INNOLUX DISPLAY CORPORATION

MT150XN03 V.0 LCD MODULE SPECIFICATION

(●) Preliminary Specification

( ) Final Specification

Customer	Checked & Approved by

Approved by	Checked by		Prepared by
PMKT	QRA	PD	PMKT

Innolux Display Corporation,

No.160 Kesyue Rd., Chu-Nan Site, Hsinchu Science Park,

Chu-Nan 350 , Miao-Li County, Taiwan

Tel: 886-37-586000 Fax: 886-37-586060

Version 1.2

Record of Revision

Version	Revise Date	Page	Content
1.0	2006-01-23		First edition to all
1.1	2006-01-25	22,23	Add ME Drawing including Front view and Back view
1.2	2006-02-23	7,13	P7. Change CCFL current Max from 8mA to 8.5mA P13. Change Lamp operation current Max. from 9mA to 8.5mA

Contents:

A. General specification

NO.	Item	Specification	Remark
1	Display resolution (pixel)	1,024(H) X 768(V), XGA resolution	
2	Active area (mm)	304.1(H) X 228.1(V)	
3	Screen size (inch)	15 inches diagonal	
4	Pixel pitch (mm)	0.297(H) X 0.297(V)	
5	Color configuration	R, G, B vertical stripe	
6	Overall dimension (mm)	326.5(W) X 253.5(H) X 12(D) (max.)	
7	Weight (g)	1050 (max)	
8	Surface treatment	Anti-glare, Haze = 25%, Hard coating (3H)	
9	Input color signal	8 bit LVDS	
10	Color saturation	60% NTSC	
11	Display colors	16.2M (6 bit with FRC)	
12	Optimum viewing direction	6 o'clock	
13	Backlight	2 CCFL	
14	TCO'03 & RoHS	TCO'03 and RoHS compliance	

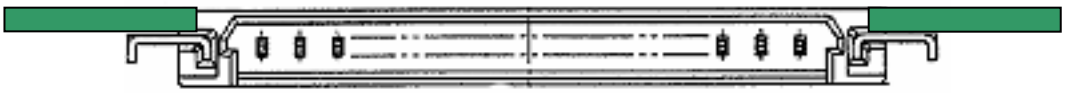
B. Electrical specifications

1. Pin assignment

Connector Hirose DF14H-20P-1.25H or equivalent

Pin No	Symbol	Description
1	VDD	Power Supply, 3.3V (typical)
2	VDD	Power Supply, 3.3V (typical)
3	VSS	Ground
4	VSS	Ground
5	Rin0-	- LVDS differential data input (R0-R5, G0)
6	Rin0+	+ LVDS differential data input (R0-R5, G0)
7	VSS	Ground
8	Rin1-	- LVDS differential data input (G1-G5, B0-B1)
9	Rin1+	+ LVDS differential data input (G1-G5, B0-B1)
10	VSS	Ground
11	Rin2-	- LVDS differential data input (B2-B5, HS, VS, DE)
12	Rin2+	+ LVDS differential data input (B2-B5, HS, VS, DE)
13	VSS	Ground
14	ClkIN-	- LVDS differential clock input
15	ClkIN+	+ LVDS differential clock input
16	VSS	Ground
17	Rin3-	- LVDS differential data input (R6-R7, G6-G7, B6-B7)
18	Rin3+	+ LVDS differential data input (R6-R7, G6-G7, B6-B7)
19	VSS	Ground
20	VSS	Ground

Pin 20 Pin 1

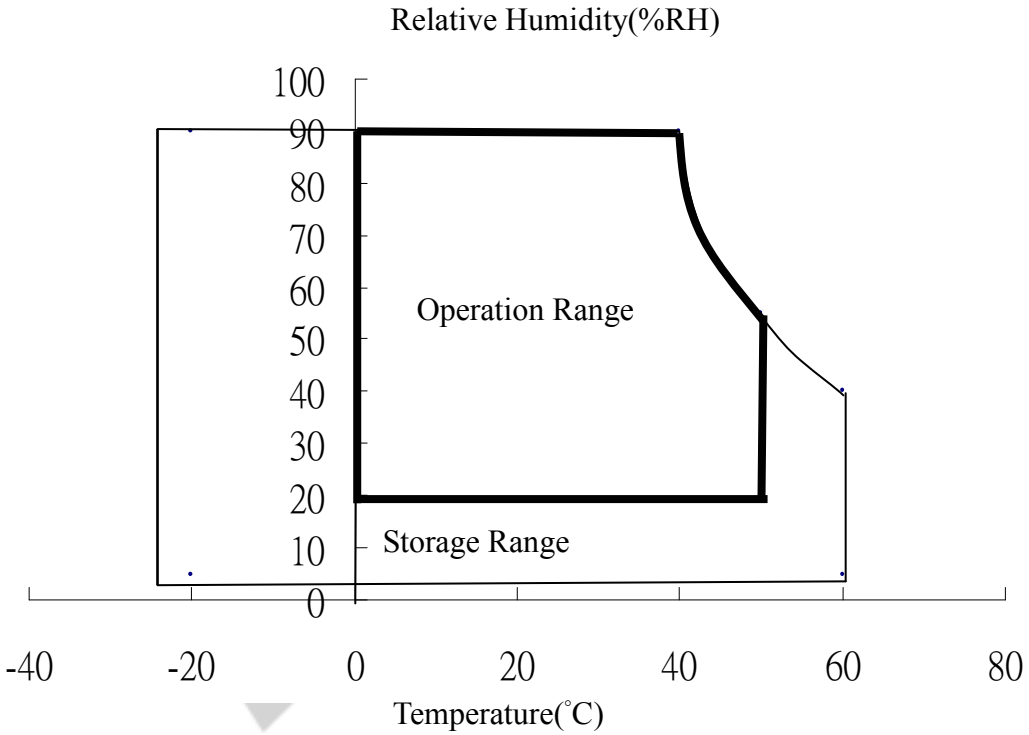


2. Absolute maximum ratings

Parameter	Symbol	Values		Unit	Remark
		Min.	Max.		
Power voltage	V_{cc}	-0.3	4.0	V	At 25°C
Input signal voltage	V_{LH}	-0.3	4.0	V	At 25°C
Operating temperature	Top	0	50	°C	Note 1
Storage temperature	T_{ST}	-25	60	°C	Note 2
CCFL Current	ICFL	3	8.5	[mA]	

Note 1: The relative humidity must not exceed 90% non-condensing at temperatures of 40°C or less. At temperatures greater than 40°C, the wet bulb temperature must not exceed 39°C.

Note 2: The unit should not be exposed to corrosive chemicals.



3. Electrical characteristics

a. Typical operating conditions

Item		Symbol	Min.	Typ.	Max.	Unit	Remark
Input Voltage		V_{cc}	3	3.3	3.6	V	
Permissive Power Input Ripple		V_{RF}	-	-	0.1	V	
Input Current	Black	I_{cc}	-	650	-	mA	Note 1
	White	I_{cc}	-	600	-		Note 2
	Mosaic	I_{cc}	-	(610)	(650)		Note 3
Rush Current		I_{Rush}	-	-	3	A	Note 4
Logic Input Voltage LVDS: IN+, IN-	Common Mode Voltage	VCM	0	1.2	2.4	V	
	Differential Input Voltage	VID	200	-	600	mV	
	Threshold Voltage (High)	VTH	-	-	100	mV	Note 5
	Threshold Voltage (Low)	VTL	-100	-	-	mV	Note 5

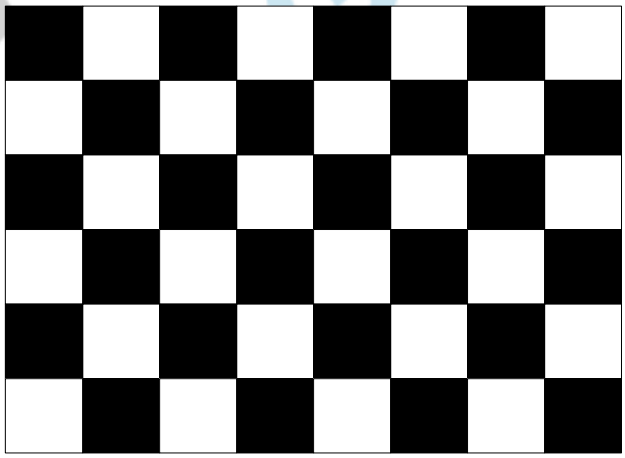
Note 1 : The specified current is under the V_{cc} =3.5V, 25 ˚C, fv=60Hz (frame frequency) condition whereas black pattern is displayed.

Note 2 : The specified current is under the Vcc =3.5V, 25 ˚C, fv=60Hz (frame frequency) condition whereas white pattern is displayed.

Note 3 : The specified current is under the Vcc =3.5V, 25 ˚C, fv=60Hz (frame frequency) condition whereas mosaic pattern(black & white [8*6]) is displayed.

White : 255 Gray

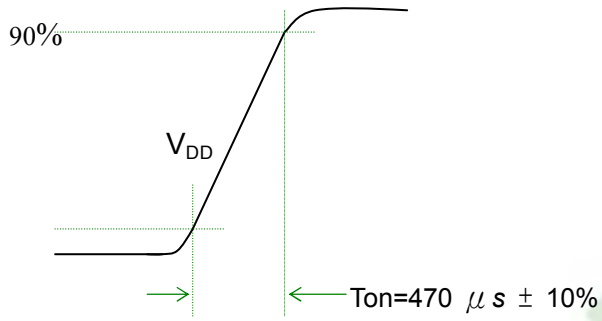
Black : 0 Gray



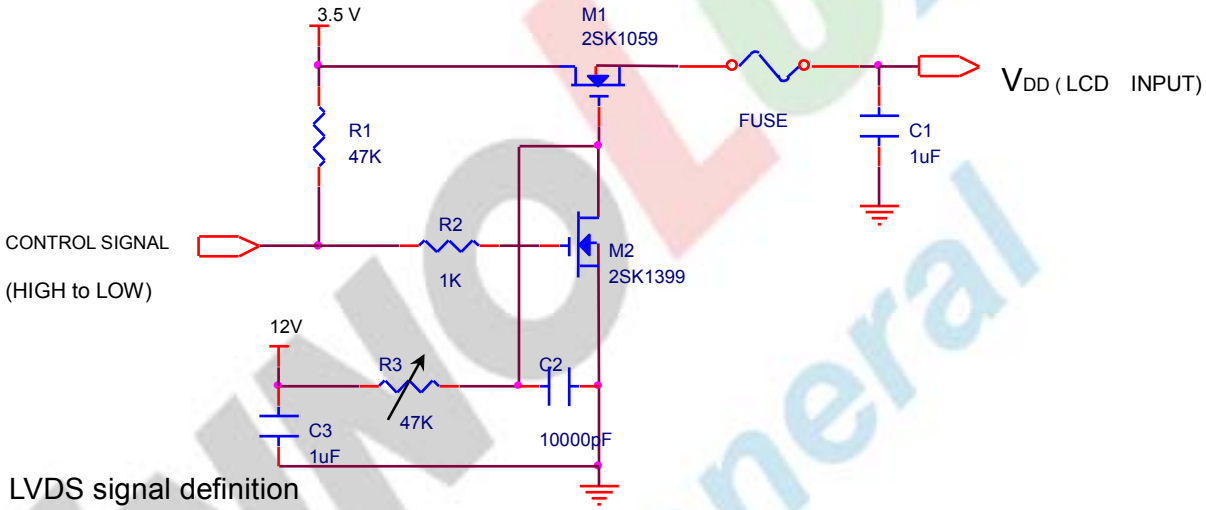
Note 4 : test condition :'

(1) V_{DD} = 3.5 V, V_{DD} rising time = 470 μs ± 10%

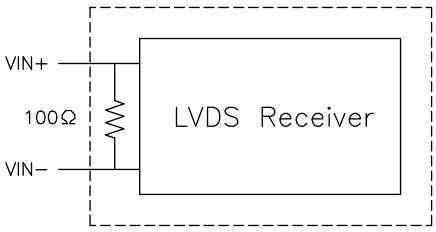
(2) Pattern: Mosaic pattern

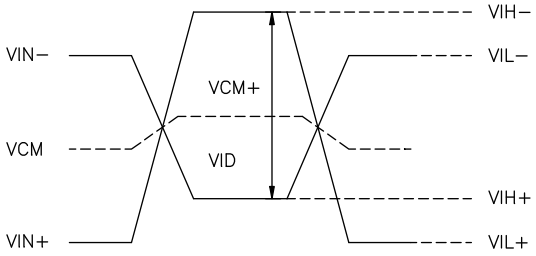


(3) Test circuit



Note 5 : LVDS signal definition





$VID = VIN_+ - VIN-$,

$\Delta VCM = | VCM_+ - VCM- |$,

$\Delta VID = | VID_+ - VID- |$,

$VID+ = | VIH_+ - VIH- |$,

$VID- = | VIL_+ - VIL- |$,

$VCM = (VIN_+ + VIN-)/2$,

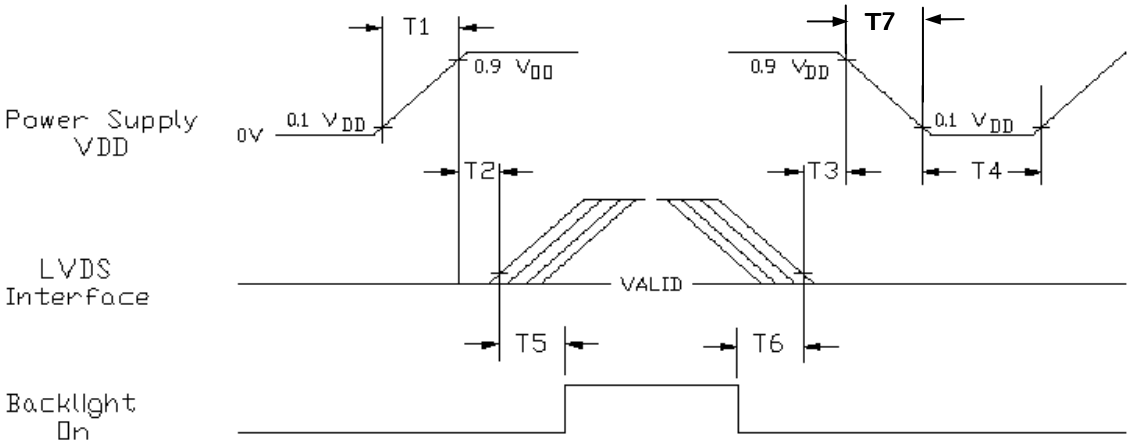
$VCM+ = (VIH_+ + VIH-)/2$,

$VCM- = (VIL_+ + VIL-)/2$,

VIN_+ = Positive differential DATA & CLK Input

VIN- = Negative differential DATA & CLK Input

Note 6 : Power on sequence for LCD V_{DD}



Parameter	Value			Unit
	Min	Typ	Max	ms
T1	0.5	--	10	ms
T2	0	--	50	ms
T3	0	--	50	ms
T4	500	--	--	ms
T5	500	--	--	ms
T6	200	--	--	ms
T7	--	--	100	ms

b. Display color vs. input data signals

The brightness of each primary color (red, green and blue) is based on the 8-bit gray scale data input for the color; the higher the binary input, the brighter the color. The table below provides a reference for color versus data input.

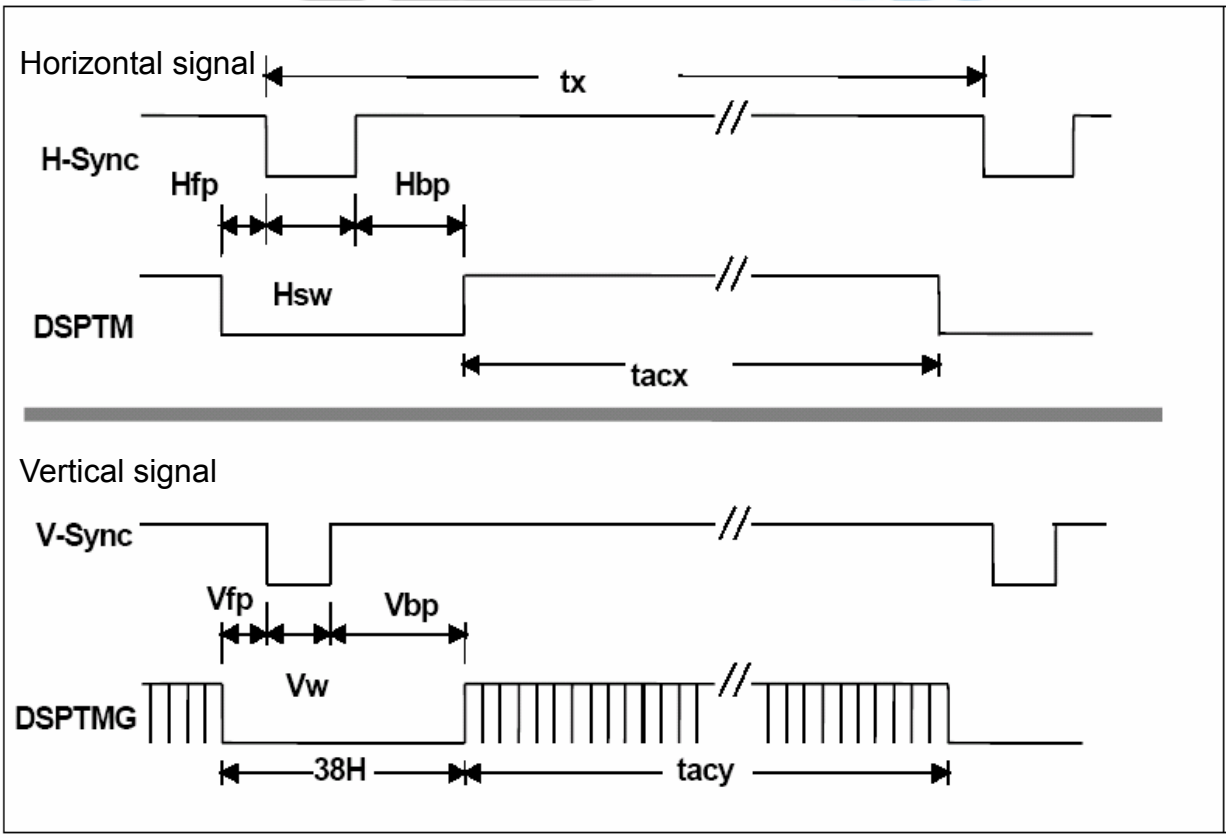
Color		Input color data																							
		Red								Green								Blue							
		MSB							LSB	MSB							LSB	MSB							LSB
		R7	R6	R5	R4	R3	R2	R1	R0	G7	G6	G5	G4	G3	G2	G1	G0	B7	B6	B5	B4	B3	B2	B1	B0
Basic colors	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red(255)	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Green(255)	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
	Blue(255)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
	Cyan	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	Magenta	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
	Yellow	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
	White	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Red	Red(000) dark	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red(001)	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red(002)	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	Red(253)	1	1	1	1	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red(254)	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red(255) bright	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Green	Green(000)dark	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Green(001)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
	Green(002)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	Green(253)	0	0	0	0	0	0	0	0	1	1	1	1	1	1	0	1	0	0	0	0	0	0	0	0
	Green(254)	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0
	Green(255)bright	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
Blue	Blue(000) dark	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Blue(001)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
	Blue(002)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	Blue(253)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	0	1
	Blue(254)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0
	Blue(255) bright	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1

c. Input signal timing

Support Input Timing Table

Description	Symbol	Min	Typ	Max	Unit
DTCLK frequency	fdck		65		[MHz]
DTCLK cycle time	tck		15.38		[nsec]
X total time	tx	1320	1344	2047	[tck]
X active time	tacx		1024		[tck]
H frequency	Hsync		48.363		[KHz]
H-Sync width	Hsw		136		[tck]
H back porch	Hbp		160		[tck]
H front porch	Hfp		24		[tck]
Y total time	ty	803	806	2047	[tx]
Y active time	tacy		768		[tx]
Frame rate	Vsync		60		[Hz]
V-sync Width	Vw		6		[tx]
V-sync front porch	Vfp		3		[tx]
V-sync back porch	Vbp		29		[tx]

Note: Hsw(H-sync width) + Hbp(H-sync back porch) should be less than 515 tck.



d. Display Position

D(1, 1)	D(2, 1)	……	D(512, 1)	……	D(1023, 1)	D(1024, 1)
D(1, 2)	D(2, 2)	……	D(512, 2)	……	D(1023, 2)	D(1024, 2)
⋮		……	⋮	……	⋮	⋮
D(1, 384)	D(2, 384)	……	D(512, 384)	……	D(1023, 384)	D(1024, 384)
⋮		……	⋮	……	⋮	⋮
D(1, 767)	D(2, 767)	……	D(512, 767)	……	D(1023, 767)	D(1024, 767)
D(1, 768)	D(2, 768)	……	D(512, 768)	……	D(1023, 768)	D(1024,768)

e. Backlight driving conditions

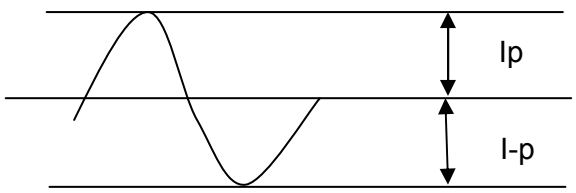
Parameter	Symbol	Min.	Typ.	Max.	Unit	Remark	
Lamp voltage	VL	(518)	(576)	(633)	Vrms	@ 8mA	
Lamp operation current	IL	(3)	(8)	(8.5)	mArms		Note 1
Lamp starting voltage	VLstart	(1350)			Vrms	T = 25°C	Note 2,3,4,5
		(1570)				T = 0°C	Note 2,3,4,5
Frequency	F	(35)	(52)	(80)	KHZ		Note 5
Lamp life time		(30000)			Hr	@ 8mA	Note 6

Note: The waveform of the voltage output of inverter must be area-symmetric and the design of the inverter must have specifications for the modularized lamp. The performance of the Backlight, such as lifetime or brightness, is greatly influenced by the characteristics of the DC-AC inverter for the lamp. All the parameters of an inverter should be carefully designed to avoid producing too much current leakage from high voltage output of the inverter. When designing or ordering the inverter please make sure that a poor lighting caused by the mismatch of the Backlight and the inverter (miss-lighting, flicker, etc.) never occurs. If the above situation is confirmed, the module should be operated in the same manners when it is installed in your instrument.

Note 1 :

The degree of unbalance: less than 10%

The ratio of wave height: less than $\sqrt{2} \pm 10\%$



Ip: high side peak

I-p: low side peak

The degree of unbalance = |Ip-I-p| /Irms*100(%)

The ratio of wave height = Ip(or I-p)/Irms

Lamp should be completely turned on.

Note 2:

Test equipment: AS-114B

Note 3:

The voltage shown above should be applied to the lamp for more than 1 second after startup. Otherwise, the lamp may not be turned on normally.

Note 4:

Inverter should provide more than min. value, and then lamp could be completely turned on.

Note 5:

Lamp frequency may produce interference with horizontal synchronous frequency and this may cause line flow on the display. Therefore lamp frequency shall be detached from the horizontal synchronous frequency and its harmonics as far as possible in order to avoid interference.

Note 6:

Lamp life definition :

The brightness of lamp becomes 50% of the initial brightness or not normal lighting.

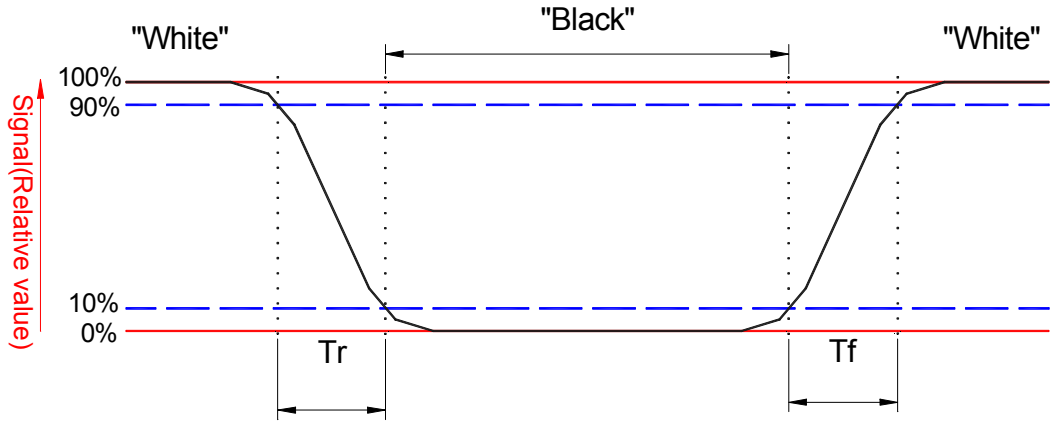
Backlight connecter : JST BHSR-03VS-1

Pin no.	Symbol	Function	Remark
1	VIH	Lamp high voltage input	Cable color: Pink
2	VIL	Lamp low voltage input	Cable color: White

C. Optical specifications

Item	Symbol	Condition	Specification			Unit	Remark
			Min.	Typ.	Max.		
Response time	Tr	$\theta = 0^\circ$		2	4	ms	Note 4
	Tf			6	12		
	Tr+Tf			8	16		
Contrast ratio	CR	$\theta = 0^\circ$	500	600			Note 3,5
Viewing angle	Top	CR≧10	(60)	(70)		deg.	Note 3,5,7
		CR≧5	75	85			
	Bottom	CR≧10	50	60			
		CR≧5	60	70			
	Left	CR≧10	65	75			
		CR≧5	75	85			
	Right	CR≧10	65	75			
		CR≧5	75	85			
Brightness (Center)	Y_L		200	250		nit	Note 3,6
Color chromaticity(CIE)	Wx	$\theta = 0^\circ$	-0.03	(0.313)	+0.03		Note 3
	Wy			(0.329)			
	Rx			(0.630)			
	Ry			(0.330)			
	Gx			(0.300)			
	Gy			(0.580)			
	Bx			(0.150)			
	By			(0.090)			
White uniformity (9)	δ_W		0.75	0.8			Note 3,8

Note 1: Ambient temperature = 25°C.
Note 2: To be measured in dark room after backlight warm up 30 minutes.
Note 3: To be measured with a viewing cone of 2°by Topcon luminance meter BM-5A.
Note 4: Definition of response time:
The output signals of BM-7 are measured when the input signals are changed from “Black” to “White” (falling time) and from “White” to “Black” (rising time), respectively. The response time interval is between the 10% and 90% of amplitudes. Refer to the figure as below.



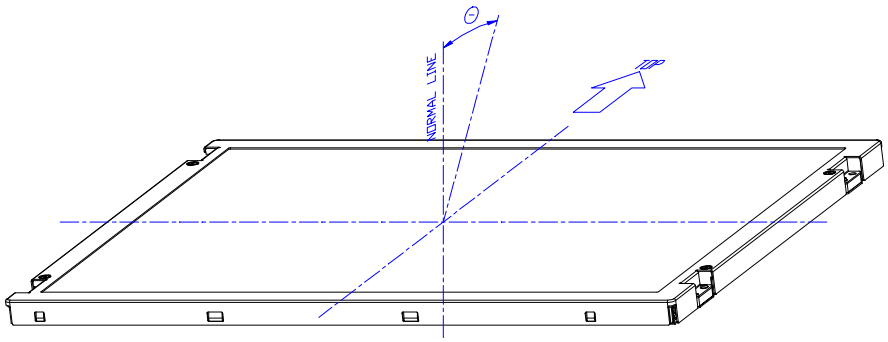
Note 5. Definition of contrast ratio:

Contrast ratio is calculated by the following formula.

$$\text{Contrast ratio (CR)} = \frac{\text{Brightness on the "white" state}}{\text{Brightness on the "black" state}}$$

Note 6: Driving conditions for CCFL: I_L= 8mA,

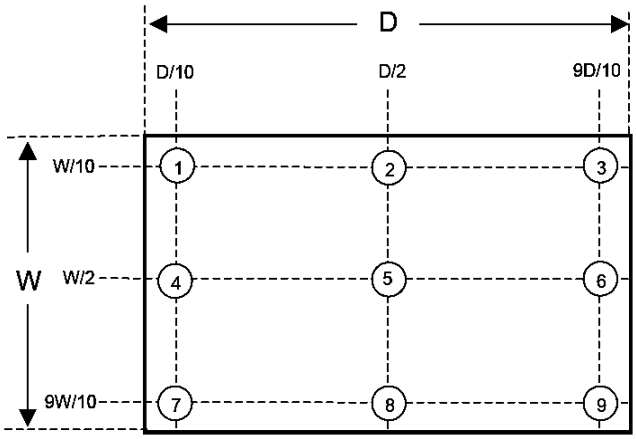
Note 7: Definition of viewing angle



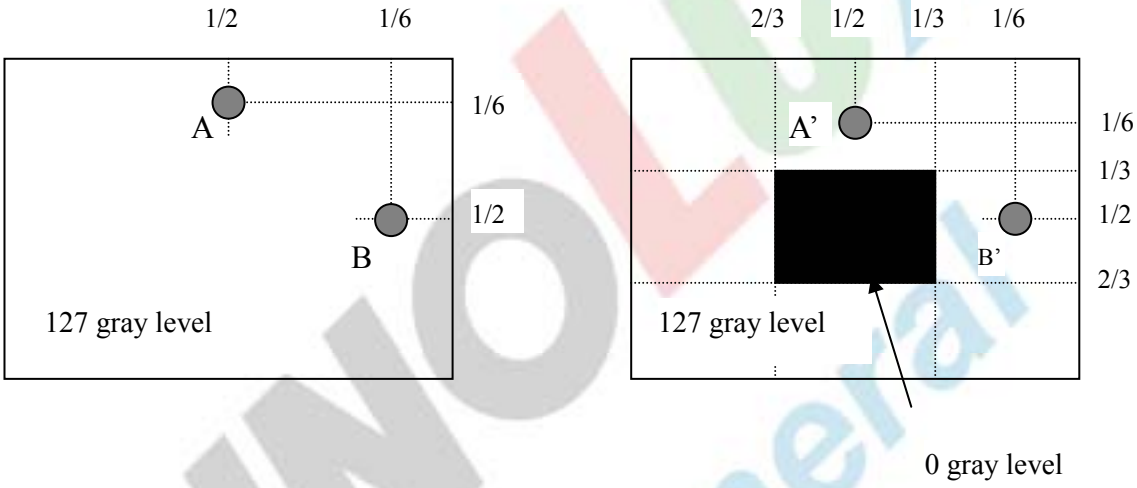
Note 8: Definition white uniformity:

Luminance are measured at the following nine points (P1~P9).

$$\delta_W = \frac{\text{Minimum Brightness of nine points (P1~P9).}}{\text{Maximum Brightness of nine points (P1~P9).}}$$



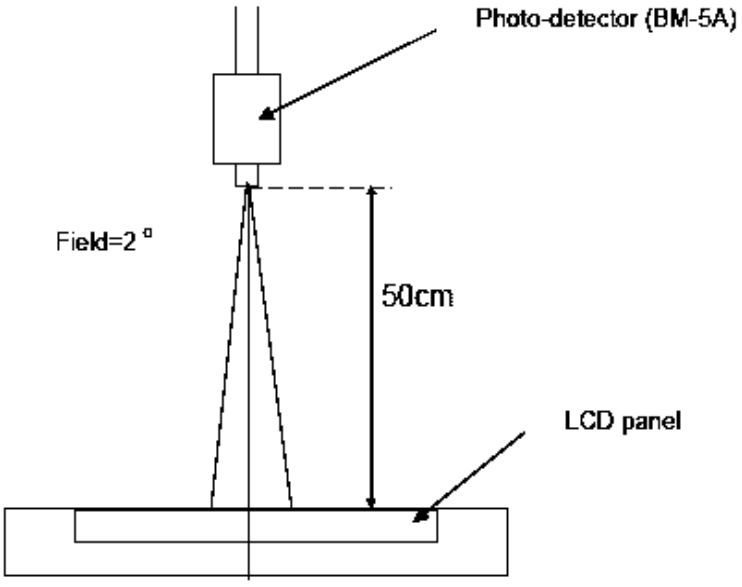
Note 9:



$I\ L_A-L_{A'}\ I / L_A \times 100\% = 2\%$ max., L_A and $L_{A'}$ are brightness at location A and A'

$I\ L_B-L_{B'}\ I / L_B \times 100\% = 2\%$ max., L_B and $L_{B'}$ are brightness at location B and B'

Note 10: Optical characteristic measurement setup.



D. Reliability test items :

Test Item	Test Condition	Judgment	Remark
High temperature storage	60°C, 240Hrs	Note 1	Note 2
Low temperature storage	-25°C, 240Hrs	Note 1	Note 2
High temperature & high humidity operation	40°C, 90%RH, 240Hrs (No condensation)	Note 1	Note 2
High temperature operation	50°C, 240Hrs	Note 1	Note 2
Low temperature operation	0°C, 240Hrs	Note 1	Note 2
Thermal Shock (non-operation)	-20°C~60°C 1Hr, 10mins, 1Hr, 100cycles	Note 1	Note 2
Electrostatic discharge (ESD) (non-operation)	Contact:+/-8kV, 150pF(330ohms), 25 times/1 point, 1 time/1 sec Air discharge:+/-15kV, 150pF(330ohms), 25 times/1 point, 1 time/1 sec	Note 1	Note 2
Vibration (non-operation)	Vibration level : 1.5G Bandwidth : 10-300Hz Waveform : sine wave, sweep rate : 10min 30 min for each direction X, Y, Z (1.5 Hrs in total)	Note 1	Note 2
Mechanical Shock (non-operation)	Shock level : 50G, 11ms Waveform : Half sine wave Direction : ±X, ±Y, ±Z One time each direction	Note 1	Note 2
MTBF Demonstration	30,000 hours with confidence level 90%	Note 1	Note 3

Note 1 :

Pass: Normal display image with no obvious non-uniformity and no line defect.
Partial transformation of the module parts should be ignored.

Fail: No display image, obvious non-uniformity, or line defects.

Note 2 :

Evaluation should be tested after storage at room temperature for one hour.

Note 3 :

The MTBF calculation is based on the assumption that the failure rate distribution meets the Exponential Model.

E. Safety

(1) Sharp Edge Requirements

There will be no sharp edges or corners on the display assembly that could cause injury.

(2) Materials

a. Toxicity

There will be no carcinogenic materials used anywhere in the display module. If toxic materials are used, they will be reviewed and approved by the responsible InnoLux Toxicologist.

b. Flammability

All components including electrical components that do not meet the flammability grade UL94-V1 in the module will complete the flammability rating exception approval process. The printed circuit board will be made from material rated 94-V1 or better. The actual UL flammability rating will be printed on the printed circuit board.

c. Capacitors

If any polarized capacitors are used in the display assembly, provisions will be made to keep them from being inserted backwards.

F. Display quality

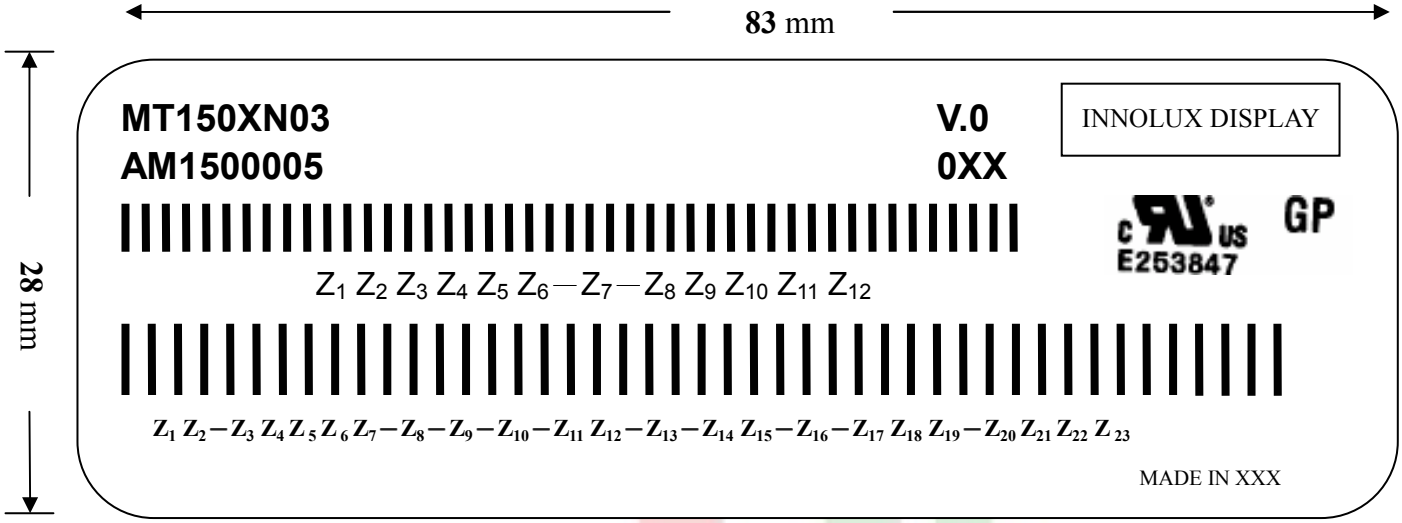
The display quality of the color TFT-LCD module should be in compliance with the Innolux's Incoming inspection standard.

G. Handling precaution

The Handling of the TFT-LCD should be in compliance with the Innolux's handling principle standard.

H. Label

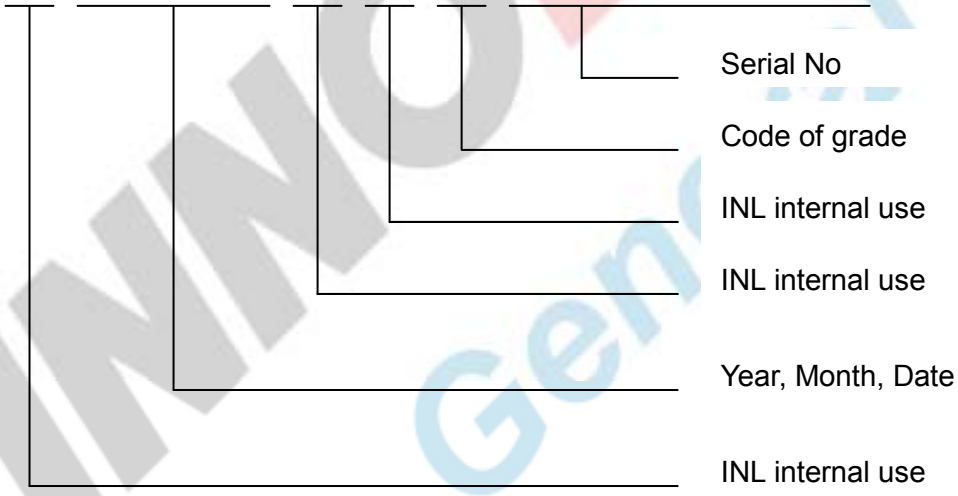
(1) Module Label



(a) Model Number: MT150XN03

(b) Version: V.0

(c) Serial ID I: Z_1 Z_2 Z_3 Z_4 Z_5 Z_6 Z_7 Z_8 Z_9 Z_{10} Z_{11} Z_{12}

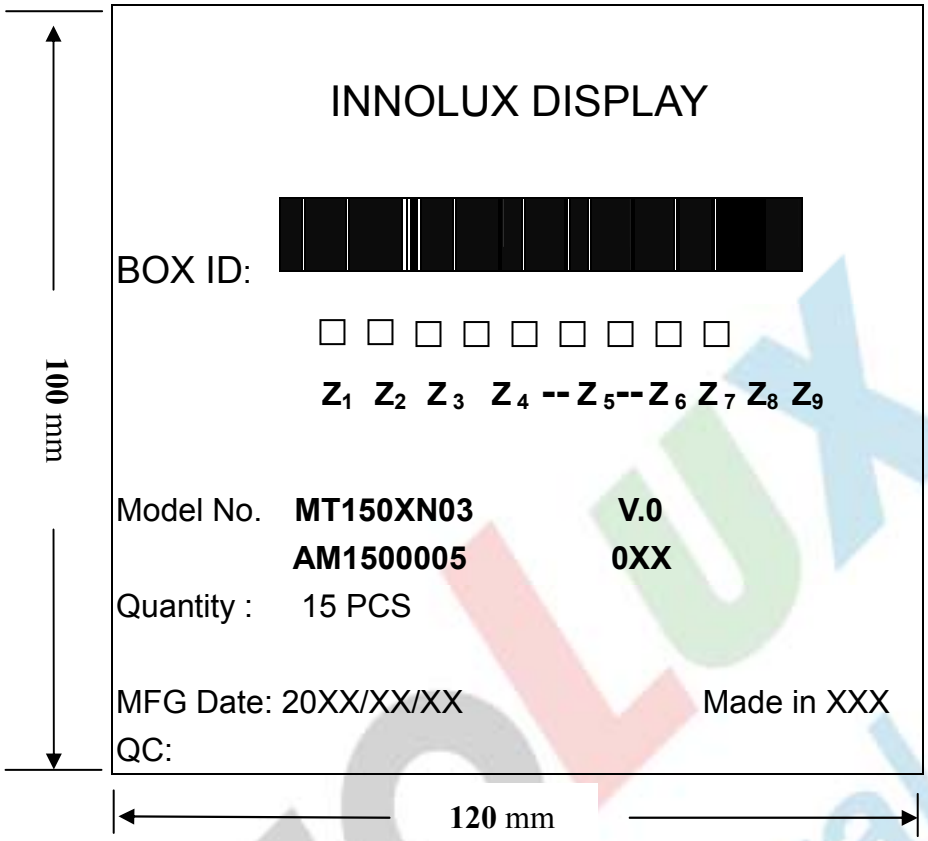


Serial ID includes the information as below:

1. Manufactured Date: Year: 0~9, for 2000~2009
2. Month: 1~9 & A~C for Jan.~Dec.
3. Date: 1~9 & A~Z (exclude I, O, Q, U) for 1th~31th
4. Code of grade: 1, 3, 5, 7, E
5. Serial No: Module manufacture sequence no

(d) Serial ID II (INL internal use)

(2) Carton Label

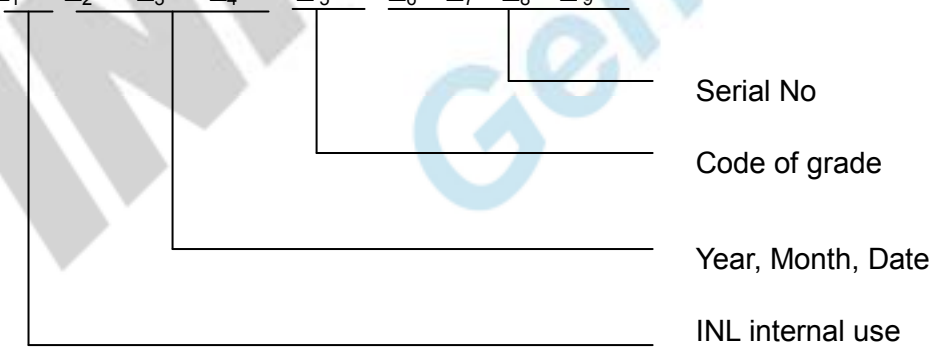


(a) Model Number: MT150XN03

(b) Version: V.0

(c) Packing quantity: 15 pcs

(d) Serial ID: Z_1 Z_2 Z_3 Z_4 Z_5 Z_6 Z_7 Z_8 Z_9



Serial ID includes the information as below :

(a) Manufactured Date: Year: 0~9, for 2000~2009

Month: 1~9 & A~C for Jan.~Dec.

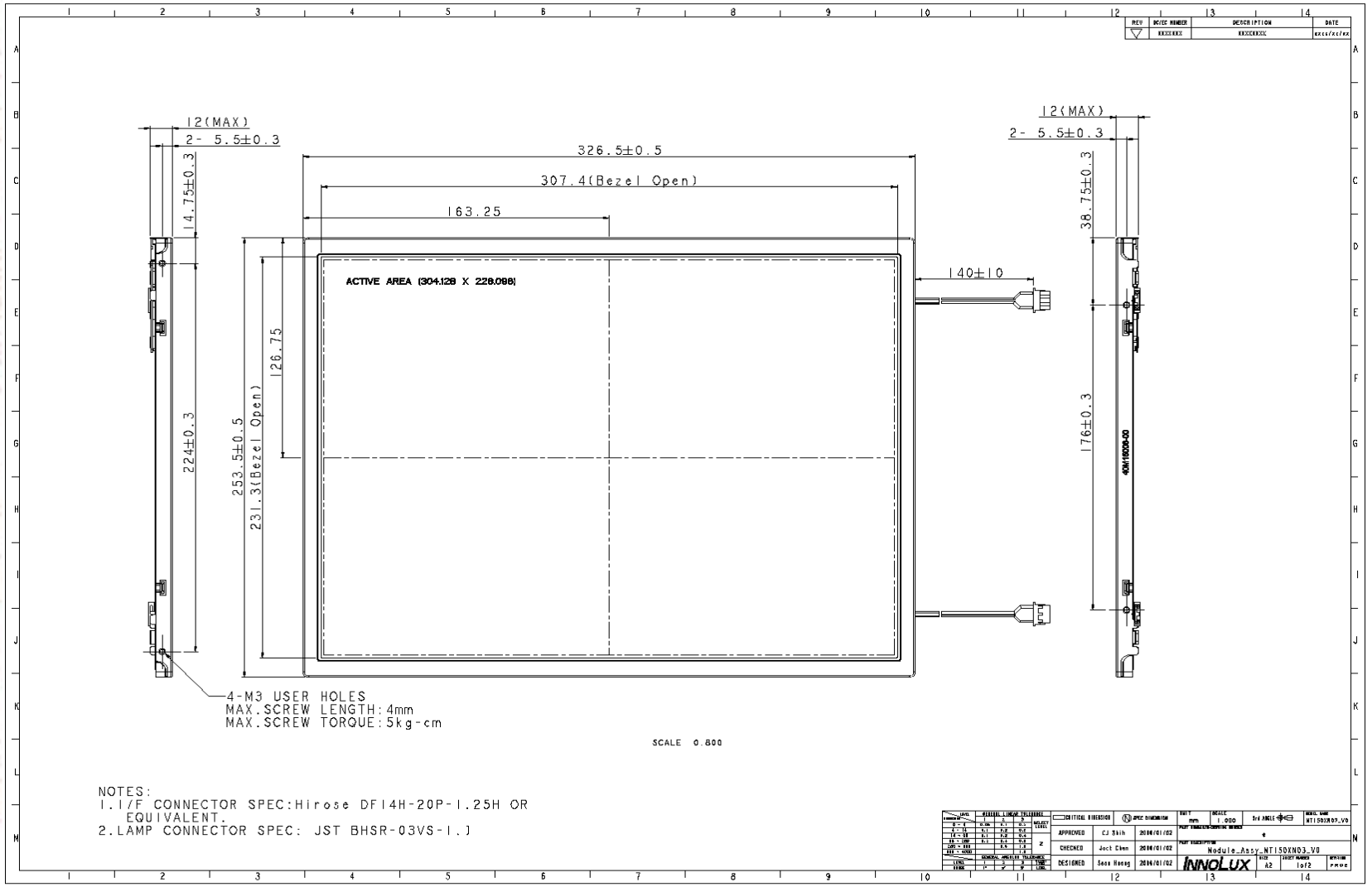
Date: 1~9 & A~Z (exclude I, O, Q, U) for 1th~31th

(b) Code of grade: 1, 3, 5, 7, E

(c) Serial No: Module packing sequence no

I. Mechanical drawings

(1) Front view



(2) Back view