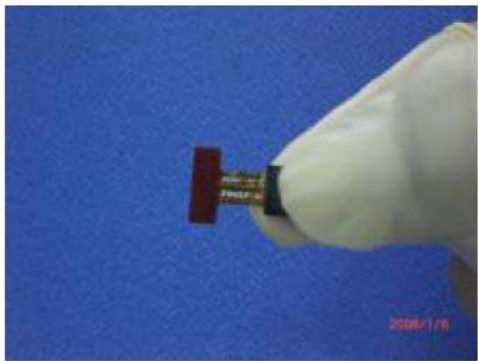
Apply indication



Correct



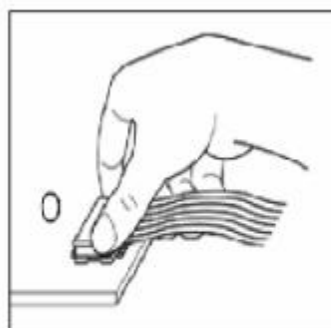
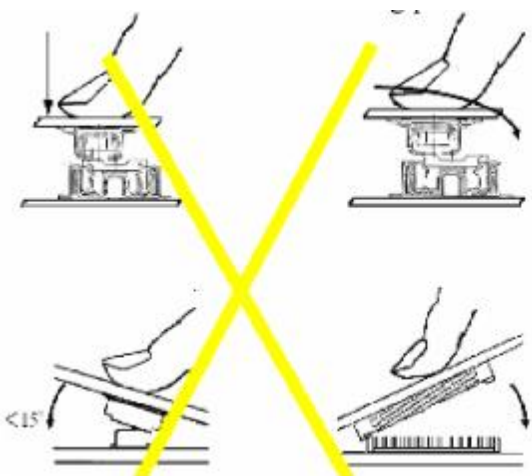
Incorrect



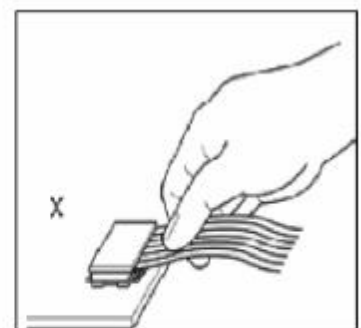
Incorrect

Precaution for assemble the module with BTB connector:

Please note the position of the male and female connector position, don't assemble or assemble like the method which the following picture shows

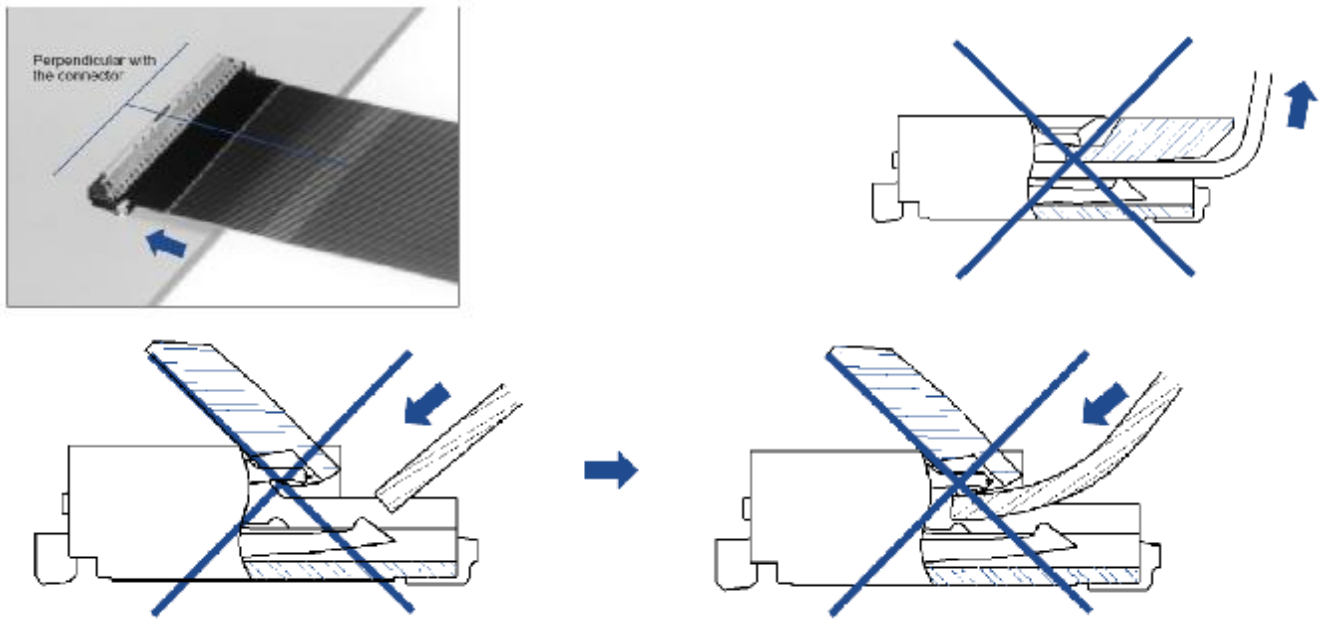


OK



NG

Precaution for assemble the module with ZIF connector:



Precaution for soldering the CCM:

	Manual soldering	Machine drag soldering	Machine press soldering
No RoHS product	290°C ~350°C. Time: 3-5S.	330°C ~350°C. Speed: 4-8 mm/s.	300°C ~330°C. Time: 3-6S. Press: 0.8~1.2Mpa
RoHS product	340°C ~370°C. Time: 3-5S.	350°C ~370°C. Speed: 4-8 mm/s.	330°C ~360°C. Time: 3-6S. Press: 0.8~1.2Mpa

- (1) If soldering flux is used, be sure to remove any remaining flux after finishing to soldering operation. (This does not apply in the case of a non-halogen type of flux.) It is recommended that you protect the lens surface with a cover during soldering to prevent any damage due to flux spatters.
- (2) The CCM module and board should not be detached more than three times. This maximum number is determined by the temperature and time conditions mentioned above, though there may be some variance depending on the temperature of the soldering iron.

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 disconnection, and so on.

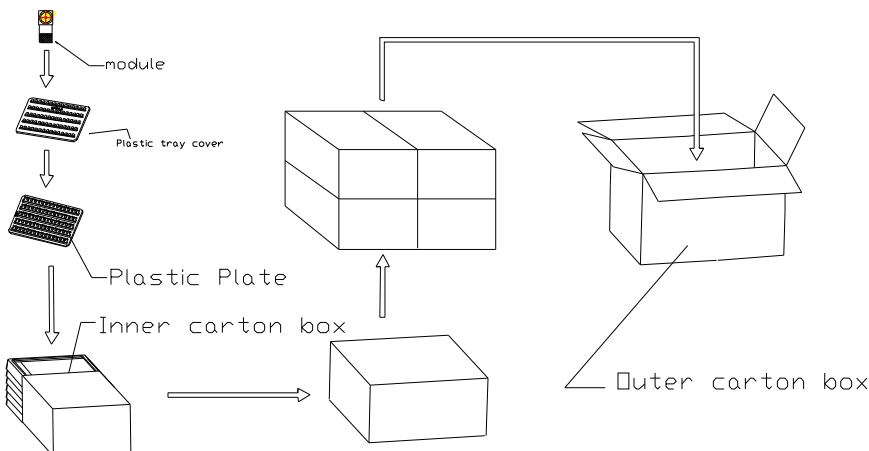
Module repairs will be invoiced to the customer upon mutual agreement. Modules must be returned with sufficient description of the failures or defects. Any connectors or cable installed by the customer must be removed completely without damaging the PCB eyelet, conductors and terminals.

Package Specification

Packaging Design One

Product No.	CM4541-O130SF-E	Release date		
Product name	Compact Camera Module	Releaser		
Supplier	TRULY OPTO-ELECTRONICS LTD.	Recycle	<input type="checkbox"/> YES	<input checked="" type="checkbox"/> NO
Quantity/ each box	TBD	Material for box	<input checked="" type="checkbox"/> paper <input type="checkbox"/> plastic	
Outer carton box size	405mm*290mm*290mm	Box type	<input checked="" type="checkbox"/> new <input type="checkbox"/> update	
Quantity / inner box * Quantity / outer box	TBD	Weight	g / pcs	BOX=TYPE Record of SRF Dept.
			Kg / outer box	

Packing Standards:



There are TBD modules each plastic plate.

There are TBD modules each inner carton box..

There are TBD modules each outer carton box.

Requirements of outer carton box :

1. Weight(Max): 0.75 Kg
2. Height (Max): 0.29 M
3. Prohibition: Box made by log

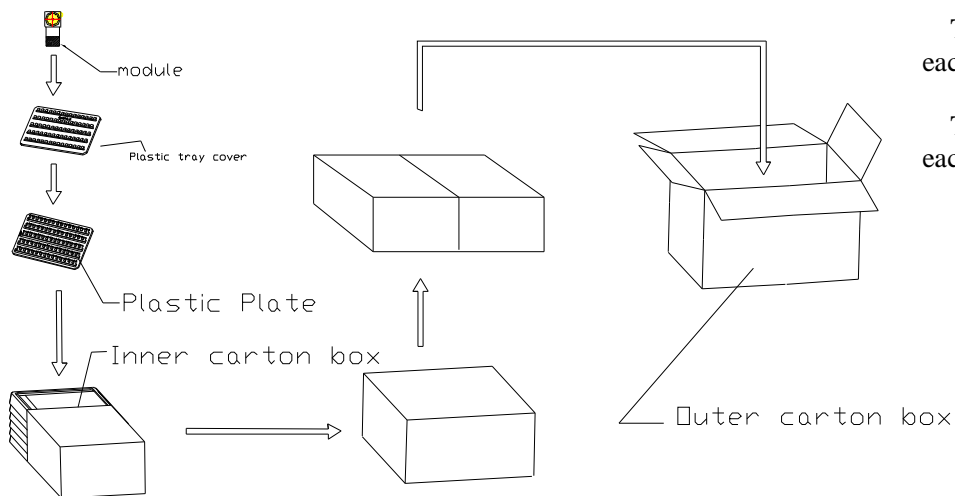
Material for Plastic tray

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

Packaging Design Two

Product No.	CM4541-O130SF-E	Release date							
Product name	Compact Camera Module	Releaser							
Supplier	TRULY SEMI CONDUCTORS LTD	Recycle	<input type="checkbox"/> YES <input checked="" type="checkbox"/> NO						
Quantity/ each box	TBD	Material for box	<input checked="" type="checkbox"/> paper <input type="checkbox"/> plastic						
Outer carton box size	405 mm *280 mm *170 mm	Box type	<input checked="" type="checkbox"/> new <input type="checkbox"/> update						
Quantity / inner box * Quantity / outer box	TBD	Weight	<table border="1"> <tr> <td>g / pcs</td> <td>BOX=TYPE Record of SRF Dept.</td> <td>TBD</td> </tr> <tr> <td>Kg / outer box</td> <td></td> <td>Kg(Max)</td> </tr> </table>	g / pcs	BOX=TYPE Record of SRF Dept.	TBD	Kg / outer box		Kg(Max)
g / pcs	BOX=TYPE Record of SRF Dept.	TBD							
Kg / outer box		Kg(Max)							

Packing Standards:



There are TBD modules each plastic plate.

There are TBD modules each inner carton box..

There are TBD modules each outer carton box.

Requirements of outer carton box :

4. Weight(Max): 0.65 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 OPTO-ELECTRONICS LTD.

FACTORY ADDRESS: Truly Industrial Area, ShanWei City, GuangDong, China

FACTORY PHONE: 86-0660-3380061 **FAX:** 86-0660-3371772