

2.7" TFT EPD Panel Product Specifications

Description	2.7" TFT EPD Panel
Model Name	EM027AS012
Doc. No.	1P033-00
Revision	01

General Description

0.1 Overview

This is a 2.7" a-Si, active matrix TFT, Electronic Paper Display (EPD) panel. The panel has such high resolution (117 dpi) that it is able to easily display fine patterns. Due to its bi-stable nature, the EPD panel requires very little power to update and needs no power to maintain an image.

0.2 Features

- a-Si TFT active matrix Electronic Paper Display(EPD)
- Resolution: 264 x 176
- Ultra low power consumption
- Super Wide Viewing Angle - near 180°
- Extra thin & light
- SPI interface
- RoHS compliant

0.3 1.3 Applications

- Electronic shelf label (ESL)
- Reusable container
- Badge

0.4 General Specifications

Item	Specification	Unit	Note
Outline Dimension	70.42(H) x 45.80(V) x 1.00(T)	mm	(1)
Active Area	57.288(H) x 38.192(V)	mm	
Driver Element	a-Si TFT active matrix	-	
FPL	V110	-	
Pixel Number	264 x 176	pixel	
Pixel Pitch	0.217 x 0.217 (117dpi)	mm	
Pixel Arrangement	Vertical stripe	-	
Display Colors	Black/White	-	
Surface Treatment	Anti-Glare	-	

Note (1): Not including the FPC.

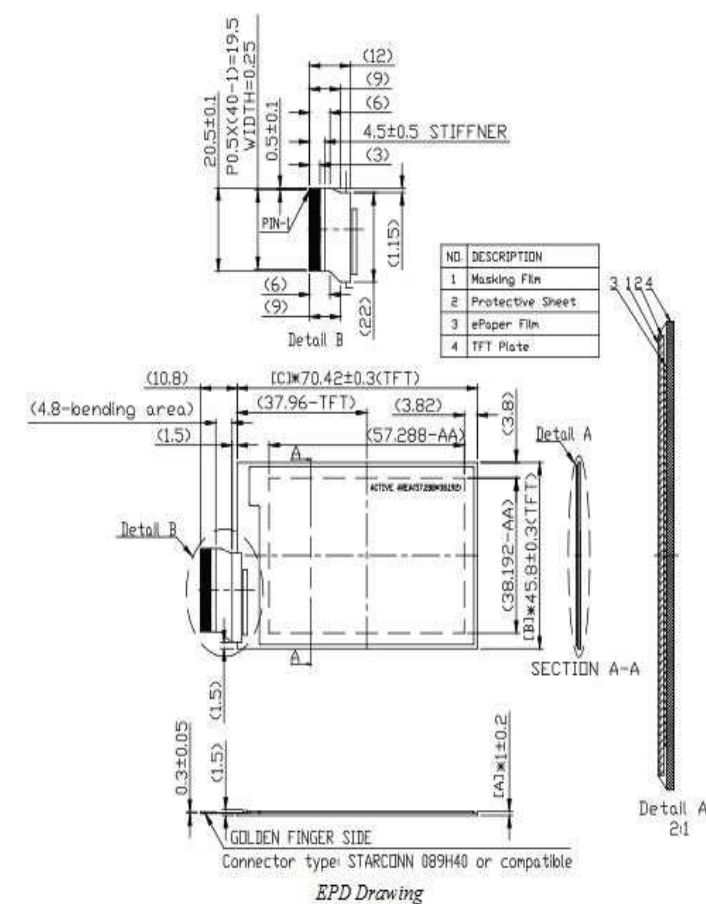
0.5 Mechanical Specifications

Item		Min.	Typ.	Max.	Unit	Note
Glass Size	Horizontal(H)	70.12	70.42	70.72	mm	
	Vertical(V)	45.50	45.80	46.10	mm	
	Thickness(T)	0.80	1.00	1.20	mm	(1)
Weight		-	6.30	7.7	g	

Note (1): Not including the Masking Film.

0.6 FPC Specification

Item	Pin numbers	Pitch (mm)	Connector	Note
Golden Finger	40	0.5	STARCONN 089H40 or Compatible	



Absolute Maximum Ratings

0.1 Absolute Ratings of Environment

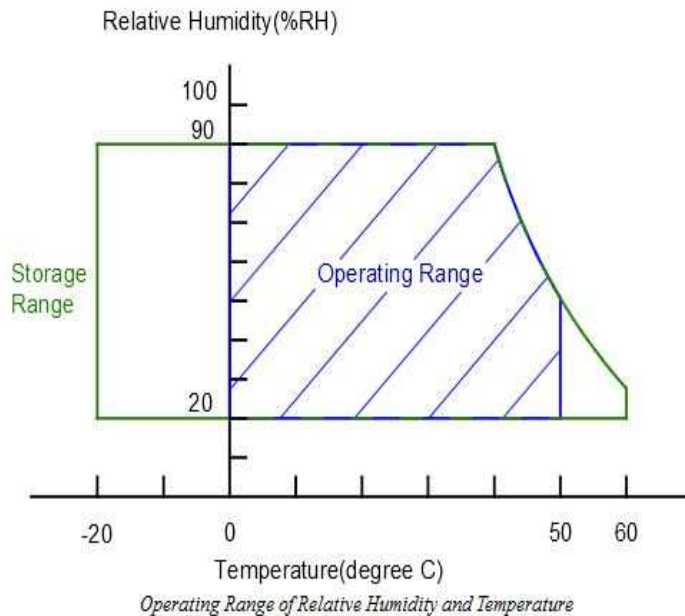
Item	Symbol	Value		Unit	Note
		Min.	Max.		
Storage Temperature	T _{ST}	-20	+60	°C	(1)
Operating Ambient Temperature	T _{OP}	0	+50	°C	(1), (2)

Note (1):

* 90 %RH Max. ($T_a \leq 40$ °C), where T_a is ambient temperature.

* Wet-bulb temperature should be 39 °C Max. ($T_a > 40$ °C). * No condensation.

Note (2): The temperature of panel display surface area should be 0 °C Min. and 50 °C Max. Refresh time depends on operation temperature.



0.2 Reliability Test Item

Item	Test Condition	Remark
High Temperature Operation	50 °C for 240h	(1) (2)
High Temperature Storage	60 °C for 240h	(1) (2)
Low Temperature Operation	0 °C for 240h	(1) (2)
Low Temperature Storage	-20 °C for 240h	(1) (2)
High Temperature/Humidity Operation	40 °C / 90 %RH for 168h	(1) (2)
High Temperature/Humidity Storage	50 °C / 80 %RH for 168h	(1) (2)
Thermal Cycles (Non-operation)	1 Cycle: -20°C/30min → 60°C/30min, for 100 Cycles	(1) (2)
Package Drop Test	Drop from 97cm. (ISTA) 1 corner, 3 edges, 6 sides. One drop for each.	(1) (2)
Package Random Vibration Test	1.15Grms, 1Hz ~ 200Hz. (ISTA)	(1) (2)

Note (1): End of test, function, mechanical, and optical shall be satisfied.

Note (2): The test result and judgment are based on PDI's 1bit driving waveform, driving fixture and driving system.

Electrical Characteristics

0.1 Absolute Maximum Ratings of Panel

Parameter	Symbol	Value		Unit	Note
		Min	Max		
Digital Power	V _{DD}	-0.3	5.0	V	
Analog Power	V _{CC}	-0.3	5.0	V	
Ground	V _{SS}	-	-		Connect V _{SS} to Ground

T_a = 25 ± 2 °C

0.2 Recommended Operation Conditions of Panel

Parameter	Symbol	Value			Unit	Note	
		Min	Typ	Max			
Digital Power	V _{DD}	2.7	3.0	3.3	V		
Analog Power	V _{CC}	2.7	3.0	3.3	V		
Input Voltage	High	V _{IH}	0.8V _{DD}	-	V _{DD}	V	/CS, ID, SCLK, SI, /RESET
	Low	V _{IL}	V _{SS}	-	0.2V _{DD}	V	
Output Voltage	High	V _{OH}	0.8V _{DD}	-	V _{DD}	V	I _{OH} =0.5mA, SO, BUSY
	Low	V _{OL}	V _{SS}	-	0.2V _{DD}	V	I _{OL} =-0.5mA, SO, BUSY
Input Leakage Current	High	I _{IH}	-	-	1.0	uA	
	Low	I _{IL}	-	-	-1.0	uA	
Input Current	I _{DD+ICC}	-	8	-	mA	(1),(2) not include inrush current	
DC/DC Inrush Current	I _{PEAK}	-	40	-	mA	(1),(2)	

T_a = 25 ± 2 °C

Note (1):

Test Pattern of Panel

These currents are tested with PDI test jig.

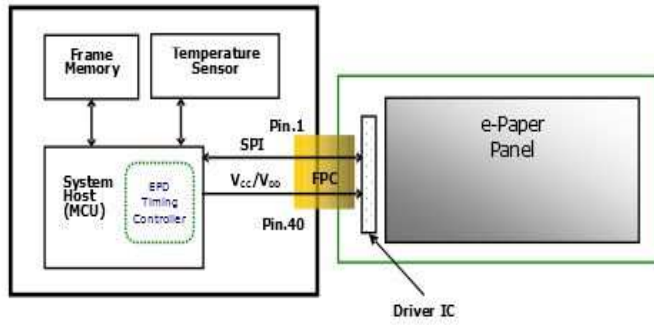
Note (2):

V_{DD}=V_{CC}=3.0V



The "Time of DC/DC ON" which contains the some current peak of V_{GH}/V_{DH} /V_{GL}/V_{DL}/V_{COM}.

Application Circuit Block Diagram



Application Circuit Block Diagram

Terminal Pin Assignment & Reference Circuit

0.1 Terminal Pin Assignment

No.	Signal	Type	Connected to	Function
1	/CS	I	MCU	Chip Select. Low enable
2	BUSY	O	MCU	When BUSY = High, EPD stays in busy state that EPD ignores any input data from SPI.
3	ID	I	Ground	Set SPI interface.
4	SCLK	I	MCU	Clock for SPI
5	SI	I	MCU	Serial input from host MCU to EPD
6	SO	O	MCU	Serial output from EPD to host MCU
7	/RESET	I	MCU	Reset signal. Low enable
8	ADC_IN	-	-	Not connected
9	V _{CL}	C	Capacitor	-
10	C42P	C	Charge-Pump Capacitor	-
11	C42M	C		-
12	C41P	C	Charge-Pump Capacitor	-
13	C41M	C		-
14	C31M	C	Charge-Pump Capacitor	-
15	C31P	C		-
16	C21M	C	Charge-Pump Capacitor	-
17	C21P	C		-
18	C16M	C	Charge-Pump Capacitor	-

Note:

Type: I: Input

O: Output C: Capacitor RC: Resistor and Capacitor P: Power

0.2 Reference Circuit

EPD Reference Circuit

Note: (1) V_{DD} and V_{CC} must be discharged promptly after power off.

Optical Characteristics

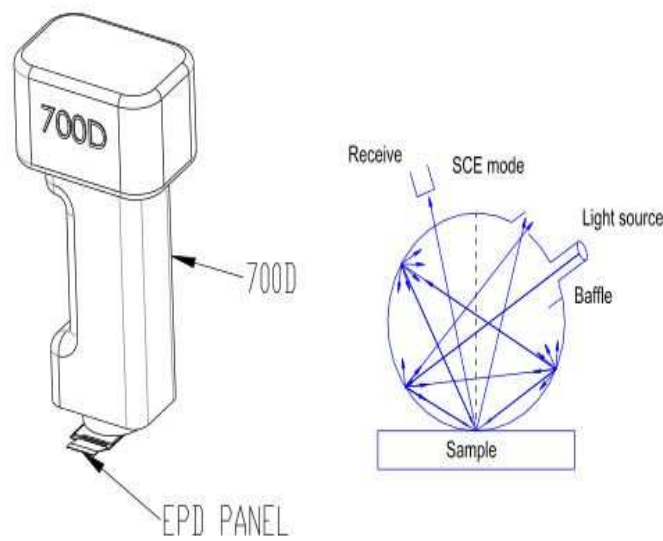
0.1 Optical Test Conditions

Item	Symbol	Value	Unit
Ambient Temperature	Ta	25±2	°C
Ambient Humidity	Ha	50±10	%RH
Supply Voltage	VCC& VDD	3.0	V

0.2 Optical Specifications

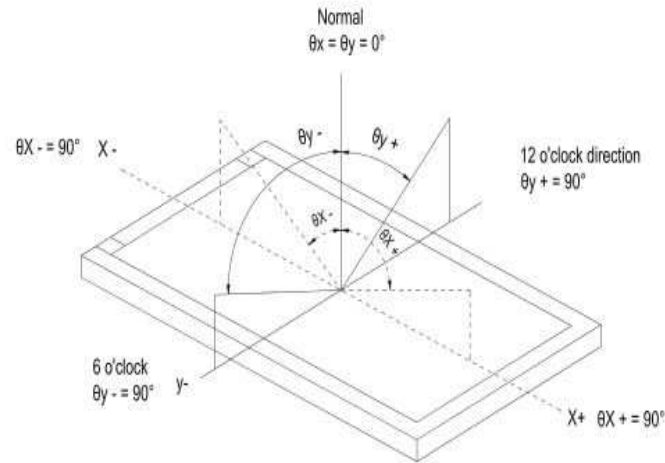
0.3 Optical Measurement with D65 light source

Item	Symbol	Rating			Unit	Note
		Min.	Typ.	Max.		
Contrast ratio	CR	5:1	7:1	-	-	$\theta_x = \theta_y = 0$ (1),(2),(3),(4)
Refresh time	Tr	-	3	-	sec	(3)
White Chromaticity	Wx	-	0.313	-	-	$\theta_x = \theta_y = 0$ (1),(4)
	Wy	-	0.338	-	-	
Reflectance	R%	25	32	-	%	(1),(4)



Optical measurement

Note (2): Definition of Viewing Angle (θ_x, θ_y):



Definition of Viewing Angle to Measure Contrast Ratio

Note (3): Refresh time is the time that e-paper particles move not including the power on and off time. The refresh time is measured at 25°C. The refresh time and contrast ratio varies due to different films, display performance requirements, and ambient temperatures.

Note (4): Contrast ratio (C.R.): The Contrast ratio is calculated by the following expression. C.R. = (R% White) / (R% Black). Reflectance is measured at 120 seconds after refresh.

Note (1): Panel is driven by PDI waveform without masking film and optical measurement by CM-700D with D65 light source and SCE mode.

Definition of Labels

Model Label 1 for preceding process



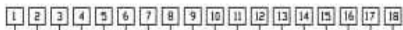
Model Labels

ID NO. definition of Model Label 1



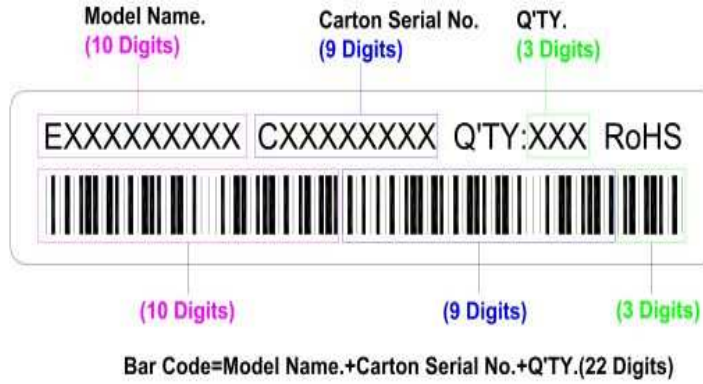
- (8~20)TFT LOT NO.
- (5~7)FPL LOT NO.
- (2~4)Manufacture Year/Month/Day
- (1)Preceding process vender code

ID NO. definition of Model Label 2



- (15~18)Serial NO.
- (12~14)Manufacture Year/Month/Day
- (2~11)Model Name
- (1)Posterior process vender code

Definition of Model Labels



Carton Label

Carton Label



Pallet Label

Pallet Label