

230k Electronic- Viewfinder-Module (230k EVF)

KCD-QMNF-ITT

Delivery Specification

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1 General Information

1.1 Product Description

This specification describes an Electronic Viewfinder Module (EVF) consisting of a 0.24" 230k (320 × 240 × 3 color dot resolution) color filter display, white LED backlight, lens set with diopter adjustment and housing.

1.2 Product Numbers

KCD-QMNF-ITT: EVF with Dial Base

1.3 Other Specifications

EVF-230k module specification PS-0247 takes precedence over any other specifications; refer to 230k display specification PS-0177 for additional display related information.

1.4 Conflict Resolution and New Matters

In the cases of items not covered by this specification, or interpretations of the specification: Kopin will work in good faith to resolve the conflict to mutual satisfaction.

2 Product Specification

2.1 General Construction

The 230k EVF consists of a 230k Cyberdisplay™ LCD display and backlight module, lens set, plastics housing, diopter adjustment dial, and cover glass. Part number KCD-QMNF-ITT includes a focus dial adaptor.

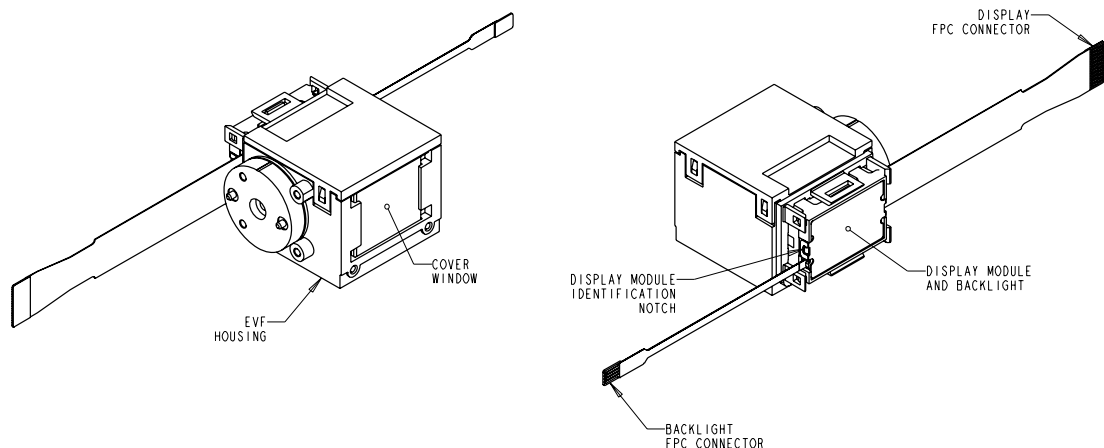


Figure 1-1: EVF with Dial Base, p/n KCD-QMNF-ITT

2.2 General Specification

Table 2-1: General Module Attributes

Item	Specification
Display Active Resolution	320 x 240 x 3 (QVGA)
Active Area	4.80mm x 3.60mm
Diagonal Size	0.24" (6mm)
Dot Pitch	5µm x 15 µm dot pitch (15µm x 15 µm square pixels)
Color Configuration	Vertical Stripe
Field of View (FOV)	22 degrees (Diagonal)
Overall Dimensions	20mm (W) x 18mm (H) x 25mm (D)
Overall Weight	~6.6g

2.3 RoHS Compliance

The 230k EVF, including all subcomponents, complies with all RoHS requirements.

3 Electrical Characteristics

3.1 Pin Out: Interface Pin List (Reference 230k Display Specification PS-0177 for detailed descriptions)

Table 3-1: Interface Pin List

Pin	Symbol	Description
1	VEE	Supply = 0V
2	VIDRH	High red video input
3	VIDGH	High green video input
4	VIDBH	High blue video input
5	VIDRL	Low red video input
6	VIDGL	Low green video input
7	VIDBL	Low blue video input
8	HS	Horizontal sync
9	VS	Vertical sync
10	INV	Inversion polarity
11	DWN	Vertical scan direction (H = top-to-bottom)
12	RGT	Horizontal scan direction (H = left-to-right)
13	SLEEP*	Sleep mode
14	CK0	Clock
15	CK1	Clock
16	VDD	Supply
17	VSS	Supply = -5V
18	TOUT1	Test output
19	TOUT2	Test output
20	VEE	Supply = 0V
21	RESV	Reserved (tied to Pin 20)
22	RESV	Reserved (tied to Pin 20)
23	RESV	Reserved (tied to Pin 20)

* Signal is active low

3.2 Display Block Diagram

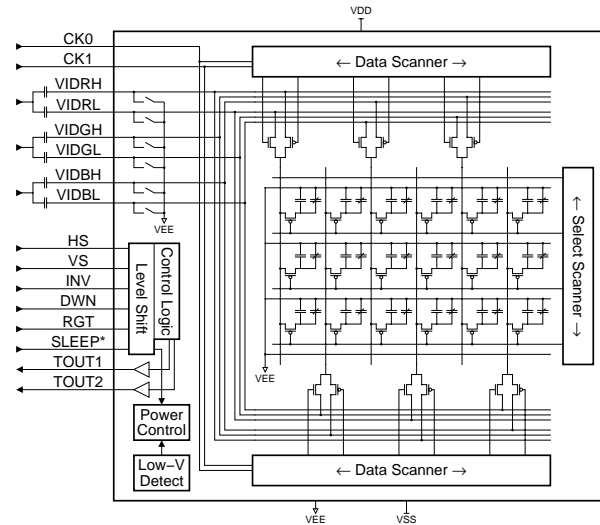


Figure 3-1: Display Block Diagram

3.3 Display Absolute Maximum Ratings

Table 3-2: Display Absolute Maximum Ratings

Parameter/Condition	Symbol	Min	Max	Units
Supply voltage --- source	V_{DD}	- 0.5	5.0	V
Supply voltage -- sink	V_{SS}	- 7.0	0.5	V
All inputs	V_I	$V_{SS} - 0.5$	$V_{DD} + 0.5$	V

Note: All voltages relative to $V_{EE}=0$.

3.4 LED Absolute Maximum Ratings

Table 3-3: LED Absolute Maximum Ratings

$T_a=25^{\circ}\text{C}$

Parameter/Condition	Symbol	Absolute Maximum	Units
LED Forward Current	I_f	25	mA
LED Forward Voltage	V_f	3.5	V
LED Reverse Voltage	V_r	5	V
LED Power Dissipation	P_d	88	mW

3.5 Typical Electrical Drive Conditions

Table 3-4: Typical Electrical Drive Conditions

Parameter/Condition	Symbol	Typ	Max	Units
LED Forward Current	I_f	6	9	mA
LED Forward Voltage	V_f	2.8	3.0	V
Display	Reference 230k Display Specification PS-0177			

4 Optical Characteristics

4.1 Display/Backlight Optical Characteristics

Optical characteristics described in section 4.1 apply to the display and backlight module only. Actual EVF lens module performance may differ somewhat due to the effects of the optical lens system.

Table 4-1: Optical Characteristics $T_a=25^{\circ}\text{C}$

Item			Symbol	Notes	Min	Typ	Max	Unit
Contrast ratio	Vsig = 0.0 + 3.5V		CR _{3.5} 25	1	70	100	--	--
Chromaticity	W	X	Wx	2	0.270	0.310	0.350	CIE standards
		Y	Wy		0.290	0.330	0.370	
	R	X	Rx		0.490	0.530	0.570	
		Y	Ry		0.270	0.310	0.350	
	G	X	Gx		0.250	0.290	0.330	
		Y	Gy		0.540	0.580	0.620	
	B	X	Bx		0.120	0.160	0.200	
		Y	By		0.080	0.120	0.160	
V-T characteristics	V ₉₀	25°C	V ₉₀₋₂₅	3	0.3	0.5	0.8	V
	V ₅₀	25°C	V ₅₀₋₂₅		0.7	1.0	1.3	
	V ₁₀	25°C	V ₁₀₋₂₅		1.3	1.7	2.1	
Response time	ON time	25°C	ton ₂₅	4	--	10	20	ms
	OFF time	25°C	toff ₂₅		--	30	40	
Flicker			F	5	--	--	-40	dB
Brightness Uniformity			BU	6	70	85	--	%
Center Brightness (If = 6mA)		θ=0	L	7	160	260	--	cd/m ²

Notes On Measurement Conditions:

1. $CR_{3.525} = (\text{Luminance White})/(\text{Luminance Black})$. System I
2. CIE Standard 1931. Color coordinate measurement allowance is ± 0.01 . System II
3. V-T is relationship of signal amplitude to transmittance. System I
4. VESA 2.0 standard. System I + Oscilloscope
5. $20\log(AC/DC)$ @ 50% transmittance. System I + Spectrum Analyzer
6. BU=Min/Maxx100%. Measured at 5 points of powered display module.
7. Measured at the center of powered display under proper image condition. System I.
8. All measurements taken from display module. EVF module performance may vary due to effects of lens system.

System I: Equipment: PR-880 @ 1° aperture

System II: Equipment: PR-650 @ 1° aperture

4.2 EVF Optical Parameters

Table 4-2: EVF Optical Parameters

Item		Specification
Field of View (1)	Diagonal	22.0 Degrees
	Horizontal	17.7 Degrees
	Vertical	13.3 Degrees
Virtual Image Size (2)	Diagonal	393mm
	Horizontal	312mm
	Vertical	234mm
Eye Relief (3)		16mm
Exit Pupil Diameter (Design Specification)		3mm
Eye Pupil Offset (4)		+/- 2.0mm
No Vignetting (5)		21mm
Focus Range, Diopter (6)		-3.0D ~ +1.0D
Eye Relief (From Lens)		16mm
TV Distortion		+/-1.0%

(1) +/-5%

(2) At 1m focus distance

(3) From vertex of front lens

(4) Offset from pupil center at 16mm eye relief

(5) 3mm exit pupil diameter, No vignetting of principal ray

(6) Guaranteed range. Actual range may be larger.

5 Reliability Items

5.1 Environmental Specifications

Table 5-1: Environmental Specifications

Parameter	Condition	Notes
Low Temperature Storage	-20°C, 240hrs	(1)
High Temperature Storage	+60°C, 240hrs	(1)
Low Temperature Operation	0°C, 240 hrs	(1)
High Temperature Operation	+60°C, 240 hrs	(1)
Humidity	40°C 80%RH, 240hrs	(1)
Shock	70 mm on Concrete, 5 times	(2)
Vibration	5 Hz – 60 Hz – 5 Hz, 30 min, 5 cycles all 3 axes	(1)
ESD (Human Model)	2000 V Electric Discharge	(3)
MTBF	20,000 hours (Based on accelerated testing)	
Focus Dial Durability	1500 cycles, full range back to front	

(1) Criteria: Pass visual appearance criteria after test

(2) Criteria: Pass visual appearance criteria after test (excluding scratches)

(3) LCD only

6 Mechanical Data

6.1 Focus Mechanism

Table 6-1: Environmental Specifications

Item		Specification
Focus Adjustment	One Click (~0.4D)	12 degrees
	Full Rotation	180 degrees
	Rotation Force	0.25Ncm ~ 0.5Ncm
	Dial Backlash, Radial	</=2 degrees
	Dial Backlash, Thrust	</=0.1mm

6.2 Display Flex Cable Interconnect

The flexible FPC cable has 23 pins with a 0.3 mm contact pitch. The FPC is designed to be compatible with specifications for Tyco (1746237-7), JST (23FXR-RSM1-GAN-TB), or equivalent connectors.

The flexible FPC cable is strain relieved, but tugging forces should be limited to less than 0.5 kg perpendicular to the display and less than 1 kg parallel to the display. The minimum inside bend radius for the cable is 0.8 mm. Repeated reforming is not recommended.

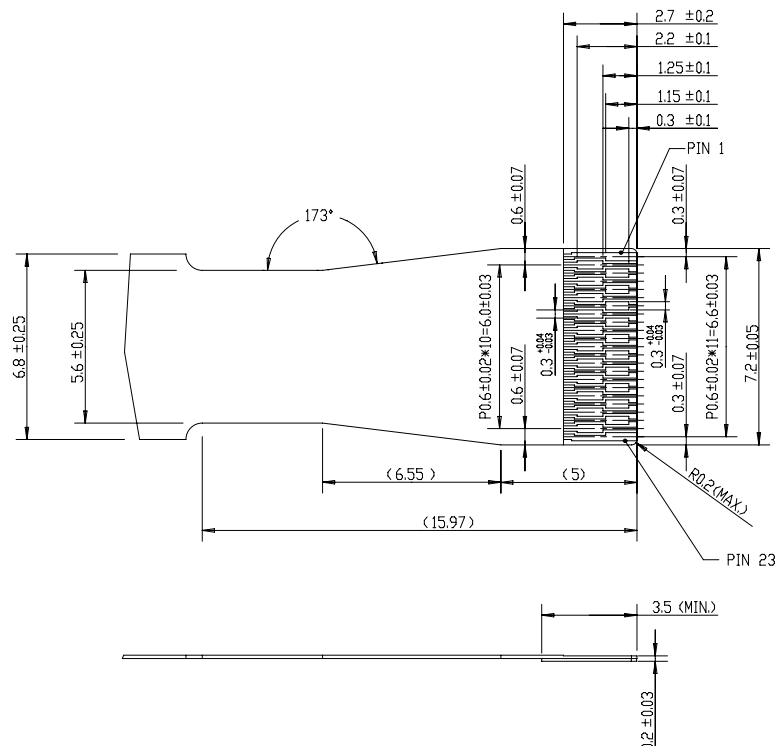


Figure 6-1: Display FPC Interconnect

6.3 Backlight Interconnect

The flexible FPC cable has 4 pins with a 0.5 mm contact pitch. The FPC is designed to be compatible with specifications for JST (04FHSY-RSM1-GAN-TB) or equivalent connectors.

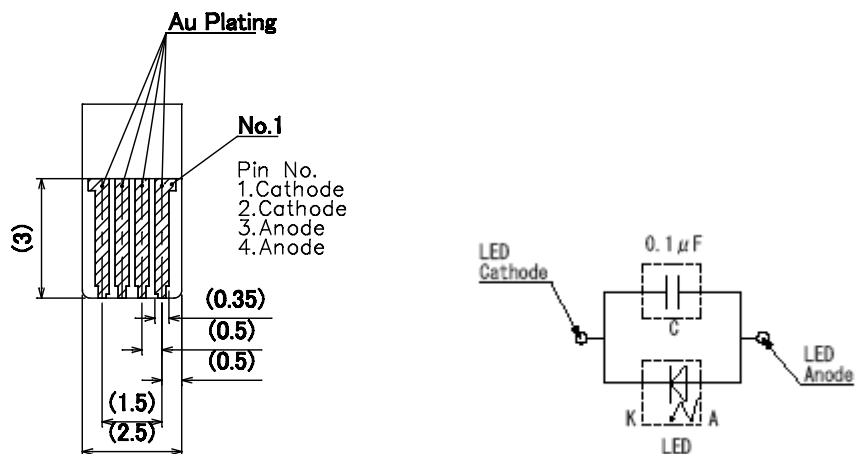


Figure 6-3: Backlight Connection

6.4 Mechanical Outline Drawings

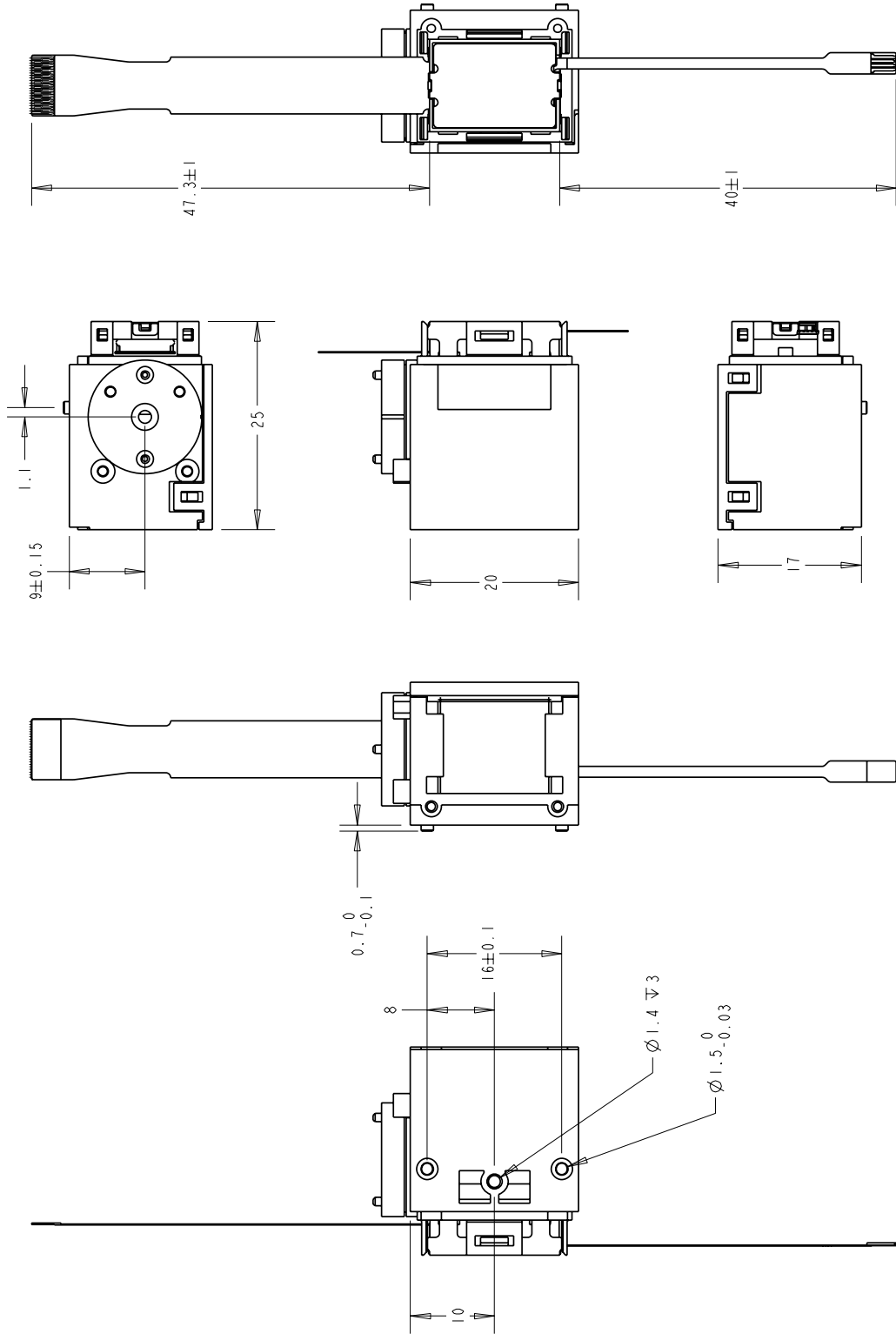


Figure 6-4: Mechanical Layout KCD-QMNF-ITT

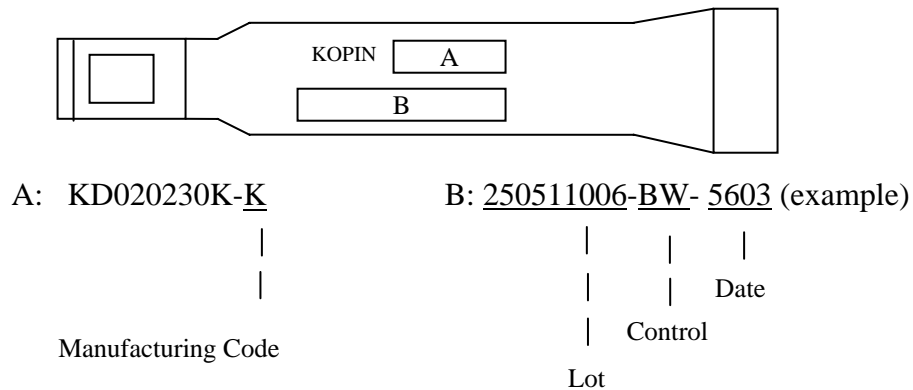
7 Packaging Specification

7.1 Lot Identification

Lot code markings are separately used for the major EVF components (LCD, backlight, lens module). These individual codes are shown below:

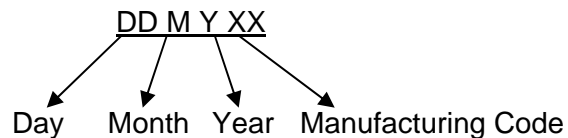
LCD Lot Code

Each LCD has an identification code printed on the display flex cable. The identification code can be used for LCD traceability.



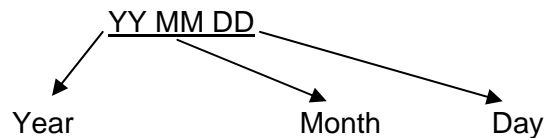
Backlight Lot Code

Each backlight has a lot identification code stamped on the metal back cover. The lot numbering is



Lens Module Lot Code

Each lens module has a lot identification code stamped on the lens module cover. The lot numbering is



7.2 Module Shipping Package

Modules are assembled and tested in a clean room environment. Modules are packaged in antistatic plastic trays. Each tray holds 100 Modules maximum. The trays stack on top of each other, with the bottom of one tray being the top of the one underneath. The trays are stacked 5 deep. One empty tray is placed on top of the stack as a cover. Each stack of trays is wrapped in an antistatic plastic bag. A fully populated bag contains up to 500 Modules. Each bag has an identification Bag Label attached. Each box contains a maximum of 1000 modules. See Figure 7-1 through 7-2.

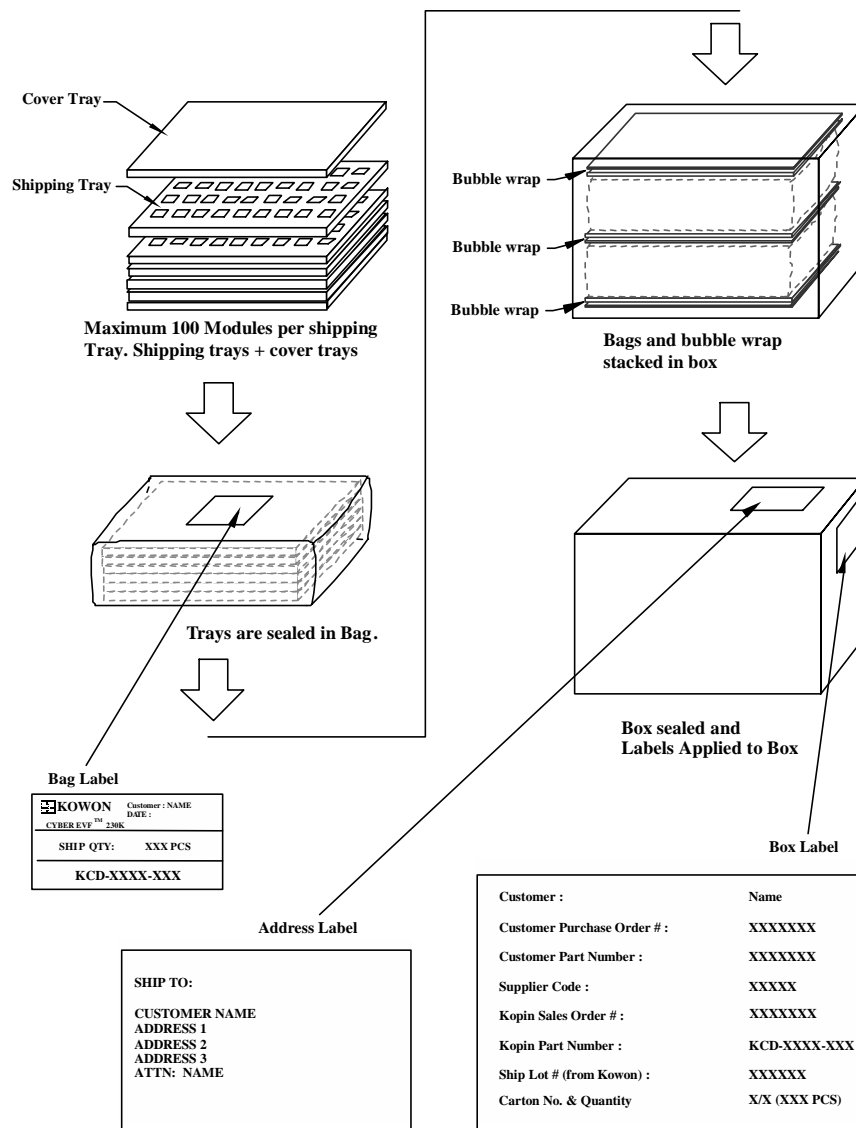


Figure 7-1: Shipping Package (Typical)

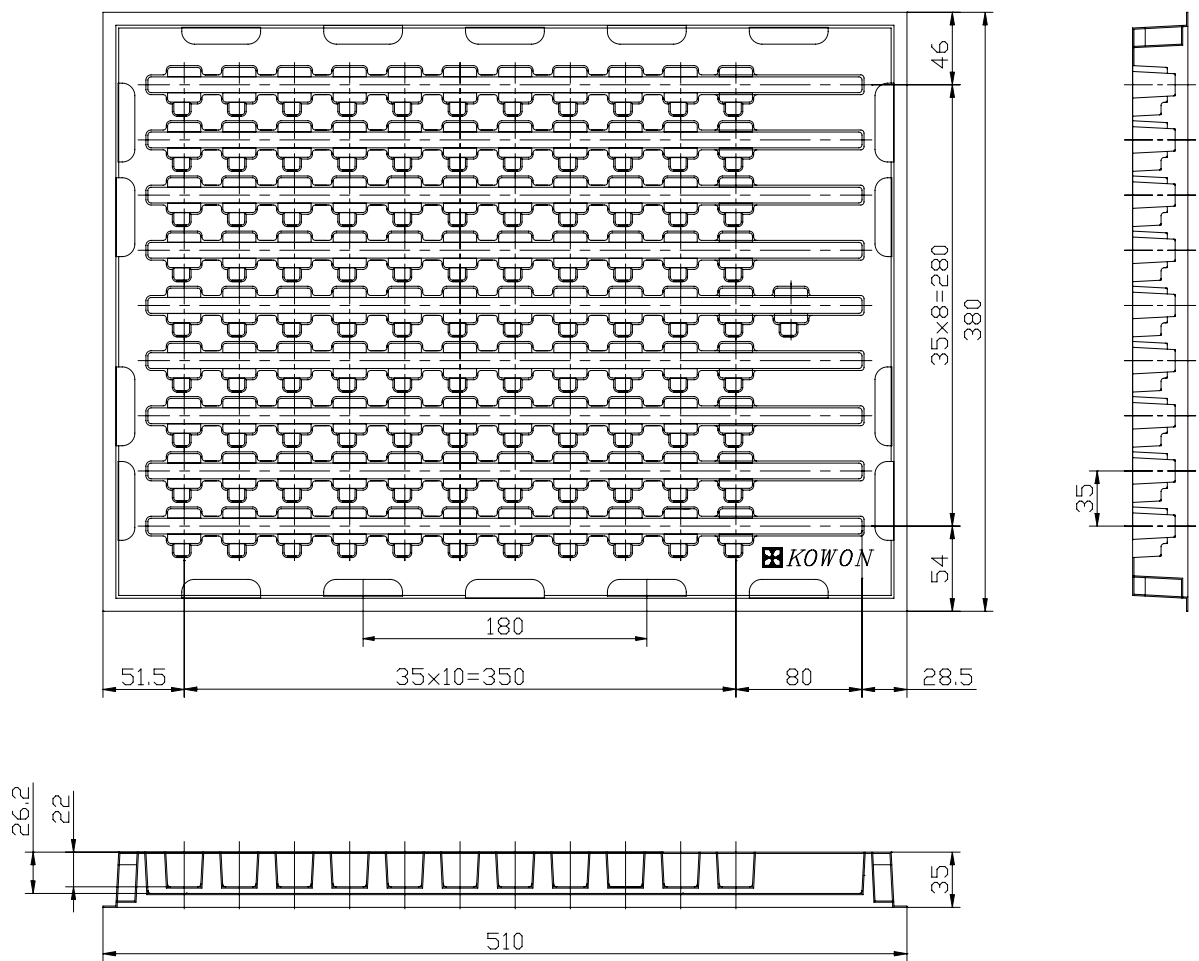


Figure 7-2: Shipping Tray (Dimensions in mm)

8 EVF Appearance

8.1 Display Appearance

Display Appearance is based upon Kopin Standard Test FAT driving conditions.

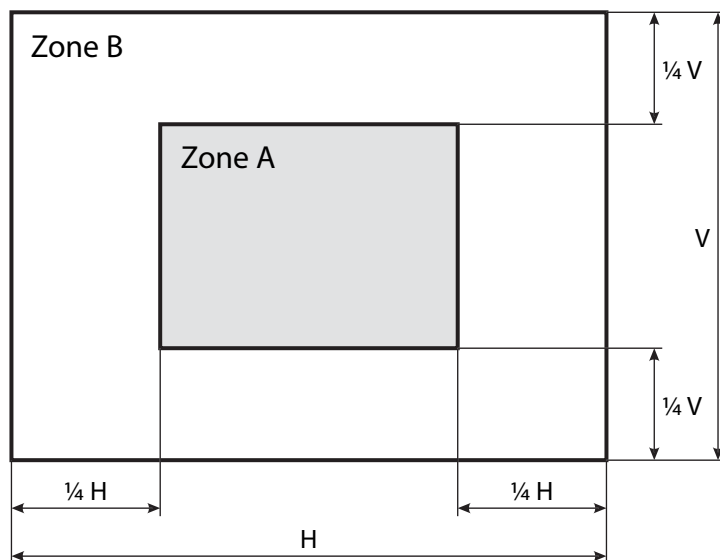


Figure 8-1: Display Appearance Specification

Table 8-1: Display Appearance

Defect Type	Defect Criteria
Image	No obvious partial or faded image, streaking or shadow, unstable image, alternating columns or rows
Line	No lines out Very faint lines allowable based on limit samples
Pixel	See Table 8-2
Adjacent pixels	Two: Same criteria as for pixel defects, based on aggregate brightness (See Table 8-2) Three or more: Not allowed

Test Conditions: Test board runs in row inversion at 60 Hz frame rate. Visual focal plane is on the pixel array.
Limit Samples: Limit samples to be used for pixel and other cosmetic defects as required.

Table 8-2: Defect Allowance

ZONE	DEFECT	NUMBER
A	S, M or L	1
B	S or M	4
	L	1
A + B	S, M or L	Max 6

Where:

Small (S) defect differs from nominal pixel brightness by 10–25%.

Medium (M) defect differs from nominal pixel brightness by 25–75%.

Large (L) defect differs from nominal pixel brightness by $\geq 75\%$.

Defect can be black or white spot.

8.2 Lens Appearance

Lens surface quality shall be the equivalent of 40-20 scratch-dig per Mil-0-13830. This is interpreted as follows:

- Maximum scratch number shall be 40 (i.e., 40 um in width).
- For multiple scratches, sum of all scratch length x (scratch number / 40) is less than one lens diameter.
- Maximum dig number shall be 20 (i.e., 200 um in diameter).
- Non-circular digs shall be measured by (length + width)/2.
- Sum of all dig diameters shall be less than 400 um.

8.3 Housing Appearance

The housing shall have no excessive voids, cracks, chipping, scratches, warpage, or contamination that affect the function of the unit.

8.4 Focus Control Movement

The focus dial shall rotate smoothly and have a clear feeling of clicks. No unstable move, jump, or shaking of the image shall be detected during focus adjustment.

9 Handling Precautions

9.1 EVF Handling

The EVF module should be handled in a clean environment only. Filtered, Ionized air should be used to blow dust particles off of the cover glass as required. The LCD display and Backlight LED can be damaged by static electricity charge. Use standard static control procedures when handling the EVF module. Static control methods should include the use of static dissipative table and floor mats, static dissipative gloves, anti-static lab coat, and ESD ground straps.