

Product Specification				
Amotec	Model: XTPQ35SN15-01	Rev. No.	Issued Date.	Page.
		A	2016,04,21	1 / 20

Thin-Film-Transistor LCD Module
Model:XTPQ35SN15-01

Acceptance

Approved and Checked by

Approved by	Checked by		Made by

Product Specification

Amotec	Model: XTPQ35SN15-01	Rev. No.	Issued Date.	Page.
		A	2016,04,21	3 / 20

Product Specification

Amotec	Model: XTPQ35SN15-01	Rev. No.	Issued Date.	Page.
		A	2016,04,21	4 / 20

1.General Description and Features

XTPQ35SN15-01 is a TM (Transmissive) type color active matrix TFT (Thin Film Transistor) liquid crystal display (LCD) that uses amorphous silicon TFT as a switching device.

This model is composed of a TFT-LCD module, a driver circuit and a back-light unit .

The resolution of a 3.5" contains 320RGBx240 dots and can display up to 262K colors. The following table described the features of XTPQ35SN15-01

LCD Module

Item	Specification	Unit
Screen Size	3.5inches	Diagona
Display Resolution	320RGB(H)x240(V)	Dot
Active Area	70.08(H) x52.56 (V)	mm
Outline Dimension	76.9(W) x 63.9 (H) x 3.34 (D)	mm
Display Mode	Normally white/Transmissive	--
Pixel Arrangement	RGB-Vertical Stripe	--
Display Color	65K/262K/16.7M	--
Gray scale inversion Direction	6 o'clock	
Viewing Direction	12 o'clock	--
Drive IC	SSD2119	--
Brightness	150nit	

Product Specification				
Amotec	Model: XTPQ35SN15-01	Rev. No.	Issued Date.	Page.
		A	2016,04,21	5 / 20

2.Mechanical Information

Item		Min.	Typ.	Max.	Unit	Note
Module Size	Horizontal (H)	--	76.9	--	mm	--
	Vertical (V)	--	63.9	--	mm	(1)
	Thickness (T)	--	3.34	--	mm	(2)
Weight		--	N/A	--	g	--

Note (1) Not include FPC.

Refer to the Outline Dimension for further information.

(2) Back-light unit are included.

3.Electrical Specifications

3.1 Absolute Max. Ratings

3.1.1 Absolute Ratings of Environment

If the operating condition exceeds the following absolute maximum ratings, the TFT LCD module may be damaged permanently.

(Ta=25±2°C, V_{SS}=GND=0)

Item	Symbol	Min.	Max.	Unit	Note
Storage temperature	T _{STG}	-30	80	°C	(1)
Operating temperature	T _{OPR}	-20	70	°C	(1,2,3)

Note (1) 95 % RH Max. (40 °C ≥ Ta). Maximum wet-bulb temperature at 39 °C or less. (Ta > 40 °C)
No condensation.

Note (2) In case of below 0°, the response time of liquid crystal (LC) becomes slower and the color of panel becomes darker than normal one. Level of retardation depends on temperature, because of LC's character

Note (3) Only operation is guaranteed at operating temperature. Contrast, response time, another display quality are evaluated at +25°C.

Product Specification

Amotec	Model: XTPQ35SN15-01	Rev. No.	Issued Date.	Page.
		A	2016,04,21	6 / 20

3.2 Electrical Absolute Rating

3.2.1 TFT-LCD Module

(Voltage Referenced to VSS)

Item	Symbol	Value		Unit	Condition
		Min.	Max.		
Digital Power Supply Voltage	VDD	VSS-0.3	4.6	V	--

3.2.2 Back-Light Unit

(Ta=25±2°C)

Item	Symbol	Min.	Max.	Unit	Note
current	I _f	--	30	mA	(1)
voltage	V _R	--	5.0	V	(1)

Note (1) Permanent damage to the device may occur if maximum values are exceeded or reverse voltage is loaded. Functional operation should be restricted to the conditions described under normal operating conditions.

Product Specification

Amotec	Model: XTPQ35SN15-01	Rev. No.	Issued Date.	Page.
		A	2016,04,21	7 / 20

4 Electrical Characteristics

4.1 TFT-LCD Module

ITEM	SYMBOL	MIN.	TYP.	MAX.	UNIT
Power supply voltage	VLOGIC	2.5	3.0	3.6	V
Input voltage'H'level	VIH	0.8*VLOGIC	-	VLOGIC	V
Input voltage'L'level	VIL	0	-	0.2*VLOGIC	V

4.2 Backlight Unit

The back-light system is an edge-lighting type with six white LEDs (Light Emitting Diode).

(Ta=25±2°C)

Item	Symbol	Value			Unit	Condition
		Min.	Typ.	Max.		
LED Voltage	VF	9.0	9.3	9.6	V	
LED Current	IF	-	30	-	mA	
Power Consumption	P _{BL}	-	--	-	mW	

Product Specification

Amotec	Model: XTPQ35SN15-01	Rev. No.	Issued Date.	Page.
		A	2016,04,21	8 / 20

5 Input Terminal Pin Assignment

NO	SYMBOL	I/O/P	FUNCTI	MEMARK																												
1	GND	P	GROUN																													
2	XR		NO TP																													
3	YD		NO TP																													
4	GND	P	GROUN																													
5	GND	P	GROUN																													
6	GND	P	GROUN																													
7	RD	I	6800-system : E (enable signal) 8080-system : RD (read strobe signal) Serial mode : Not used and should be connected to V _{DDIO} or V _{ss}																													
8	SDO	O	Data output pin in serial interface																													
9	RST	I	System reset pin. - An active low pulse at this pin will reset the IC, Connect to V _{DDIO} in normal operation																													
10	CS	I	CS : Chip select pin for 6800/8080 Parallel Interface SCS : Chip Select pin for Serial Mode Interface																													
11	SCL	I	Serial clock input																													
12	SDI	I	Data input pin in serial interface																													
13	D/C	I	Data or command DC : Parallel Interface SDC : Serial Interface																													
14	W R	I	6800-system : RW (indicates read cycle when High, write cycle when Low) 8080-system : WR (write strobe signal)																													
15	PS3	I	<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: center;">PS3</th> <th style="text-align: center;">PS2</th> <th style="text-align: center;">PS1</th> <th style="text-align: center;">PS0</th> <th style="text-align: center;">Interface Mode</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">0</td> <td style="text-align: center;">0</td> <td style="text-align: center;">0</td> <td style="text-align: center;">0</td> <td style="text-align: center;">16-bit 6800 parallel interface</td> </tr> <tr> <td style="text-align: center;">0</td> <td style="text-align: center;">0</td> <td style="text-align: center;">0</td> <td style="text-align: center;">1</td> <td style="text-align: center;">8-bit 6800 parallel interface</td> </tr> <tr> <td style="text-align: center;">0</td> <td style="text-align: center;">0</td> <td style="text-align: center;">1</td> <td style="text-align: center;">0</td> <td style="text-align: center;">16-bit 8080 parallel interface</td> </tr> <tr> <td style="text-align: center;">0</td> <td style="text-align: center;">0</td> <td style="text-align: center;">1</td> <td style="text-align: center;">1</td> <td style="text-align: center;">8-bit 8080 parallel interface</td> </tr> </tbody> </table>					PS3	PS2	PS1	PS0	Interface Mode	0	0	0	0	16-bit 6800 parallel interface	0	0	0	1	8-bit 6800 parallel interface	0	0	1	0	16-bit 8080 parallel interface	0	0	1	1	8-bit 8080 parallel interface
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16	PS2																															
17	PS1																															

Product Specification

Amotec	Model: XTPQ35SN15-01	Rev. No.	Issued Date.	Page.
		A	2016,04,21	9 / 20

18	PS0			
19-36	DB17-DB0	I O	For parallel mode, 8/9/16/18 bit interface. Please refer to Section 15 Interface Mapping Section for definition. Unused pins should connect to V _{SS} .	
37	DEN	I	Display enable pin from controller.	
38	HSYNC	I	Line Synchronization input	
39	VSYNC	I	Frame/Ram Write Synchronization input	
40	DCLK	I	Dot-clock signal and oscillator source. A non-stop external clock must be provided to that pin even at front or black porch non-display period.	
41	XL		NO TP	
42	GND	P	GROUN	
43	GND	P	GROUN	
44	V LOGIC	P	Voltage input pin for logic I/O, connect to system VDD. - Connect to voltage source between 1.4V to 3.6V	
45	V LOGIC	P	Voltage input pin for logic I/O, connect to system VDD. - Connect to voltage source between 1.4V to 3.6V	
46	YU		NO TP	
47	K2	P	POWER FOR BACKLIGHT (GROUN)	
48	A2	P	POWER FOR BACKLIGHT(ANODE)	
49	A1	P	POWER FOR BACKLIGHT(ANODE)	
50	K1	P	POWER FOR BACKLIGHT (GROUN)	

Product Specification

Amotec	Model: XTPQ35SN15-01	Rev. No.	Issued Date.	Page.
		A	2016,04,21	10 / 20

6 LCD Optical Characteristics

Item	Symbol	Specifications			Unit	Note
		Min.	Typ.	Max.		
Transmittance (Without Polarizer)	T%	-	14	-	%	[1]Here the transmittance and response time are design value. [2]Chromaticity measuring machine: CFT-01. Reference Only
Contrast ratio	Cr ($\Theta=0^\circ$)	150	300	-		
Response time (25°C)	T _r +T _f	-	35	50	ms	
Viewing angle (Cr≥ 10)	Θ21	15	25	-	deg	
	Θ22	35	45	-		
	Θ12	35	45	-		
	Θ11	35	45	-		
Chromaticity of CF	Red	x	0.604	0.624	0.644	
		y	0.302	0.322	0.342	
		Y	15.6	20.6	25.6	
	Green	x	0.268	0.288	0.308	
		y	0.54	0.56	0.58	
		Y	53.6	58.6	63.6	
	Blue	x	0.127	0.147	0.167	
		y	0.097	0.117	0.137	
		Y	8.3	13.3	18.3	
	White	x		0.307		
y			0.328			
Y			30.8			
Color gamut of CF (NTSC%)	S		58		%	

Product Specification

Amotec	Model: XTPQ35SN15-01	Rev. No.	Issued Date.	Page.
		A	2016,04,21	11 / 20

FIG. 1 The definition of Response Time

The response time is defined as the following figure and shall be measured by switching the input signal for "black" and "white".

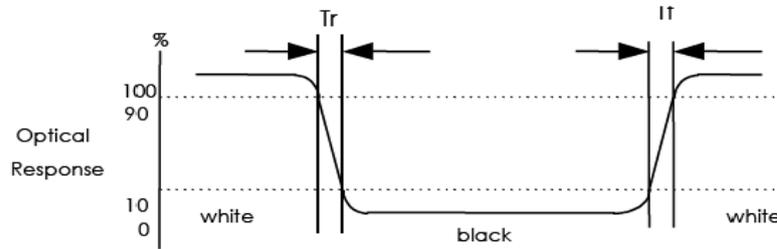


FIG. 2 Measuring method for Contrast ratio, surface luminance, Luminance uniformity , CIE (x, y) chromaticity

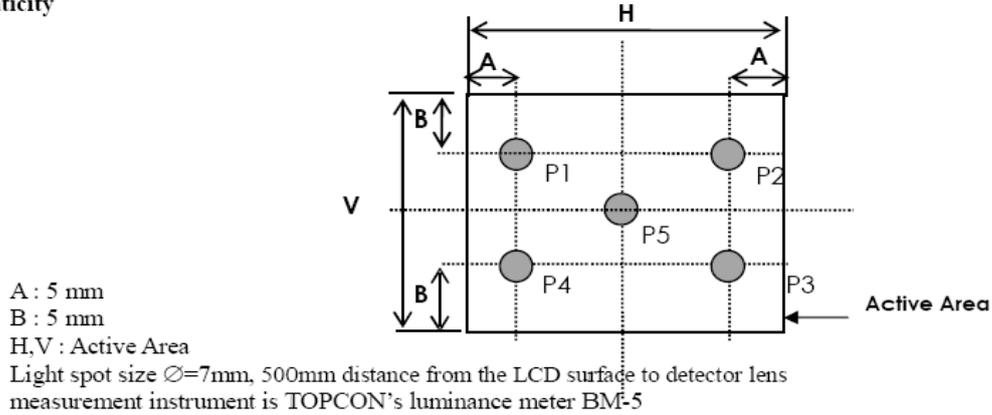
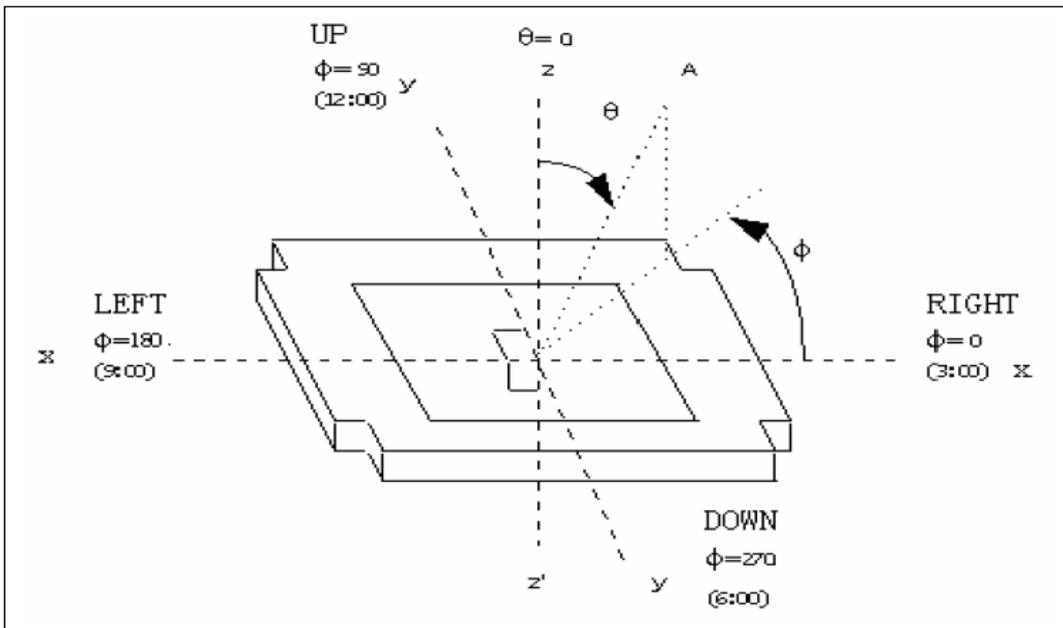


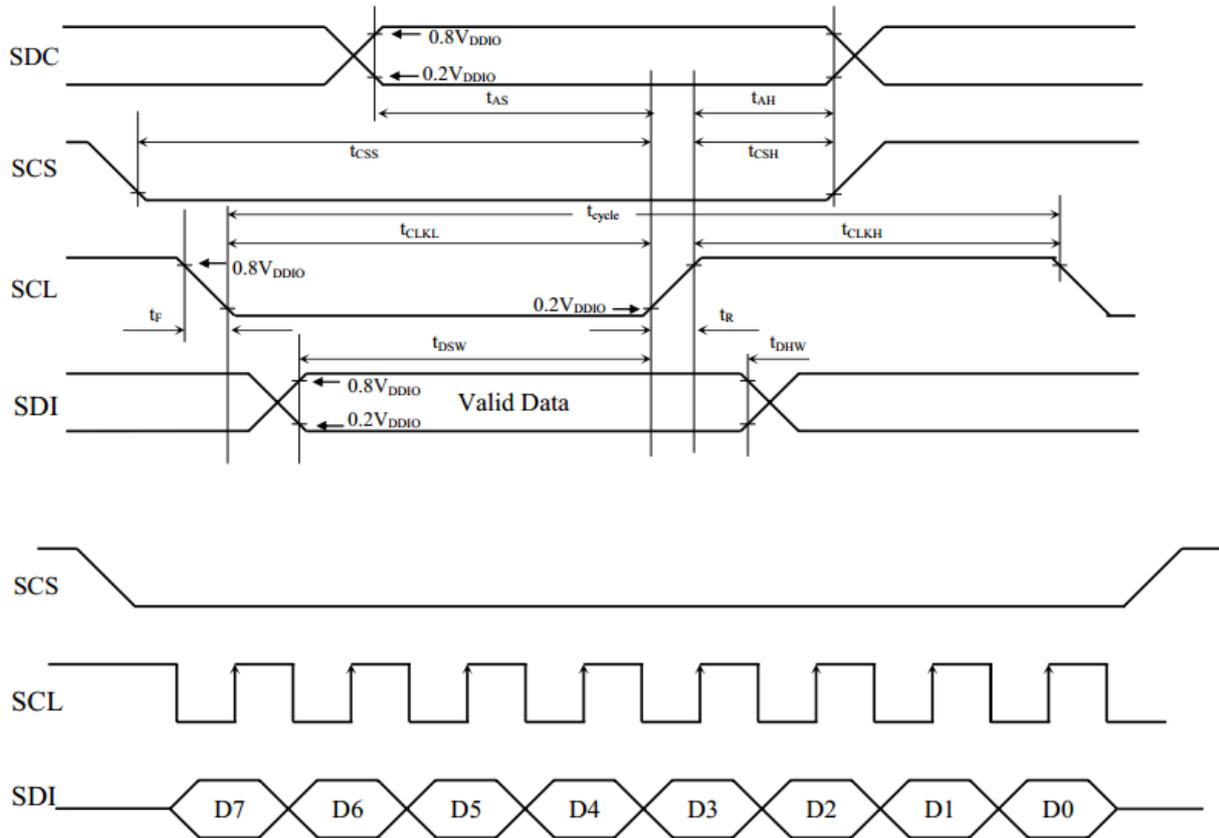
FIG. 3 The definition of viewing angle



Product Specification

Amotec	Model: XTPQ35SN15-01	Rev. No.	Issued Date.	Page.
		A	2016,04,21	12 / 20

7 Interface Timing



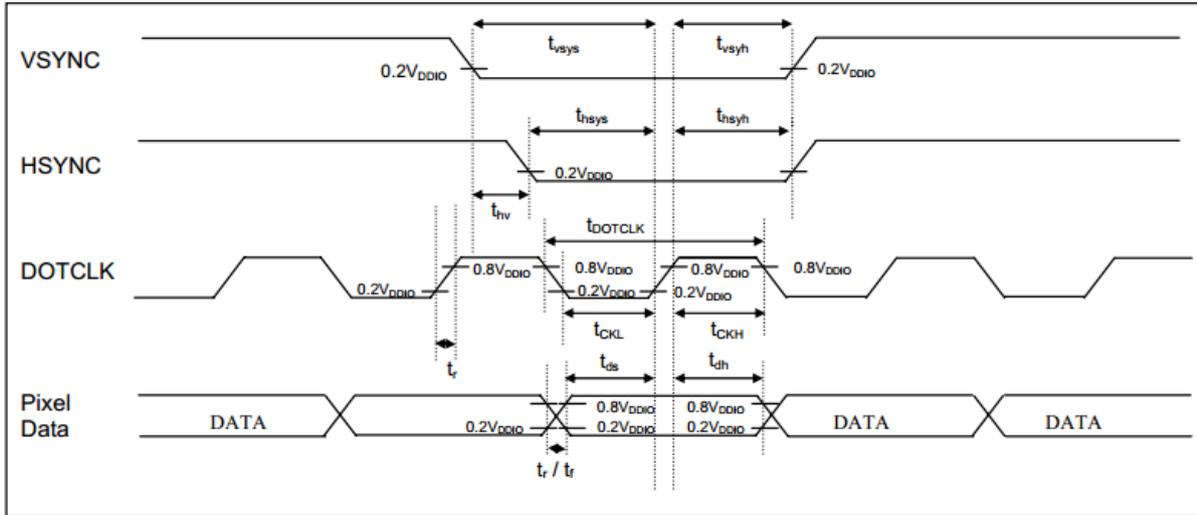
($T_A = -40$ to 85°C , $V_{DDIO} = 1.4\text{V}$ to 3.6V)

Symbol	Parameter	Min	Typ	Max	Unit
f_{DOTCLK}	DOTCLK Frequency (70Hz frame rate)	1	5.5	8.2	MHz
t_{DOTCLK}	DOTCLK Period	122	182	1000	us
t_{VSYs}	Vertical Sync Setup Time	20	-	-	ns
t_{VSYH}	Vertical Sync Hold Time	20	-	-	ns
t_{HSYs}	Horizontal Sync Setup Time	20	-	-	ns
t_{HSYH}	Horizontal Sync Hold Time	20	-	-	ns
t_{HV}	Phase difference of Sync Signal Falling Edge	0	-	320	t_{DOTCLK}
t_{CLK}	DOTCLK Low Period	61	-	-	ns
t_{CKH}	DOTCLK High Period	61	-	-	ns
t_{DS}	Data Setup Time	25	-	-	ns
t_{DH}	Data hold Time	25	-	-	ns
t_{RES}	Reset pulse width	8	-	-	ns

Note: External clock source must be provided to DOTCLK pin of SSD2119. The driver will not operate in absence of the clocking signal.

Product Specification

Amotec	Model: XTPQ35SN15-01	Rev. No.	Issued Date.	Page.
		A	2016,04,21	13 / 20



Product Specification

Amotec	Model: XTPQ35SN15-01	Rev. No.	Issued Date.	Page.
		A	2016,04,21	14 / 20

8 Reliability Condition for LCD

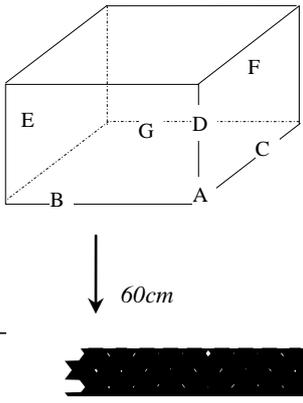
No change on display and in operation under the following test condition.

Condition: Unless otherwise specified, tests will be conducted under the following condition.

Temperature: 20±5°C Humidity: 65±5%RH

Tests will be not conducted under functioning state.

No.	Parameter	Condition	Notes
1	High Temperature Operating	70°C±2°C, 240hrs (Operation state)	--
2	Low Temperature Operating	-20°C±2°C, 240hrs (Operation state)	--
3	High Temperature Storage	80°C±2°C, 240hrs	--
4	Low Temperature Storage	-30°C±2°C, 240hrs	--
5	High Temperature and High Humidity Operation Test	60°C±2°C, 90%, 240hrs	--
6	Vibration Test	Total fixed amplitude: 1.5mm Vibration Frequency: 10~55Hz One cycle 60 seconds to 3 direction of X, Y, Z each 15 minutes.	--

7.	Drop Test	<p>To be measured after dropping from 60cm high on the concrete surface in packing state.</p> <div style="text-align: center;">  </div> <p style="text-align: right; margin-right: 20px;"> <i>Dropping method corner dropping</i> <i>A corner: once</i> <i>Edge dropping</i> <i>B, C, D edge: once</i> <i>Face dropping</i> <i>E, F, G face: once</i> </p>	--
----	-----------	--	----

- Notes:
1. No dew condensation to be observed.
 2. The function test shall be conducted after 4 hours storage at the normal temperature and humidity after removed from the test chamber.
 3. Vibration test will be conducted to the product itself without putting I in a container.

Product Specification				
Amotec	Model: XTPQ35SN15-01	Rev. No.	Issued Date.	Page.
		A	2016,04,21	16 / 20

10 Incoming Inspection Standards

11.1 VISUAL & FUNCTION INSPECTION STANDARD

11.1.1 Inspection conditions

Inspection performed under the following conditions is recommended.

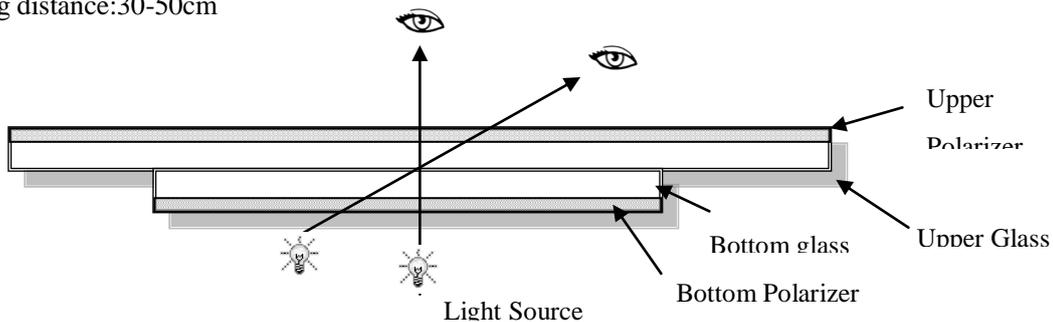
Temperature : $25 \pm 5^{\circ}\text{C}$

Humidity : $65\% \pm 10\% \text{RH}$

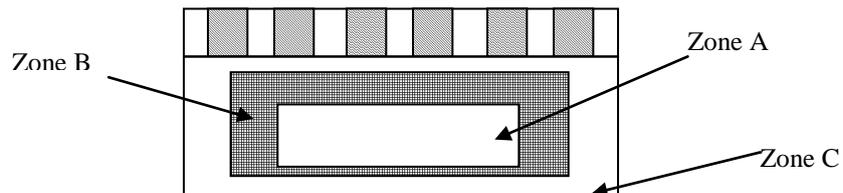
Viewing Angle : Normal viewing Angle.

Illumination: Single fluorescent lamp (300 to 700Lux)

Viewing distance:30-50cm



11.1.2 Definition



Zone A : Effective Viewing Area(Character or Digit can be seen)

Zone B : Viewing Area except Zone A

Zone C : Outside (Zone A+Zone B) which can not be seen after assembly by customer .)

Note:

As a general rule ,visual defects in Zone C can be ignored when it doesn't effect product function or appearance after assembly by customer.

11.1.3 Sampling Plan

According to GB/T 2828-2003 ; , normal inspection, Class II

Product Specification				
Amotec	Model: XTPQ35SN15-01	Rev. No.	Issued Date.	Page.
		A	2016,04,21	17 / 20

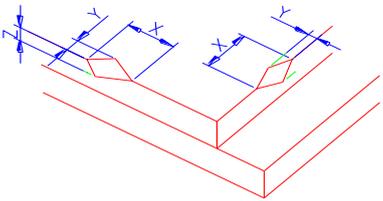
AQL:

Major defect	Minor defect
0.65	1.5

LCD: Liquid Crystal Display , TP: Touch Panel , LCM: Liquid Crystal Module

No	Items to be inspected	Criteria	Classification of defects
1	Functional defects	1) No display, Open or miss line 2) Display abnormally, Short 3) Backlight no lighting, abnormal lighting. 4) TP no function	Major
2	Missing	Missing component	
3	Outline dimension	Overall outline dimension beyond the drawing is not allowed	
4	Color tone	Color unevenness, refer to limited sample	Minor
5	Soldering appearance	Good soldering , Peeling off is not allowed.	
6	LCD/Polarizer/TP	Black/White spot/line, scratch, crack, etc.	

11.1.4 Criteria (Visual)

Number	Items	Criteria(mm)						
1.0 LCD Crack/Broken	(1) The edge of LCD broken	 <table border="1" data-bbox="847 1666 1391 1818"> <thead> <tr> <th>X</th> <th>Y</th> <th>Z</th> </tr> </thead> <tbody> <tr> <td>≤3.0mm</td> <td><Inner border line of the seal</td> <td>≤T</td> </tr> </tbody> </table>	X	Y	Z	≤3.0mm	<Inner border line of the seal	≤T
X	Y	Z						
≤3.0mm	<Inner border line of the seal	≤T						

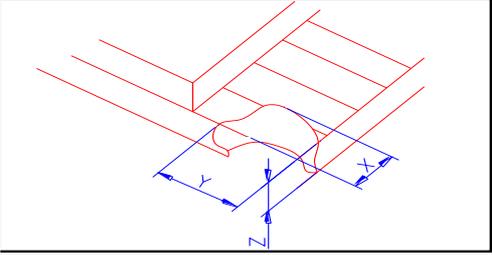
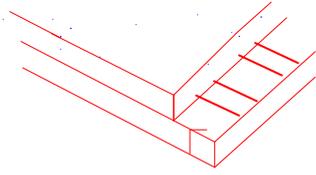
NOTE:

X: Length

Y: Width

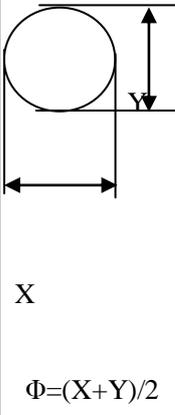
Product Specification

Amotec	Model: XTPQ35SN15-01	Rev. No.	Issued Date.	Page.
		A	2016,04,21	18 / 20

<p>Z: Height L: Length of ITO, T: Height of LCD</p>	<p>(2) LCD corner broken</p>	 <table border="1" style="margin: auto; border-collapse: collapse;"> <thead> <tr> <th style="padding: 5px;">X</th> <th style="padding: 5px;">Y</th> <th style="padding: 5px;">Z</th> </tr> </thead> <tbody> <tr> <td style="padding: 5px;">$\leq 3.0\text{mm}$</td> <td style="padding: 5px;">$\leq L$</td> <td style="padding: 5px;">$\leq T$</td> </tr> </tbody> </table>	X	Y	Z	$\leq 3.0\text{mm}$	$\leq L$	$\leq T$
	X	Y	Z					
$\leq 3.0\text{mm}$	$\leq L$	$\leq T$						
<p>(3) LCD crack</p>	 <p style="text-align: center;">Crack Not allowed</p>							

Product Specification

Amotec	Model: XTPQ35SN15-01	Rev. No.	Issued Date.	Page.
		A	2016,04,21	19 / 20

Number	Items	Criteria (mm)																																																																	
2.0	Spot defect  <p style="text-align: center;">$\Phi = (X+Y)/2$</p>	① light dot (LCD/TP/Polarizer black/white spot , light dot, pinhole, dent, stain) <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th rowspan="2" style="text-align: center;">Zone Size (mm)</th> <th colspan="3" style="text-align: center;">Acceptable Qty</th> </tr> <tr> <th style="text-align: center;">A</th> <th style="text-align: center;">B</th> <th style="text-align: center;">C</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">$\Phi \leq 0.10$</td> <td colspan="3" style="text-align: center;">Ignore</td> </tr> <tr> <td style="text-align: center;">$0.10 < \Phi \leq 0.15$</td> <td colspan="3" style="text-align: center;">3(distance $\geq 10\text{mm}$)</td> </tr> <tr> <td style="text-align: center;">$0.15 < \Phi \leq 0.2$</td> <td colspan="3" style="text-align: center;">1</td> </tr> <tr> <td style="text-align: center;">$0.2 < \Phi$</td> <td colspan="3" style="text-align: center;">0</td> </tr> </tbody> </table> ② Dim spot (LCD/TP/Polarizer dim dot, light leakage、 dark spot) <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th rowspan="2" style="text-align: center;">Zone Size (mm)</th> <th colspan="3" style="text-align: center;">Acceptable Qty</th> </tr> <tr> <th style="text-align: center;">A</th> <th style="text-align: center;">B</th> <th style="text-align: center;">C</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">$\Phi \leq 0.1$</td> <td colspan="3" style="text-align: center;">Ignore</td> </tr> <tr> <td style="text-align: center;">$0.1 < \Phi \leq 0.2$</td> <td colspan="3" style="text-align: center;">2(distance $\geq 10\text{mm}$)</td> </tr> <tr> <td style="text-align: center;">$0.2 < \Phi \leq 0.3$</td> <td colspan="3" style="text-align: center;">1</td> </tr> <tr> <td style="text-align: center;">$\Phi > 0.3$</td> <td colspan="3" style="text-align: center;">0</td> </tr> </tbody> </table> ③ Polarizer accidented spot <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th rowspan="2" style="text-align: center;">Zone Size (mm)</th> <th colspan="3" style="text-align: center;">Acceptable Qty</th> </tr> <tr> <th style="text-align: center;">A</th> <th style="text-align: center;">B</th> <th style="text-align: center;">C</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">$\Phi \leq 0.2$</td> <td colspan="3" style="text-align: center;">Ignore</td> </tr> <tr> <td style="text-align: center;">$0.2 < \Phi \leq 0.5$</td> <td colspan="3" style="text-align: center;">2(distance $\geq 10\text{mm}$)</td> </tr> <tr> <td style="text-align: center;">$\Phi > 0.5$</td> <td colspan="3" style="text-align: center;">0</td> </tr> </tbody> </table>	Zone Size (mm)	Acceptable Qty			A	B	C	$\Phi \leq 0.10$	Ignore			$0.10 < \Phi \leq 0.15$	3(distance $\geq 10\text{mm}$)			$0.15 < \Phi \leq 0.2$	1			$0.2 < \Phi$	0			Zone Size (mm)	Acceptable Qty			A	B	C	$\Phi \leq 0.1$	Ignore			$0.1 < \Phi \leq 0.2$	2(distance $\geq 10\text{mm}$)			$0.2 < \Phi \leq 0.3$	1			$\Phi > 0.3$	0			Zone Size (mm)	Acceptable Qty			A	B	C	$\Phi \leq 0.2$	Ignore			$0.2 < \Phi \leq 0.5$	2(distance $\geq 10\text{mm}$)			$\Phi > 0.5$	0		
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$0.1 < \Phi \leq 0.2$	2(distance $\geq 10\text{mm}$)																																																																		
$0.2 < \Phi \leq 0.3$	1																																																																		
$\Phi > 0.3$	0																																																																		
Zone Size (mm)	Acceptable Qty																																																																		
	A	B	C																																																																
$\Phi \leq 0.2$	Ignore																																																																		
$0.2 < \Phi \leq 0.5$	2(distance $\geq 10\text{mm}$)																																																																		
$\Phi > 0.5$	0																																																																		

Product Specification

Amotec	Model: XTPQ35SN15-01	Rev. No.	Issued Date.	Page.
		A	2016,04,21	20 / 20

	Line defect (LCD/TP /Polarizer black/white line, scratch, stain)	<table border="1" style="width: 100%; border-collapse: collapse; text-align: center;"> <thead> <tr> <th rowspan="2">Width(mm)</th> <th rowspan="2">Length(mm)</th> <th colspan="3">Acceptable Qty</th> </tr> <tr> <th>A</th> <th>B</th> <th>C</th> </tr> </thead> <tbody> <tr> <td>$\Phi \leq 0.03$</td> <td>Ignore</td> <td colspan="2">Ignore</td> <td rowspan="3">Ignore</td> </tr> <tr> <td>$0.03 < W \leq 0.05$</td> <td>$L \leq 3.0$</td> <td colspan="2">$N \leq 2$</td> </tr> <tr> <td>$0.05 < W \leq 0.08$</td> <td>$L \leq 2.0$</td> <td colspan="2">$N \leq 2$</td> </tr> <tr> <td>$0.08 < W$</td> <td colspan="4">Define as spot defect</td> </tr> </tbody> </table>	Width(mm)	Length(mm)	Acceptable Qty			A	B	C	$\Phi \leq 0.03$	Ignore	Ignore		Ignore	$0.03 < W \leq 0.05$	$L \leq 3.0$	$N \leq 2$		$0.05 < W \leq 0.08$	$L \leq 2.0$	$N \leq 2$		$0.08 < W$	Define as spot defect			
Width(mm)	Length(mm)	Acceptable Qty																										
		A	B	C																								
$\Phi \leq 0.03$	Ignore	Ignore		Ignore																								
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$0.08 < W$	Define as spot defect																											
3.0	Polarizer Bubble	<table border="1" style="width: 100%; border-collapse: collapse; text-align: center;"> <thead> <tr> <th rowspan="2">Zone Size (mm)</th> <th colspan="3">Acceptable Qty</th> </tr> <tr> <th>A</th> <th>B</th> <th>C</th> </tr> </thead> <tbody> <tr> <td>$\Phi \leq 0.2$</td> <td colspan="2">Ignore</td> <td rowspan="4">Ignore</td> </tr> <tr> <td>$0.2 < \Phi < 0.4$</td> <td colspan="2">2(distance ≥ 10mm)</td> </tr> <tr> <td>$0.4 < \Phi \leq 0.6$</td> <td colspan="2">1</td> </tr> <tr> <td>$0.6 < \Phi$</td> <td colspan="2">0</td> </tr> </tbody> </table>	Zone Size (mm)	Acceptable Qty			A	B	C	$\Phi \leq 0.2$	Ignore		Ignore	$0.2 < \Phi < 0.4$	2(distance ≥ 10 mm)		$0.4 < \Phi \leq 0.6$	1		$0.6 < \Phi$	0							
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4.0	SMT	According to IPC-A-610C class II standard . Function defect and missing part are major defect ,the others are minor defect.																										