



# DATASHEET

4/10/2013

Fema Part Number

GM480272X-43-TTX2NLW-TPC	
Description	4.3" Full Color TFT Display
	480x272 Resolution
	Brightness = 430 nits (Typical)
	Integrated Projected Capacitive Touch Panel

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## 1. BASIC SPECIFICATION

### 1.1 Mechanical specifications

Items	Nominal Dimension	Unit
Active screen size	4.3" diagonal	-
Dot Matrix	480 x RGB x 272	Pixel
Module Size (W x H x T)	105.5 x 67.2 x 4.7	mm.
Active Area (W x H)	95.04 x 53.856	mm.
Dot Pitch	0.066 x 0.198	mm.
Interface	Digital	-
Driving IC Package	COG	-
Module Weight	TBD	g

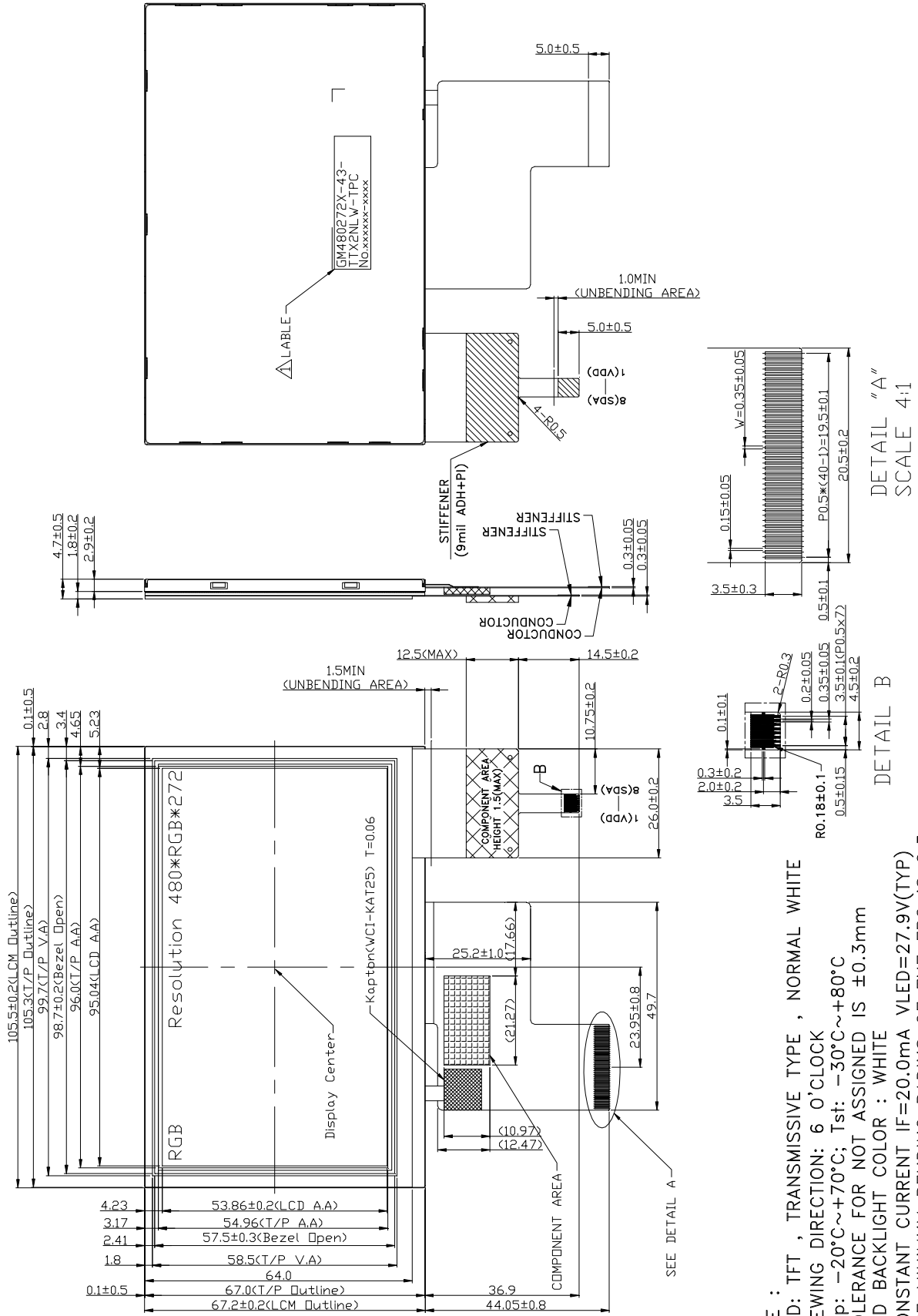
### 1.2 Display specification

Display	Descriptions	Note
LCD Type	a-Si TFT	-
LCD Mode	TN/Normally white	-
Polarizer Mode	Transmissive	-
Polarizer Surface	Anti-Glare	-
Pixel arrangement	RGB-stripe	-
Backlight Type	LED	-
Viewing Direction(Gray inversion)	6 O'clock Direction	-

\*Color tone is slightly changed by temperature and driving voltage.

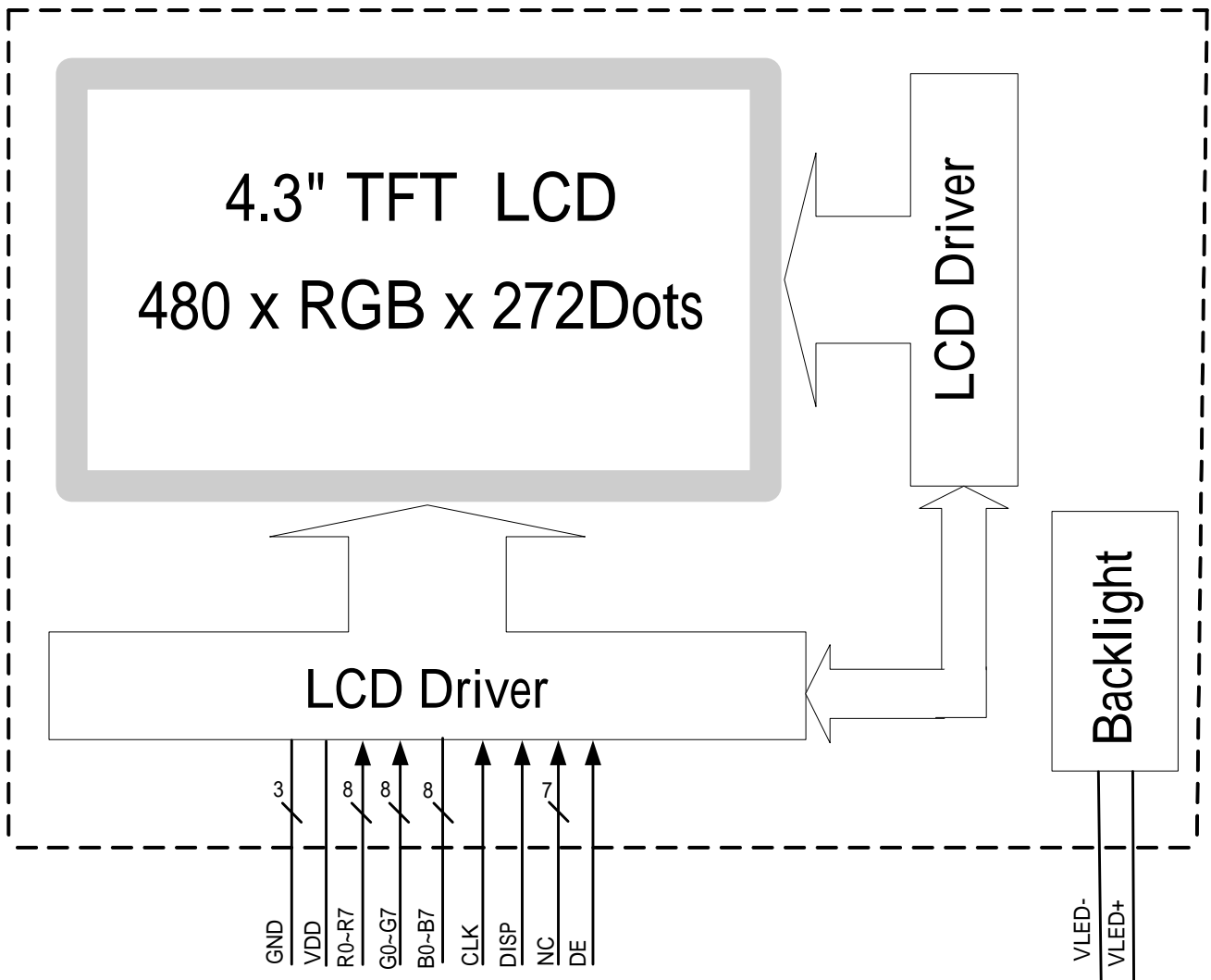
Note 1 : The viewing direction defined in this specification is according to the rubbing direction of its TFT surface treatment by the TFT glass manufacturer. The grayscale inversion is at this direction as well. However, the optimal viewing direction for human view is normally where the color does NOT change to grayscale inversion, and this would be the opposite site of the specified viewing direction in this specification. In any case we advise customers to judge by themselves, and be aware of this phenomenon.

### 1.3 Outline dimension



- NOTE :**
- 1.LCD : TFT , TRANSMISSIVE TYPE , NORMAL WHITE
  - 2.VIEWING DIRECTION: 6 O'CLOCK
  - 3.Top: -20°C~+70°C; Tst: -30°C~+80°C
  - 4.TOLERANCE FOR NOT ASSIGNED IS ±0.3mm
  - 5.LED BACKLIGHT COLOR : WHITE
  - 6.CONSTANT CURRENT IF=20.0mA VLED=27.9V(TYP)
  - 7.THE MINIMUM BENDING RADIUS OF THE FPC IS 0.5mm

### 1.4 Block diagram:



### 1.5 Interface pin connection:

Pin No.	Symbol	I/O	Function	Remark
1	V <sub>LED-</sub>	P	Power for LED backlight cathode	
2	V <sub>LED+</sub>	P	Power for LED backlight anode	
3	GND	P	Power ground	
4	V <sub>DD</sub>	P	Power voltage	
5	R0	I	Red data (LSB)	
6	R1	I	Red data	
7	R2	I	Red data	
8	R3	I	Red data	
9	R4	I	Red data	
10	R5	I	Red data	
11	R6	I	Red data	
12	R7	I	Red data (MSB)	
13	G0	I	Green data (LSB)	
14	G1	I	Green data	
15	G2	I	Green data	
16	G3	I	Green data	
17	G4	I	Green data	
18	G5	I	Green data	
19	G6	I	Green data	
20	G7	I	Green data (MSB)	

### 1.5 Interface Pin Connection(cont.)

21	B0	I	Blue data (LSB)	
22	B1	I	Blue data	
23	B2	I	Blue data	
24	B3	I	Blue data	
25	B4	I	Blue data	
26	B5	I	Blue data	
27	B6	I	Blue data	
28	B7	I	Blue data (MSB)	
29	GND	P	Power ground	
30	CLK	I	Pixel clock	
31	DISP	I	Display on/off	
32	NC	-	No connection	
33	NC	-	No connection	
34	DE	I	Data Enable	
35	NC	-	No connection	
36	GND	P	Power ground	
37	NC	-	No connection	
38	NC	-	No connection	
39	NC	-	No connection	
40	NC	-	No connection	

I: input, O: output, P: Power

## 2. ELECTRICAL CHARACTERISTICS

### 2.1 Absolute Maximum Ratings

(Note 1)

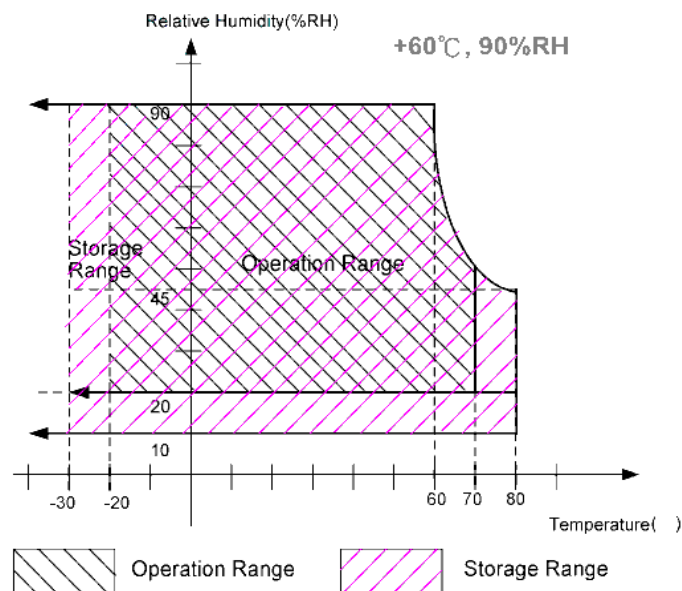
Item	Symbol	Values		Unit	Remark
		Min.	Max.		
Power voltage	$V_{DD}$	-0.5	5.0	V	
Input signal voltage	Logic input	-0.5	5.0	V	
Operation temperature	$T_{OP}$	-20	70	°C	Note 3, 4
Storage temperature	$T_{ST}$	-30	80	°C	Note 3, 4
LED Reverse Voltage	$V_R$	-	1.2	V	Each LED Note 2
LED Forward Current	$I_F$	-	25	mA	Each LED

Note 1: The absolute maximum rating values of this product are not allowed to be exceeded at any times. A module should be used with any of the absolute maximum ratings exceeded, the characteristics of the module may not be recovered, or in an extreme condition, the module may be permanently destroyed.

Note 2:  $V_R$  Conditions: Zener Diode 20mA

Note 3: 90% RH Max. (Max wet temp. is 60°C)

Maximum wet-bulb temperature is at 60°C or less. And No condensation (no drops of dew)



Note 4: In case of temperature below 0°C, the response time of liquid crystal (LC) becomes slower and the color of panel darker than normal one.

## 2.2 Typical Operation Conditions:

Item	Symbol	Values			Unit	Remark
		Min.	Typ.	Max.		
Power voltage	$V_{DD}$	3.1	3.3	3.5	V	
Current for Driver	$I_{V_{DD}}$	-	17	25	mA	$V_{DD} = 3.3V$
Input logic high voltage	$V_{IH}$	$0.8V_{DD}$	-	$V_{DD}$	V	Note 1
Input logic low voltage	$V_{IL}$	GND	-	$0.2V_{DD}$	V	

Note1: CLK, DE, R0~ R7, G0~ G7, B0~ B7.

## 2.3 Backlight Driving Conditions:

Item	Symbol	Values			Unit	Remark
		Min.	Typ.	Max.		
Voltage for LED Backlight	$V_L$	25.2	27.9	31.5	V	Note 2
Current for LED Backlight	$I_L$	18	20	22	mA	
LED life time	-	20,000	-	-	Hr	Note 1

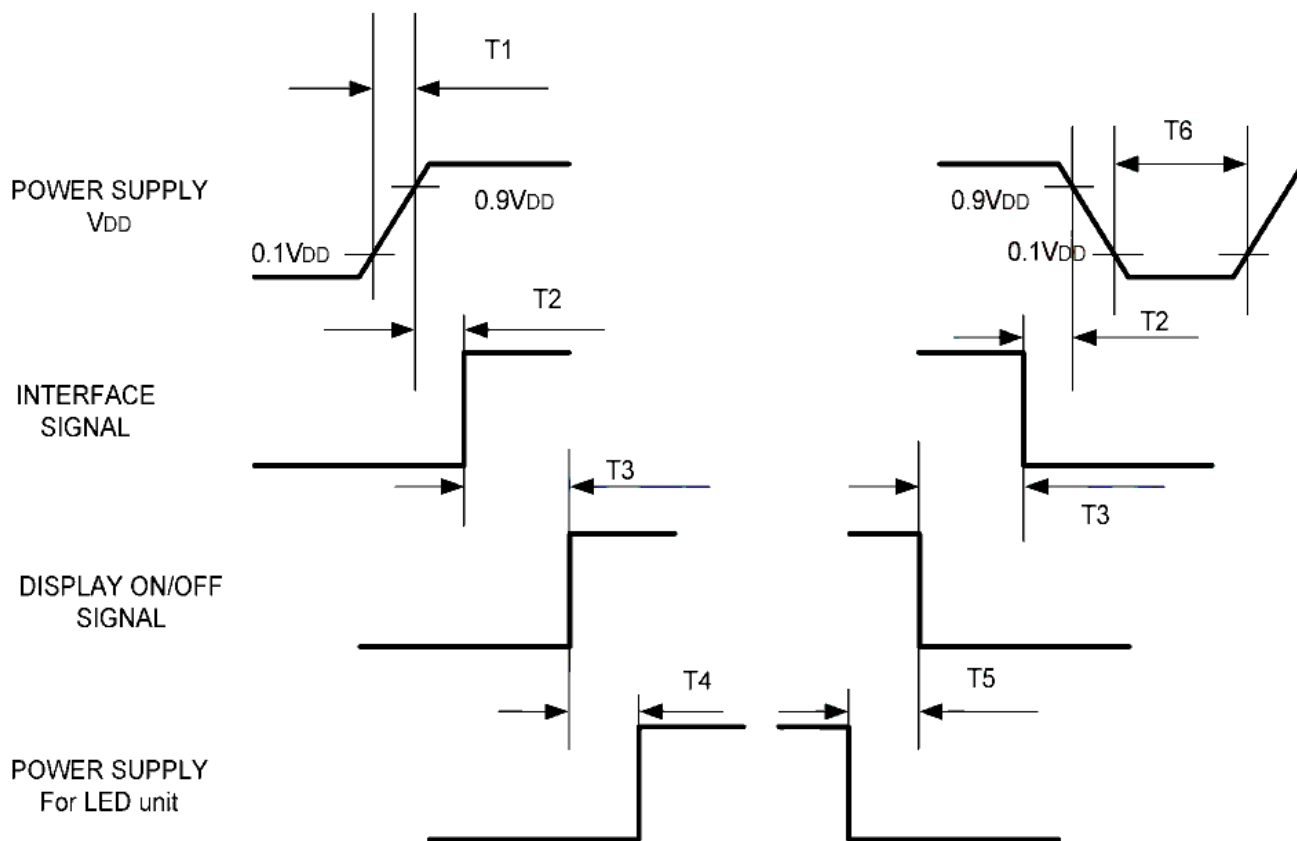
Note 1: The "LED life time" is defined as the module brightness decrease to 50% original brightness that the ambient temperature is 25°C and  $I_L = 20mA$ . The LED lifetime could be decreased if operating  $I_L$  is larger than 20 mA.

Note 2: The LED Supply Voltage is defined by the number of LED at  $T_a = 25^\circ C$  and  $I_L = 20mA$ .



## 2.4 Power Sequence :

To prevent a latch-up or DC operation of the LCD module, the power on/off sequence should be as the diagram below.



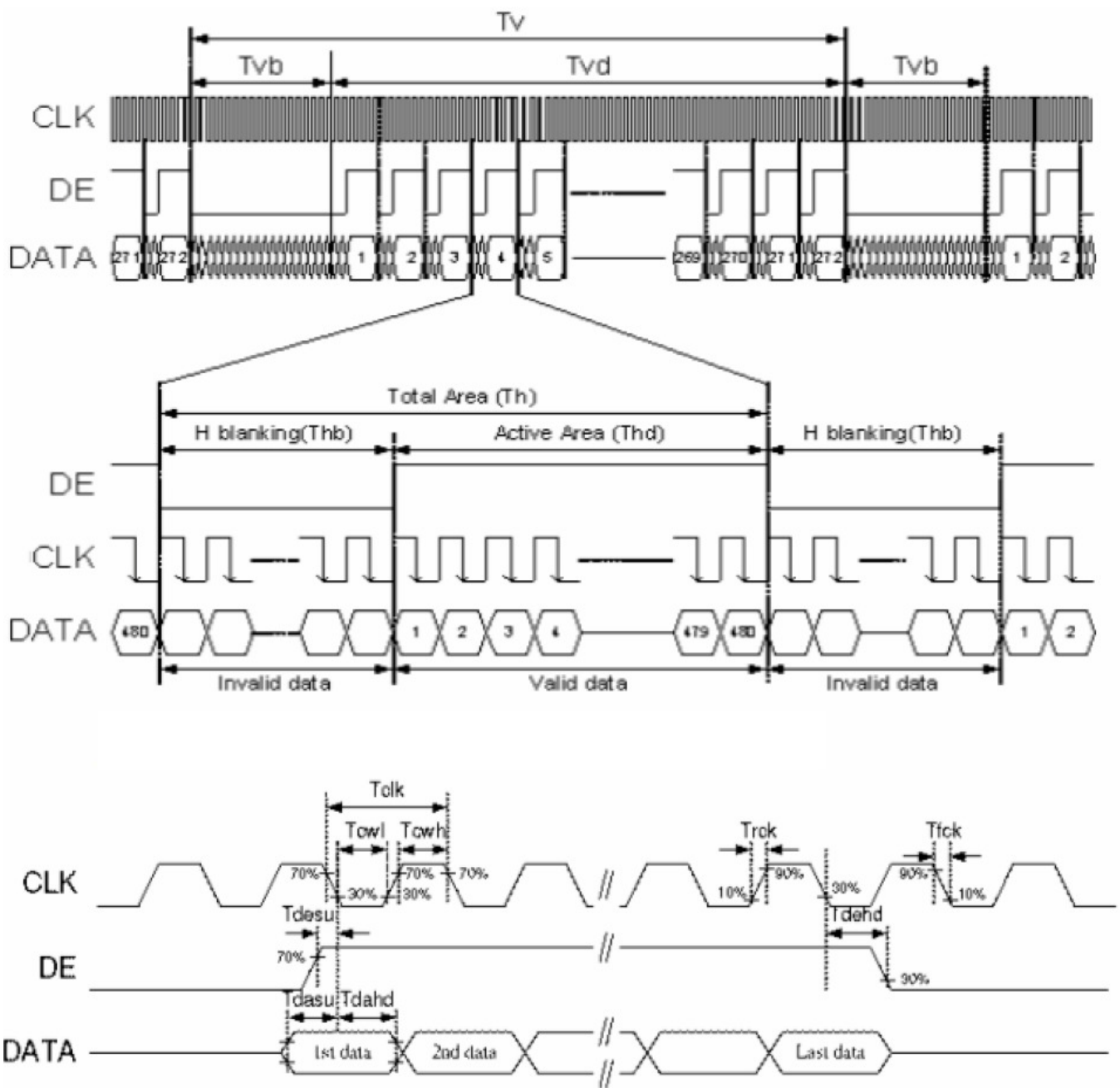
Symbol	Specification	Symbol	Specification
T1	$0 \leq T1 \leq 10 \text{ msec}$	T4	$160 \text{ msec} \leq T4$
T2	$0 \leq T2 \leq 100 \text{ msec}$	T5	$160 \text{ msec} \leq T5$
T3	$0 \leq T3 \leq 200 \text{ msec}$	T6	$1 \text{ msec} \leq T6$

## 2.5 AC Characteristics

Parallel DE mode RGB input timing table

Parameter	Symbol	Value			Unit
		Min.	Typ.	Max.	
CLK frequency	fclk	7	9	12	MHz
DEV period time	Tv	277	288	400	H
DEV display area	Tvd	272			H
DEV blanking	Tvb	5	16	128	H
DEH period time	Th	520	525	800	CLK
DEH display area	Thd	480			CLK
DEH blanking	Thb	40	45	320	CLK
CLK cycle time	Tclk	83	110	143	ns
Clock width of high level	Tcwh	40	50	60	%
Clock width of low level	Tcwl	40	50	60	%
Clock rising time	t <sub>rck</sub>		-	9	ns
Clock falling time	t <sub>fck</sub>		-	9	ns
Data Setup Time	t <sub>desu</sub>	10	-	-	ns
Data Hold Time	t <sub>dahd</sub>	10	-	-	ns
DE Setup Time	t <sub>desu</sub>	10	-	-	ns
DE Hold Time	t <sub>dehd</sub>	10	-	-	ns

## 2.6 Timing Diagram :



## 2.7 Capacitor Touch Panel Characteristics

### 2.7.1 Mechanical Specifications :

Items	Nominal Dimension	Unit
Touch Panel Size	4.3	inch
Module Size ( WxH )	105.3 ± 0.3 x 67.0 ± 0.3	mm
Active Area ( WxH )	95.0 ± 0.3 x 54.16 ± 0.3	mm
Thickness	1.58 ± 0.15 ( without protective film )	mm

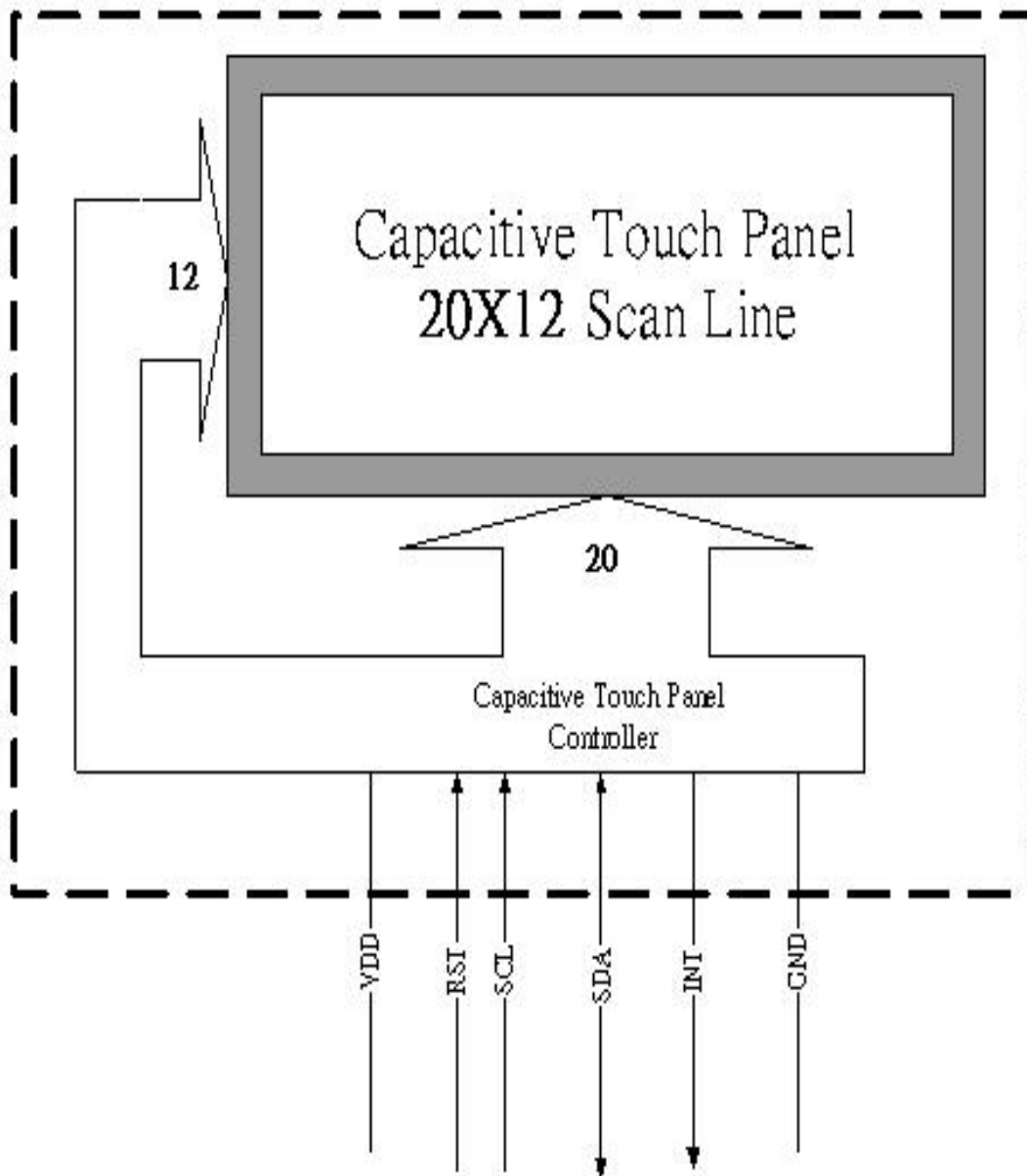
### 2.7.2 Touch Panel Specifications :

Display	Descriptions	Note
Type	Capacitive Touch Panel	
Structure	ITO Glass : T = 0.7mm	
	ITO Glass : T = 0.7mm	
Surface Hardness	≥ 3H	3H pencil , pressure 500g/45 degree (JIS-K5600)
Input mode	Finger	
Connector Type	FPC	
Resolution	480 x 272	1024 x 1024 ( Max )

### 2.7.3 Mechanical Characteristics :

Items	Descriptions	Note
FPC Strength ( Vertical )	Strength ≥ 600g/cm	-
FPC Bending	Min. 10 times for each side	Normal performance after Bending 90° test, no damage on FPC

### 2.7.4 Block diagram:



### 2.7.5 Interface Pin :

No	Name	I/O	Description
1	VDD	P	Power ; VDD =3.3V
2	GND	P	Ground
3	GND	P	Ground
4	RST	I	System reset signal input, active low . Note (1)
5	INT	O	Active low when data output from touch panel
6	SCL	I	Serial Clock .
7	GND	P	Ground
8	SDA	I/O	Serial data access .

Note (1) : Reset pin is low active and needs hold low for 1ms to take effect .

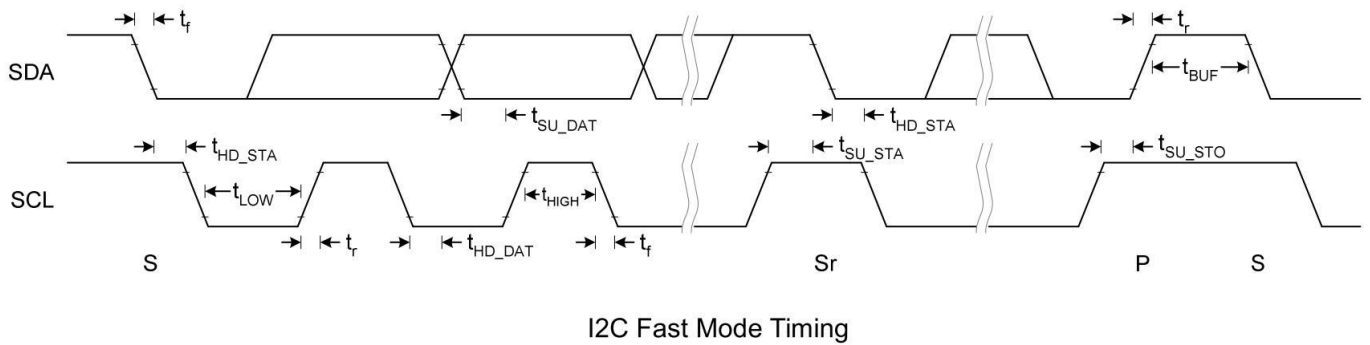
### 2.7.6 Absolute Maximum Ratings :

Items	Symbol	Min.	Max.	Unit
Supply voltage	VDD	-0.3	7	V
Operating temperature range	T <sub>OP</sub>	-20	70	°C
Storage temperature range	T <sub>ST</sub>	-30	+80	°C

### 2.7.7 DC Characteristics :

Items	Symbol	Min.	Typ.	Max.	Unit	Condition
Supply voltage (Logic)	VDD	--	3.3	--	V	
Power supply current(V <sub>DD</sub> )	I <sub>DD</sub>	--	4	8	mA	

## 2.7.8 AC Characteristics :



I2C Fast Mode Timing Characteristic

Conditions: VDD = IOVDD = 3.3V, GND = 0V, T<sub>A</sub> = 25°C

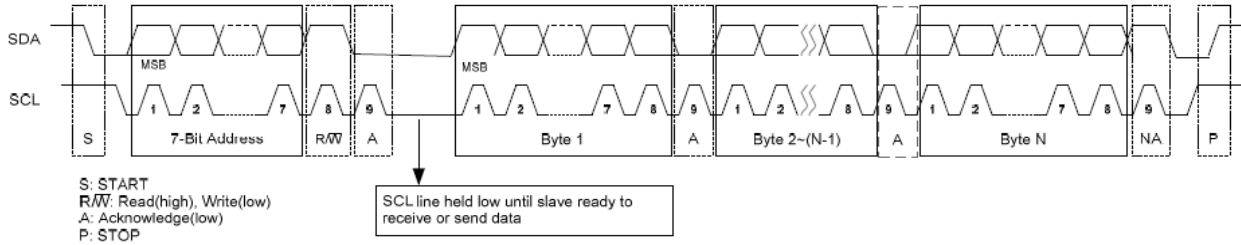
Symbol	Parameter	Rating			Unit
		Min.	Typ.	Max.	
$f_{SCL}$	SCL clock frequency	0	-	400	kHz
$t_{LOW}$	Low period of the SCL clock	1.3	-	-	us
$t_{HIGH}$	High period of the SCL clock	0.6	-	-	us
$t_f$	Signal falling time	-	-	300	ns
$t_r$	Signal rising time	-	-	300	ns
$t_{SU\_STA}$	Set up time for a repeated START condition	0.6	-	-	us
$t_{HD\_STA}$	Hold time (repeated) START condition. After this period, the first clock pulse is generated	0.6	-	-	us
$t_{SU\_DAT}$	Data set up time	100	-	-	ns
$t_{HD\_DAT}$	Data hold time	0	-	0.9	us
$t_{SU\_STO}$	Set up time for STOP condition	0.6	-	-	us
$t_{BUF}$	Bus free time between a STOP and START condition	1.3	-	-	us
$C_b$	Capacitive load for each bus line	-	-	400	pF



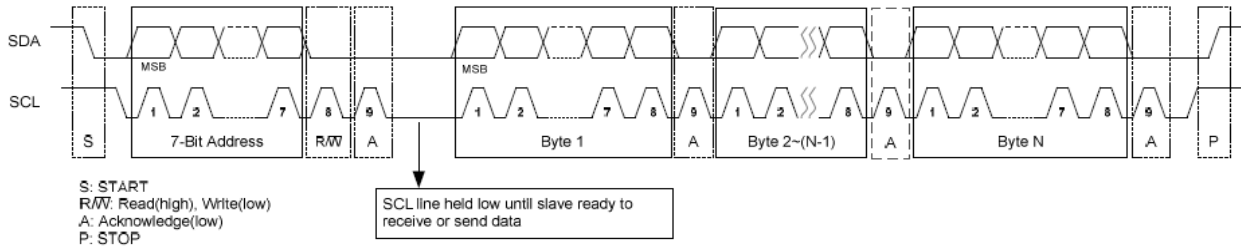
## 2.7.9 I2C Host Interface Protocol :

### I2C Slave Interface

Read



Write



### 2.7.10 Register Read :

For reading register value from I2C device, host has to tell I2C device the *Start Register Address* before reading corresponding register value.

I2C Start	I2C Header (W)	Start Reg. Addr. (a)	I2C Stop	I2C Start	I2C Header (R)	Value of Reg(a)	Value of Reg(a+1)	...	Value of Reg(a+n)	I2C Stop
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ST1232/ST1332 I2C host interface protocol supports *Repeated Register Read*. That is, once the *Start Register Address* has been set by host, consequent I2C Read(R) transactions will directly read register values starting from the *Start Register Address* without setting address first.

I2C Start	I2C Header (R)	Value of Reg(a)	Value of Reg(a+1)	...	Value of Reg(a+n)	I2C Stop	I2C Start	I2C Header (R)	Value of Reg(a)	Value of Reg(a+1)	...	Value of Reg(a+n)	I2C Stop
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### 2.7.11 Register Write :

For writing register to I2C device, host has to tell I2C device the *Start Register Address* in each I2C Register Write transaction. Register values to the I2C device will be written to the address starting from the *Start Register Address* described in Register Write I2C transaction.

I2C Start	I2C Header (W)	Start Reg. Addr. (a)	Value to Reg(a)	Value to Reg(a+1)	...	Value to Reg(a+n)	I2C Stop
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Header Value : 0xaa

## 2.7.12 Registers :

ST1232 provides a register set for host to configure device attributes and retrieve information about fingers , gestures , XY Coordinates through device host interface. Host interface registers are listed below.

Host Interface Registers ( Report Page )										
Reg Addr.	Name	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	
0x00	----	Reserved								
0x01	----									
0x02	Device Control Reg	Reserved				Reserved	Reserved	Power Down (R/W)	Reset (R/W)	
0x03	Timeout to Idle Register	Timeout to Idle ( Sec ) (R/W)								
0x04 ~ 0x0F	-----	Reserved								
0x10	Fingers/Gesrure	Gesture Code(RO)					Fingers(RO)			
0x11	-----	Reserved								
0x12	XY0 Coord ( High Byte )	Valid 0 ( RO )	X0_H(RO)			Reserved	Y0_H (RO)			
0x13	X0 Coord ( Low Byte )	X0_L(RO)								
0x14	Y0 Coord ( Low Byte )	Y0_L(RO)								
0x15	XY1 Coord ( High Byte )	Valid 1 ( RO )	X1_H(RO)			Reserved	Y1_H (RO)			
0x16	X1 Coord ( Low Byte )	X1_L(RO)								
0x17	Y1 Coord ( Low Byte )	Y1_L(RO)								

### 2.7.13 Device Control Register :

Reg Addr.	Name	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0x02	Device Control Reg	Reserved				Reserved	Reserved	Power Down (R/W)	Reset (R/W)

Device Control Register provides device control bits for host to reset the device , power down the device.

### 2.7.14 Timeout to Idle Register

Reg Addr.	Name	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0x03	Timeout to Idle Register	Timeout to Idle ( Sec ) (R/W)							

Timeout to Idle Register provides timeout control to entering Idle Mode for host.

The touch controller will enter Idle Mode after the number of seconds specified in Timeout to Idle Register if there is no touch detected in this period.

Set the field to 0xFF will disable Idle Mode. Set the field to 0 will entering Idle Mode immediately.

The default value of Timeout to Idle Register is set to 0x08 for 8 seconds to Idle Mode.

### 2.7.15 Fingers and Gesture Register

Reg Addr.	Name	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	
0x10	Fingers/Gesture	Gesture Code(RO)					Fingers(RO)			

Fingers field represents number of fingers detected by touch controller.

The coordinates of each finger detected are represents in X Coordinate and Y Coordinate fields.

Gesture Register tells host which gesture is detected by the controller .Gesture Code for each gesture are listed below.

Gesture Code	
0x00	No Detected
0x01	Single Touch Tap
0x02	Single Touch Double Tap
0x03	Single Touch Slide Up
0x04	Single Touch Slide Down
0x05	Single Touch Slide Left
0x06	Single Touch Slide Right
0x0B	Pitch In ( Zoom In )
0x0C	Pitch Out ( Zoom Out )

## 2.7.16 XY Coordinate Registers

Reg Addr.	Name	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0x12	XY0 Coord ( High Byte )	Valid 0 ( RO)	X0_H(RO)			Reserved	Y0_H (RO)		
0x13	X0 Coord ( Low Byte )	X0_L(RO)							
0x14	Y0 Coord ( Low Byte )	Y0_L(RO)							
0x15	XY1 Coord ( High Byte )	Valid 1 ( RO)	X1_H(RO)			Reserved	Y1_H (RO)		
0x16	X01 Coord ( Low Byte )	X1_L(RO)							
0x17	Y01 Coord ( Low Byte )	Y1_L(RO)							

XY Coordinate Registers represent the XY coordinates for each touch point ID.

Valid bit field tells that this point ID is valid and the XY information represents a real touch point on touch sensor.

### 3. OPTICAL CHARACTERISTICS

#### 3.1 Characteristics

Electrical and Optical Characteristics

No.	Item			symbol / temp.		Min.	Typ.	Max.	Unit	Note
1	Response Time			Tr	25 °C	-	10	20	ms	2
				Tf	25 °C	-	15	30	ms	2
2	Viewing Angle	Hor.	Cr>=10	$\Theta_{2+}$	0°	60	70	-	degree	3
				$\Theta_{2-}$	180°	60	70	-		
		Ver.		$\Theta_{1+}$	270°	60	70	-		
				$\Theta_{1-}$	90°	40	50	-		
3	Contrast Ratio			Cr	25 °C	400	500	-	-	4
4	White x-code			Wx		0.26	0.31	0.36	cd/m <sup>2</sup>	
	White y-code			Wy		0.28	0.33	0.38		
	Brightness			Y		340	430	-		
5	Brightness Uniformity				25 °C	70	75	-	%	6

#### 4. RELIABILITY :

Item No	Items	Condition	Note
1	High temperature operating	70 , 200 hours	1
2	Low temperature operating	-20 , 200 hours	1
3	High temperature storage	80 , 200 hours	1
4	Low temperature storage	-30 , 200 hours	1
5	High temperature & humidity storage	60 , 90%RH, 100 hours	2
6	Thermal Shock storage	-30 , 30min.<=> 80 , 30min. 10 Cycles	1
7	Vibration test	10 => 55 =>10 => 55 => 10 Hz , within 1 minute Amplitude : 1.5mm. 15 minutes for each Direction ( X,Y,Z )	
8	Drop test	Packed, 100CM free fall, 6 sides, 1 corner, 3edges	
9	Life time	50,000 hours 25 , 60%RH , specification condition driving	

Note 1 : The product move into the room temperature for at least 2 hours with no condensation.

Note 2 : The product move into the room temperature for at least 24 hours with no condensation.

\* One single product test for only one item.

\* Judgment after test : keep in room temperature for more than 2 hours.

- Current consumption < 2 times of initial value

- Contrast > 1/2 initial value

- Function : work normally