

Specification

Part Number:	MCT024N0W240320PMLIPS
Version:	1
Date:	20/07/2014

Revision

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design • manufacture • supply

Display Size	2.4"
Resolution	240 x 320
VGA Size	QVGA
Orientation	Portrait
Appearance	RGB
Logic Voltage	3.3V
Interface	Parallel
Brightness	450 cd/m ²
Touchscreen	N/A
Module Size W x H x D	42.72 x 60.26 x 2.1 mm
Operating Temperature	-20°C ~ +70°C
Pin Out	45 – Way



Midas Active Matrix Display Part Number System

MC	T	057	A	6	*	W	320240	L	M	L	*	*
1	2	3	4	5	6	7	8	9	10	11	12	13

- | | | |
|----|---|---|
| 1 | = | MC: Midas Components |
| 2 | = | T: TFT A: Active Matrix OLED |
| 3 | = | Size |
| 4 | = | Series |
| 5 | = | Viewing Angle: 6: 6 O'clock 12: 12 O'clock |
| 6 | = | Blank: No Touch T: Resistive Touchscreen C: Capacitive Touchscreen |
| 7 | = | Operating Temp Range: S: 0+50Deg C B: -20+60Deg C
W: -20+70Deg C E: -30+85Deg C
X: -30+80Deg C |
| 8 | = | No of Pixels |
| 9 | = | Orientation: P: Portrait L: Landscape |
| 10 | = | Mode: R: Reflective M: Transmissive T: Transflective
S: Sunlight Readable (transmissive)
W: White on Black (Monochrome) |
| 11 | = | Backlight: Blank: None L: LED C: CCFL |
| 12 | = | Blank: No Module/board C: Controller board module |
| 13 | = | Blank: None OB: Optically Bonded |

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General Description

* Description

This is a color active matrix TFT (Thin Film Transistor) LCD (liquid crystal display) that uses amorphous silicon TFT as a switching device. This model is composed of a Transmissive type TFT-LCD Panel, driver circuit, back-light unit. The resolution of a 2.4”TFT-LCD contains 240x320 pixels, and can display up to 65K/262K colors.

* Features

- Input Voltage: 3.3V(TYP).
- Display Colors of TFT LCD: 65K/262Kcolors
- Interface: 8/9/16/18-bits MCU interface,1618-bits RGB interface ,3-line/4-line serial interface.

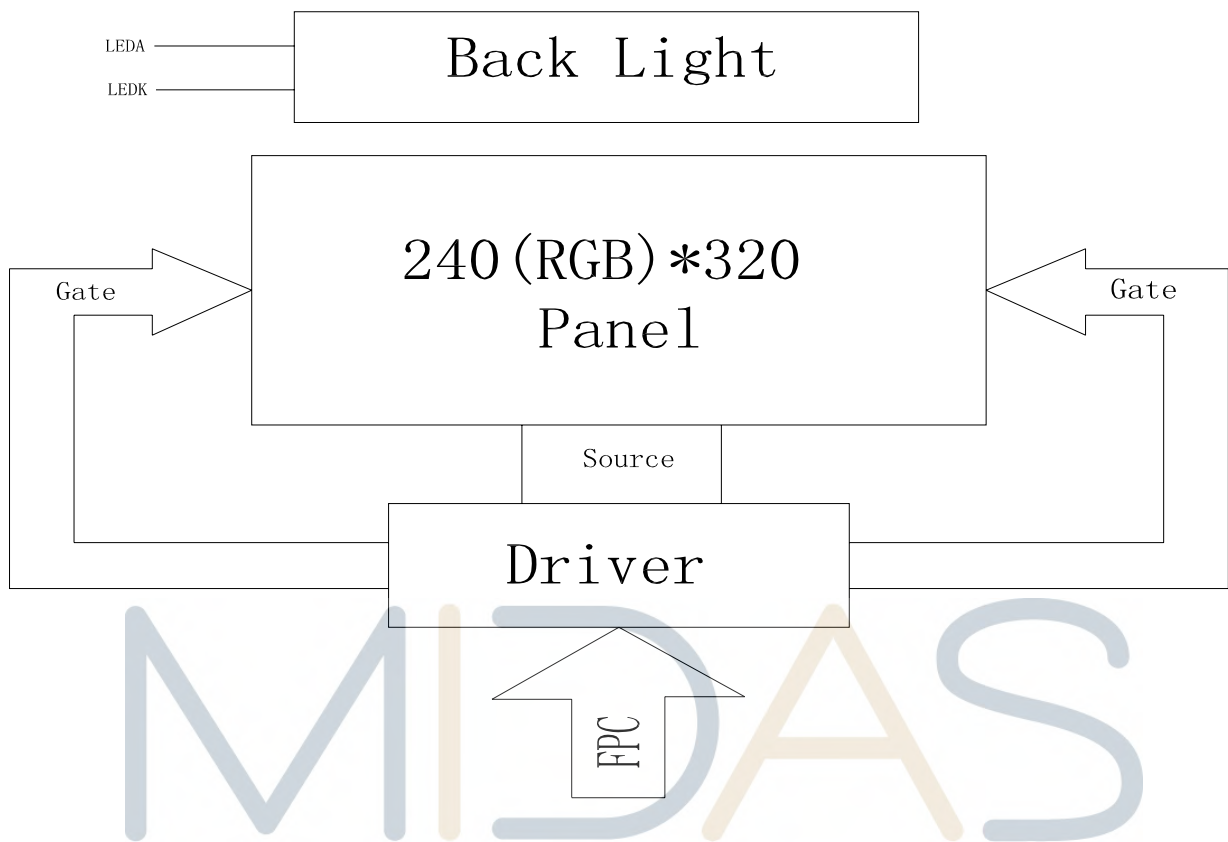
General Information Items	Specification	Unit	Note
	Main Panel		
Display area(AA)	36. 72(H) *48.96(V) (2. 4inch)	mm	-
Driver element	TFT active matrix	-	-
Display colors	65K/262K	colors	-
Number of pixels	240(RGB)*320	dots	-
Pixel arrangement	RGB vertical stripe	-	-
Pixel pitch	0.051 (H) x 0.051 (V)	mm	-
Viewing angle	ALL	o'clock	-
Controller IC	ST7789V	-	-
Display mode	Transmissive/ Normally Black	-	-
Operating temperature	-20~+70	℃	-
Storage temperature	-30~+80	℃	-

* Mechanical Information

Item		Min.	Typ.	Max.	Unit	Note
Module size	Horizontal(H)		42.72		mm	-
	Vertical(V)		60.26		mm	-
	Depth(D)		2.1		mm	-
Weight			TBD		g	-



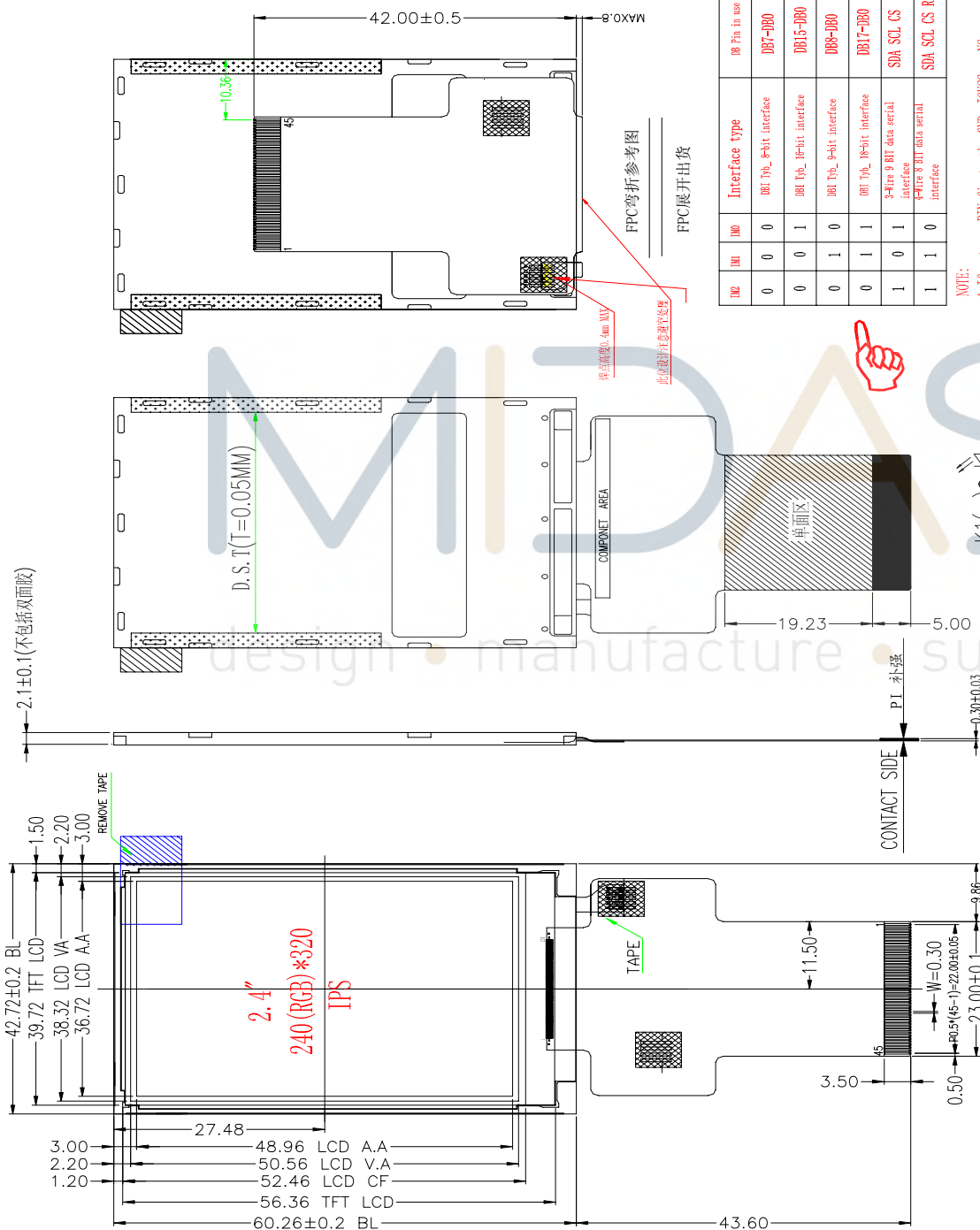
1. Block Diagram



design • manufacture • supply



2. Outline dimension



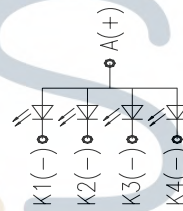
NOTES:

1. DISPLAY TYPE: 2.4", TFT-LCD, 65K/262K COLORS
2. DISPLAY MODE: IPS NORMALLY BLACK
3. VIEWING DIRECTION: ALL
4. DRIVER IC: ST7789V (COG)
5. VCI: 3.3V
6. OPERATING TEMP: -20°C TO 70°C
STORAGE TEMP: -50°C TO 80°C
7. BACK LIGHT: LED WHITE, 4 LED, 80mA, 3.2±0.3V
8. RoHS COMPLIANT.

D0	D1	D2	D3	D4	D5	D6	D7	D8	D9	D10	D11	D12	D13	D14	D15	D16	D17	D18	D19	D20	D21	D22	D23	D24	D25	D26	D27	D28	D29	D30	D31	D32	D33	D34	D35	D36	D37	D38	D39	D40	D41	D42	D43	D44	D45	D46	D47	D48	D49	D50	D51	D52	D53	D54	D55	D56	D57	D58	D59	D60	D61	D62	D63	D64	D65	D66	D67	D68	D69	D70	D71	D72	D73	D74	D75	D76	D77	D78	D79	D80	D81	D82	D83	D84	D85	D86	D87	D88	D89	D90	D91	D92	D93	D94	D95	D96	D97	D98	D99	D100	D101	D102	D103	D104	D105	D106	D107	D108	D109	D110	D111	D112	D113	D114	D115	D116	D117	D118	D119	D120	D121	D122	D123	D124	D125	D126	D127	D128	D129	D130	D131	D132	D133	D134	D135	D136	D137	D138	D139	D140	D141	D142	D143	D144	D145	D146	D147	D148	D149	D150	D151	D152	D153	D154	D155	D156	D157	D158	D159	D160	D161	D162	D163	D164	D165	D166	D167	D168	D169	D170	D171	D172	D173	D174	D175	D176	D177	D178	D179	D180	D181	D182	D183	D184	D185	D186	D187	D188	D189	D190	D191	D192	D193	D194	D195	D196	D197	D198	D199	D200	D201	D202	D203	D204	D205	D206	D207	D208	D209	D210	D211	D212	D213	D214	D215	D216	D217	D218	D219	D220	D221	D222	D223	D224	D225	D226	D227	D228	D229	D230	D231	D232	D233	D234	D235	D236	D237	D238	D239	D240	D241	D242	D243	D244	D245	D246	D247	D248	D249	D250	D251	D252	D253	D254	D255	D256	D257	D258	D259	D260	D261	D262	D263	D264	D265	D266	D267	D268	D269	D270	D271	D272	D273	D274	D275	D276	D277	D278	D279	D280	D281	D282	D283	D284	D285	D286	D287	D288	D289	D290	D291	D292	D293	D294	D295	D296	D297	D298	D299	D300	D301	D302	D303	D304	D305	D306	D307	D308	D309	D310	D311	D312	D313	D314	D315	D316	D317	D318	D319	D320	D321	D322	D323	D324	D325	D326	D327	D328	D329	D330	D331	D332	D333	D334	D335	D336	D337	D338	D339	D340	D341	D342	D343	D344	D345	D346	D347	D348	D349	D350	D351	D352	D353	D354	D355	D356	D357	D358	D359	D360	D361	D362	D363	D364	D365	D366	D367	D368	D369	D370	D371	D372	D373	D374	D375	D376	D377	D378	D379	D380	D381	D382	D383	D384	D385	D386	D387	D388	D389	D390	D391	D392	D393	D394	D395	D396	D397	D398	D399	D400	D401	D402	D403	D404	D405	D406	D407	D408	D409	D410	D411	D412	D413	D414	D415	D416	D417	D418	D419	D420	D421	D422	D423	D424	D425	D426	D427	D428	D429	D430	D431	D432	D433	D434	D435	D436	D437	D438	D439	D440	D441	D442	D443	D444	D445	D446	D447	D448	D449	D450	D451	D452	D453	D454	D455	D456	D457	D458	D459	D460	D461	D462	D463	D464	D465	D466	D467	D468	D469	D470	D471	D472	D473	D474	D475	D476	D477	D478	D479	D480	D481	D482	D483	D484	D485	D486	D487	D488	D489	D490	D491	D492	D493	D494	D495	D496	D497	D498	D499	D500	D501	D502	D503	D504	D505	D506	D507	D508	D509	D510	D511	D512	D513	D514	D515	D516	D517	D518	D519	D520	D521	D522	D523	D524	D525	D526	D527	D528	D529	D530	D531	D532	D533	D534	D535	D536	D537	D538	D539	D540	D541	D542	D543	D544	D545	D546	D547	D548	D549	D550	D551	D552	D553	D554	D555	D556	D557	D558	D559	D560	D561	D562	D563	D564	D565	D566	D567	D568	D569	D570	D571	D572	D573	D574	D575	D576	D577	D578	D579	D580	D581	D582	D583	D584	D585	D586	D587	D588	D589	D590	D591	D592	D593	D594	D595	D596	D597	D598	D599	D600	D601	D602	D603	D604	D605	D606	D607	D608	D609	D610	D611	D612	D613	D614	D615	D616	D617	D618	D619	D620	D621	D622	D623	D624	D625	D626	D627	D628	D629	D630	D631	D632	D633	D634	D635	D636	D637	D638	D639	D640	D641	D642	D643	D644	D645	D646	D647	D648	D649	D650	D651	D652	D653	D654	D655	D656	D657	D658	D659	D660	D661	D662	D663	D664	D665	D666	D667	D668	D669	D670	D671	D672	D673	D674	D675	D676	D677	D678	D679	D680	D681	D682	D683	D684	D685	D686	D687	D688	D689	D690	D691	D692	D693	D694	D695	D696	D697	D698	D699	D700	D701	D702	D703	D704	D705	D706	D707	D708	D709	D710	D711	D712	D713	D714	D715	D716	D717	D718	D719	D720	D721	D722	D723	D724	D725	D726	D727	D728	D729	D730	D731	D732	D733	D734	D735	D736	D737	D738	D739	D740	D741	D742	D743	D744	D745	D746	D747	D748	D749	D750	D751	D752	D753	D754	D755	D756	D757	D758	D759	D760	D761	D762	D763	D764	D765	D766	D767	D768	D769	D770	D771	D772	D773	D774	D775	D776	D777	D778	D779	D780	D781	D782	D783	D784	D785	D786	D787	D788	D789	D790	D791	D792	D793	D794	D795	D796	D797	D798	D799	D800	D801	D802	D803	D804	D805	D806	D807	D808	D809	D810	D811	D812	D813	D814	D815	D816	D817	D818	D819	D820	D821	D822	D823	D824	D825	D826	D827	D828	D829	D830	D831	D832	D833	D834	D835	D836	D837	D838	D839	D840	D841	D842	D843	D844	D845	D846	D847	D848	D849	D850	D851	D852	D853	D854	D855	D856	D857	D858	D859	D860	D861	D862	D863	D864	D865	D866	D867	D868	D869	D870	D871	D872	D873	D874	D875	D876	D877	D878	D879	D880	D881	D882	D883	D884	D885	D886	D887	D888	D889	D890	D891	D892	D893	D894	D895	D896	D897	D898	D899	D900	D901	D902	D903	D904	D905	D906	D907	D908	D909	D910	D911	D912	D913	D914	D915	D916	D917	D918	D919	D920	D921	D922	D923	D924	D925	D926	D927	D928	D929	D930	D931	D932	D933	D934	D935	D936	D937	D938	D939	D940	D941	D942	D943	D944	D945	D946	D947	D948	D949	D950	D951	D952	D953	D954	D955	D956	D957	D958	D959	D960	D961	D962	D963	D964	D965	D966	D967	D968	D969	D970	D971	D972	D973	D974	D975	D976	D977	D978	D979	D980	D981	D982	D983	D984	D985	D986	D987	D988	D989	D990	D991	D992	D993	D994	D995	D996	D997	D998	D999	D1000	D1001	D1002	D1003	D1004	D1005	D1006	D1007	D1008	D1009	D1010	D1011	D1012	D1013	D1014	D1015	D1016	D1017	D1018	D1019	D1020	D1021	D1022	D1023	D1024	D1025	D1026	D1027	D1028	D1029	D1030	D1031	D1032	D1033	D1034	D1035	D1036	D1037	D1038	D1039	D1040	D1041	D1042	D1043	D1044	D1045	D1046	D1047	D1048	D1049	D1050	D1051	D1052	D1053	D1054	D1055	D1056	D1057	D1058	D1059	D1060	D1061	D1062	D1063	D1064	D1065	D1066	D1067	D1068	D1069	D1070	D1071	D1072	D1073	D1074	D1075	D1076	D1077	D1078	D1079	D1080	D1081	D1082	D1083	D1084	D1085	D1086	D1087	D1088	D1089	D1090	D1091	D1092	D1093	D1094	D1095	D1096	D1097	D1098	D1099	D1100	D1101	D1102	D1103	D1104	D1105	D1106	D1107	D1108	D1109	D1110	D1111	D1112	D1113	D1114	D1115	D1116	D1117	D1118	D1119	D1120	D1121	D1122	D1123	D1124	D1125	D1126	D1127	D1128	D1129	D1130	D1131	D1132	D1133	D1134	D1135	D1136	D1137	D1138	D1139	D1140	D1141	D1142	D1143	D1144	D1145	D1146	D1147	D1148	D1149	D1150	D1151	D1152	D1153	D1154	D1155	D1156	D1157	D1158	D1159	D1160	D1161	D1162	D1163	D1164	D1165	D1166	D1167	D1168	D1169	D1170	D1171	D1172	D1173	D1174	D1175	D1176	D1177	D1178	D1179	D1180	D1181	D1182	D1183	D1184	D1185	D1186	D1187	D1188	D1189	D1190	D1191	D1192	D1193	D1194	D1195	D1196	D1197	D1198	D1199	D1200	D1201	D1202	D1203	D1204	D1205	D1206	D1207	D1208	D1209	D1210	D1211	D1212	D1213	D1214	D1215	D1216	D1217	D1218	D1219	D1220	D1221	D1222	D1223	D1224	D1225	D1226	D1227	D1228	D1229	D1230	D1231	D1232	D1233	D1234	D1235	D1236	D1237	D1238	D1239	D1240	D1241	D1242	D1243	D1244	D1245	D1246	D1247	D1248	D1249	D1250	D1251	D1252	D1253	D1254	D1255	D1256	D1257	D1258	D1259	D1260	D1261	D1262	D1263	D1264	D1265	D1266	D1267	D1268	D1269	D1270	D1271	D1272	D1273	D1274	D1275	D1276	D1277	D1278	D1279	D1280	D1281	D1282	D1283	D1284	D1285	D1286	D1287	D1288	D1289	D1290	D1291	D1292	D1293	D1294	D1295	D1296	D1297	D1298	D1299	D1300	D1301	D1302	D1303	D1304	D1305	D1306	D1307	D1308	D1309	D1310	D1311	D1312	D1313	D1314	D1315	D1316	D1317	D1318	D1319	D1320	D1321	D1322	D1323	D1324	D1325	D1326	D1327	D1328	D1329	D1330	D1331	D1332	D1333	D1334	D1335	D1336	D1337	D1338	D1339	D1340	D1341	D1342	D1343	D1344	D1345	D1346	D1347	D1348	D1349	D1350	D1351	D1352	D1353	D1354	D1355	D1356	D1357	D1358	D1359	D1360	D1361	D1362	D1363	D1364	D1365	D1366	D1367	D1368	D1369	D1370	D1371	D1372	D1373	D1374	D1375	D1376	D1377	D1378	D1379	D1380	D1381	D1382	D1383	D1384	D1385	D1386	D1387	D1388	D1389	D1390	D1391	D1392	D1393	D1394	D1395	D1396	D1397	D1398	D1399	D1400	D1401	D1402	D1403	D1404	D1405	D1406	D1407	D1408	D1409	D1410	D1411	D1412	D1413	D1414	D1415	D1416	D1417	D1418	D1419	D1420	D1421	D1422	D1423	D1424	D1425	D1426	D1427	D1428	D1429	D1430	D1431	D1432	D1433	D1434	D1435	D1436	D1437	D1438	D1439	D1440	D1441	D1442	D1443	D1444	D1445	D1446	D1447	D1448	D1449	D1450	D1451	D1452	D1453	D1454	D1455	D1456	D1457	D1458	D1459	D1460	D1461	D1462	D1463	D1464	D1465	D1466	D1467	D1468	D1469	D1470	D1471	D1472	D1473	D1474	D1475	D1476	D1477	D1478	D1479	D1480	D1481	D1482	D1483	D1484	D1485	D1486	D1487	D1488	D1489	D1490	D1491	D1492	D1493	D1494	D1495	D1496	D1497	D1498
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NOTE:

1. If not use PIN, fix to the GND , IOVCC or NC.
2. If use RGB mode must select serial interface



BLU CIRCUIT DIAGRAM

Rev	Revision content description	Date
A	FIRST	2013/03/29

TOLERANCE (公差)	DRAWING	NAME	Midas Displays	
	TOLERANCE UNLESS OTHERWISE SPECIFIED	Drawn		Unit
		Checked		mm
Scale 1:1		Approve		Page 1/1

MCT024N0W240320PMLIPS

3. Input terminal Pin Assignment

NO.	SYMBOL	DISCRIPTION	I/O
1	GND	Ground.	P
2	VCI	Supply voltage(3.3V).	P
3	VCI	Supply voltage(3.3V).	P
4	IM2	MPU Parallel interface bus and serial interface select If use RGB Interface must select serial interface. Fix this pin at VCI and GND.	I
5	IM1		I
6	IM0		I
7	RESET	This signal will reset the device and must be applied to properly initialize the chip.	I
8	CS	Chip select input pin ("Low" enable). fix this pin at VCI or GND when not in use.	I
9	DC(SPI_SCL)	This pin is used to select "Data or Command" in the parallel interface. When D/CX = '1', data is selected. When D/CX = '0', command is selected. This pin is used serial interface clock in 3-wire 9-bit / 4-wire 8-bit serial data interface. fix this pin at VCI or GND when not in use.	I
10	WR(SPI_RS,SDA 2)	The data is applied on the rising edge of the SCL signal. If not used, Second Data lane in 2 data lane serial interface. fix this pin at VCI or GND when not in use.	I
11	RD	Serves as a read signal and MCU read data at the rising edge. fix this pin at VCI or GND when not in use.	I
12	VSYNC	Frame synchronizing signal for RGB interface operation. fix this pin at VCI or GND when not in use.	I
13	HSYNC	Line synchronizing signal for RGB interface operation. fix this pin at VCI or GND when not in use.	I
14	ENABLE	Data enable signal for RGB interface operation. fix this pin at VCI or GND when not in use.	I
15	DOTCLK	Dot clock signal for RGB interface operation.	I



		Fix this pin at VCI or GND when not in use.	
16	SDA1	Data lane in 1 data lane serial interface. The data is latched on the rising edge of the SCL signal.	I
17-34	DB0-DB17	18-bit parallel bi-directional data bus for MCU system and RGB interface mode . Fix to GND level when not in use	I/O
35	SDO	SPI interface output pin. -The data is output on the falling edge of the SCL signal. -If not used, let this pin open.	O
36	LEDA	Anode pin of backlight	P
37	LEDK1	Cathode pin OF backlight	P
38	LEDK2	Cathode pin OF backlight	P
39	LEDK3	Cathode pin OF backlight	P
40	LEDK4	Cathode pin OF backlight	P
41	XR(NC)	Touch panel Right Glass Terminal	A/D
42	YD(NC)	Touch panel Bottom Film Terminal	A/D
43	XL(NC)	Touch panel LIFT Glass Terminal	A/D
44	YU(NC)	Touch panel Top Film Terminal	A/D
45	GND	Ground.	P

4. LCD Optical Characteristics

4.1 Optical specification

Item		Symbol	Condition	Min.	Typ.	Max.	Unit	Note
Transmittance (with Polarizer)		T (%)	Θ=0 Normal viewing angle	—	4.65	—	%	Measuring with Polarizer , Reference Only
Transmittance (without Polarizer)		T (%)		—	14.6	—	%	
Contrast		CR		640	800	—	—	(1)(2)
Response time	Rising	T _R		—	16	21	msec	(1)(3)
	Falling	T _F		—	19	24		
Color gamut	(%)			—	70	—	%	C-light
Color chromaticity (CIE1931)	White	W _x		0.290	0.310	0.330	—	(1)(4) CF glass
		W _y		0.316	0.336	0.356		
	Red	R _x		0.627	0.647	0.667	—	
		R _y		0.297	0.317	0.337	—	
	Green	G _x	0.255	0.275	0.295	—		
		G _y	0.562	0.582	0.602			
	Blue	B _x	0.120	0.140	0.160			
		B _y	0.068	0.088	0.108			
Viewing angle	Hor.	Θ _L	CR>10	—	80	—	—	(1)(4) Measuring with Polarizer , Reference Only
		Θ _R		—	80	—		
	Ver.	Θ _U		—	80	—		
		Θ _D		—	80	—		
Optima View Direction		Free						(5)



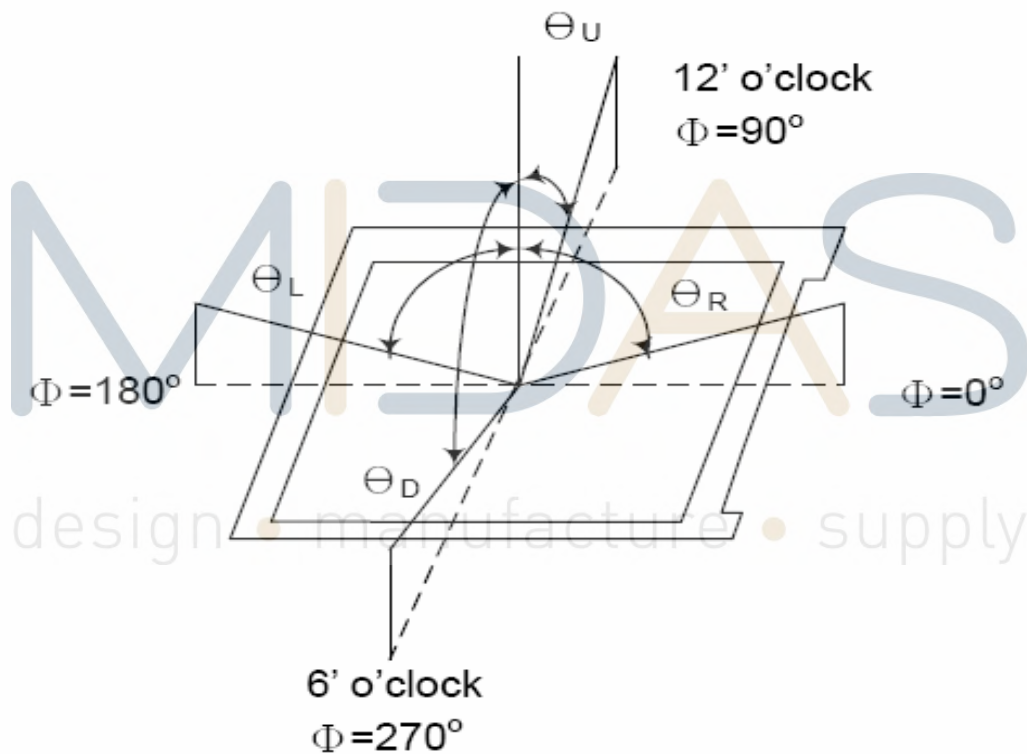
4.2 Measuring Condition

- Measuring surrounding : dark room
- Ambient temperature : $25 \pm 2^\circ\text{C}$
- 15min. warm-up time

4.3 Measuring Equipment

Midas utilized SR-3 for Chromaticity and BM-5A for other optical characteristics.

Note (1) Definition of Viewing Angle :



Note (2) Definition of Contrast Ratio(CR) :

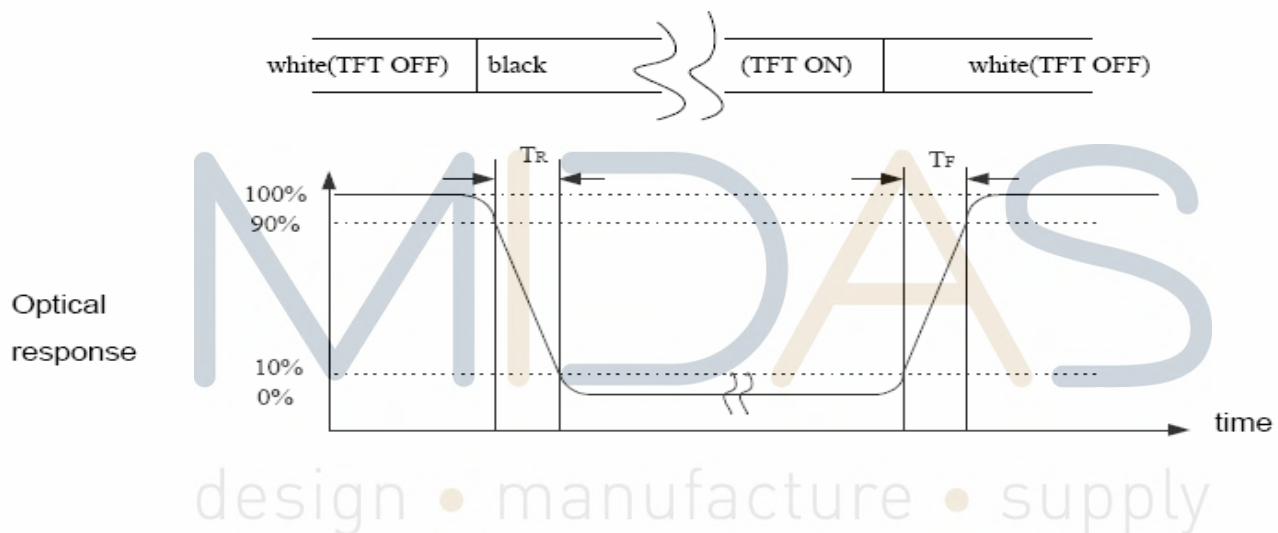
measured at the center point of panel

$$\text{CR} = \frac{\text{Luminance with all pixels white}}{\text{Luminance with all pixels black}}$$

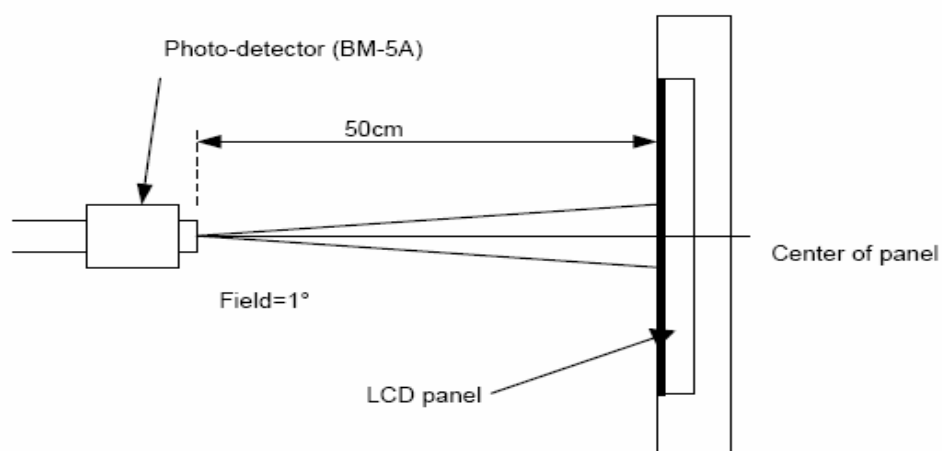
Note (2) Definition of Contrast Ratio(CR) :
measured at the center point of panel

$$CR = \frac{\text{Luminance with all pixels white}}{\text{Luminance with all pixels black}}$$

Note (3) Definition of Response Time : Sum of T_R and T_F



Note (4) Definition of optical measurement setup



5. Electrical Characteristics

5.1 Absolute Maximum Rating (Ta=25 VSS=0V)

Characteristics	Symbol	Min.	Max.	Unit
Digital Supply Voltage	VDD	-0.3	4.6	V
Digital interface supplle Voltage	VDDIO	-0.3	4.6	V
Operating temperature	T _{OP}	-20	+70	°C
Storage temperature	T _{ST}	-30	+80	°C

5.2 DC Electrical Characteristics

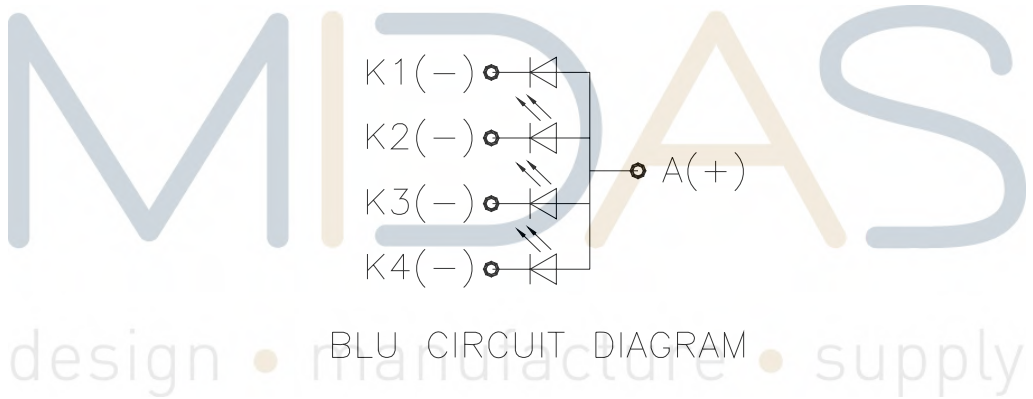
Characteristics	Symbol	Min.	Typ.	Max.	Unit	Note
Digital Supply Voltage	VDD	2.6	3.3	4.2	V	
Digital interface supplle Voltage	VDDIO	1.65	1.8	4.2	V	
Normal mode Current consumption	IDD	--	8	--	mA	
Level input voltage	V _{IH}	0.7V _{DDIO}		VDDIO	V	
	V _{IL}	GND		0.3V _{DDIO}	V	
Level output voltage	V _{OH}	0.8VDDIO		VDDIO	V	
	V _{OL}	GND		0.2VDDIO	V	



5.3 LED Backlight Characteristics

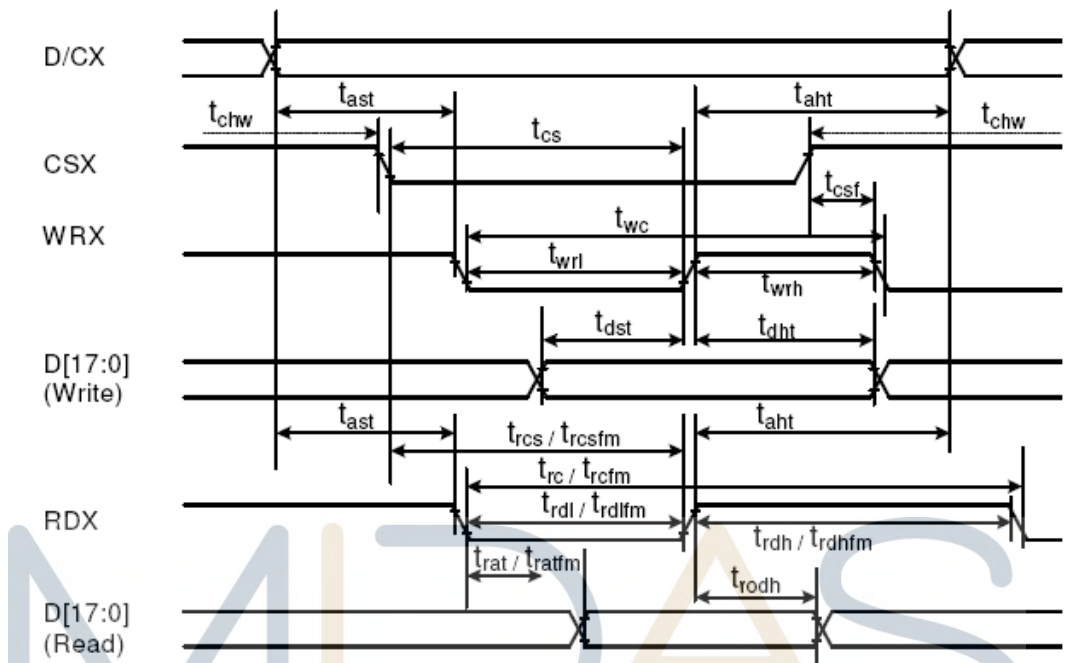
The back-light system is edge-lighting type with 4 chips White LED

Item	Symbol	Min.	Typ.	Max.	Unit	Note
Forward Current	I_F	60	80	--	mA	
Forward Voltage	V_F	--	3.2	--	V	
LCM Luminance	L_v	450	--	--	cd/m2	IF=80mA
Uniformity	AVg	80	--	--	%	



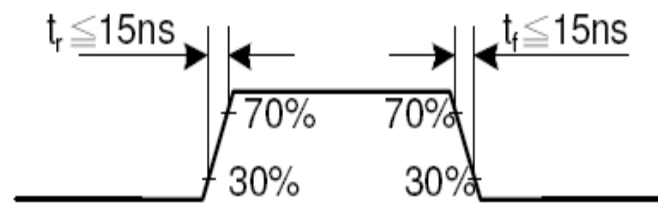
6. AC Characteristic

6.1. Display Parallel 18/16/9/8-bit Interface Timing Characteristics (8080- I system)

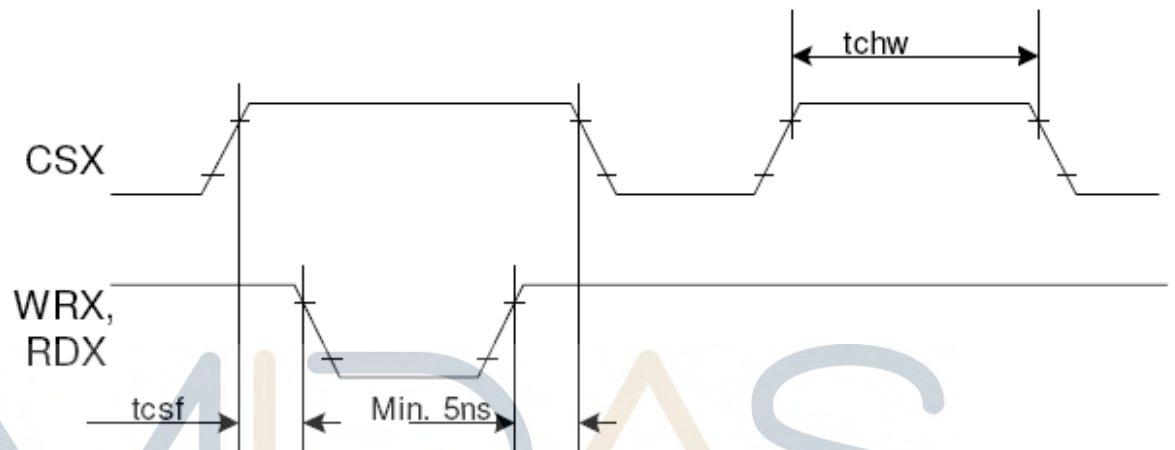


Signal	Symbol	Parameter	min	max	Unit	Description
DCX	tast	Address setup time	0	-	ns	
	taht	Address hold time (Write/Read)	0	-	ns	
CSX	tchw	CSX "H" pulse width	0	-	ns	
	tcs	Chip Select setup time (Write)	15	-	ns	
	trcs	Chip Select setup time (Read ID)	45	-	ns	
	trcsfm	Chip Select setup time (Read FM)	355	-	ns	
	tcsf	Chip Select Wait time (Write/Read)	10	-	ns	
WRX	twc	Write cycle	66	-	ns	
	twrh	Write Control pulse H duration	15	-	ns	
	twrl	Write Control pulse L duration	15	-	ns	
RDX (FM)	trcfm	Read Cycle (FM)	450	-	ns	
	trdhfm	Read Control H duration (FM)	90	-	ns	
	trdlfm	Read Control L duration (FM)	355	-	ns	
RDX (ID)	trc	Read cycle (ID)	160	-	ns	
	trdh	Read Control pulse H duration	90	-	ns	
	trdl	Read Control pulse L duration	45	-	ns	
D[17:0], D[15:0], D[8:0], D[7:0]	tdst	Write data setup time	10	-	ns	For maximum CL=30pF For minimum CL=8pF
	tdht	Write data hold time	10	-	ns	
	trat	Read access time	-	40	ns	
	tratfm	Read access time	-	340	ns	
	trod	Read output disable time	20	80	ns	

Note: Ta = -30 to 70 °C, VDDI=1.65V to 3.3V, VCI=2.5V to 3.3V, VSS=0V



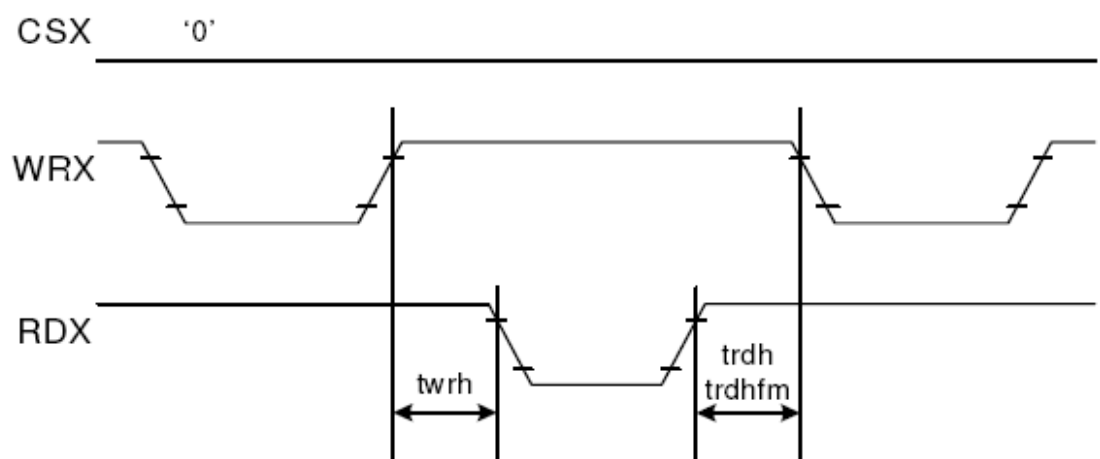
CSX timings :



Note: Logic high and low levels are specified as 30% and 70% of VDDI for Input signals.

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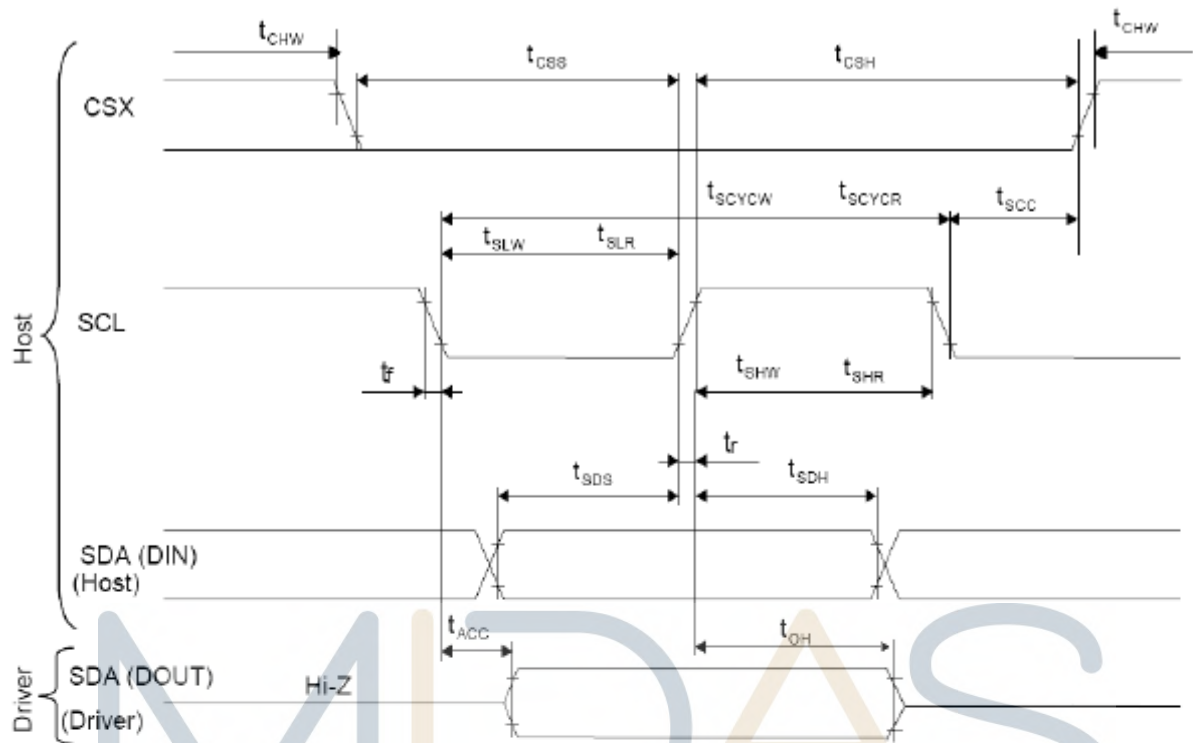
Write to read or read to write timings:



Note: Logic high and low levels are specified as 30% and 70% of VDDI for Input signals.

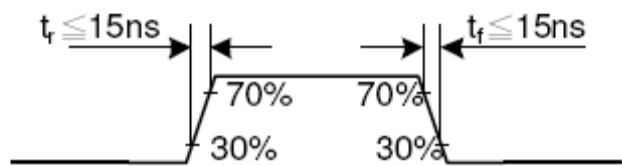


6.2 Display Serial Interface Timing Characteristics (3-line SPI system)

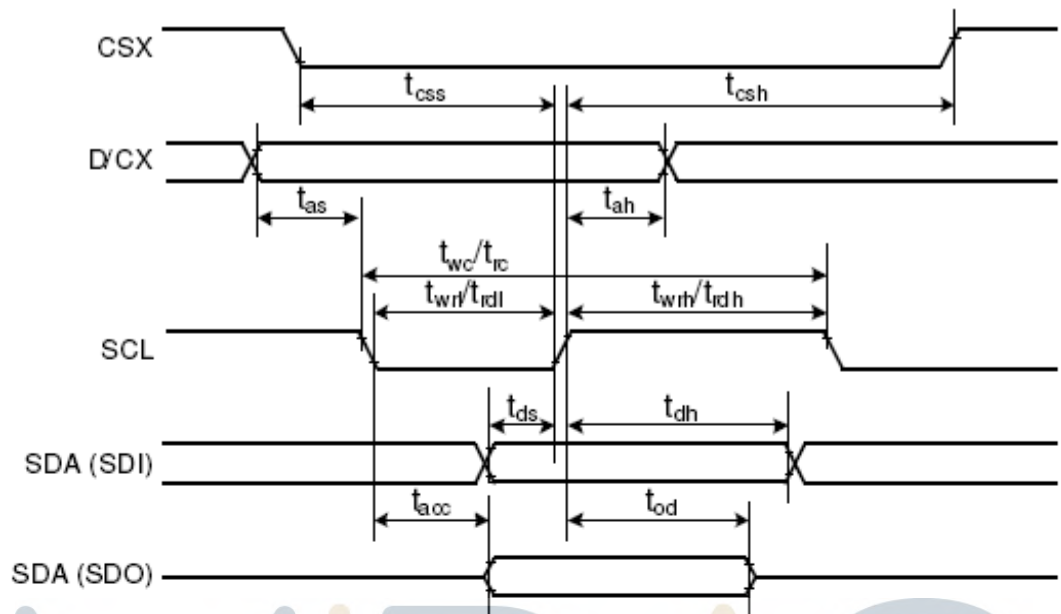


Signal	Symbol	Parameter	min	max	Unit	Description
SCL	tscycw	Serial Clock Cycle (Write)	100	-	ns	
	tshw	SCL "H" Pulse Width (Write)	40	-	ns	
	tslw	SCL "L" Pulse Width (Write)	40	-	ns	
	tscycr	Serial Clock Cycle (Read)	150	-	ns	
	tshr	SCL "H" Pulse Width (Read)	60	-	ns	
	tslr	SCL "L" Pulse Width (Read)	60	-	ns	
SDA / SDI (Input)	tsds	Data setup time (Write)	30	-	ns	
	tsdh	Data hold time (Write)	30	-	ns	
SDA / SDO (Output)	tacc	Access time (Read)	10	-	ns	
	toh	Output disable time (Read)	10	50	ns	
CSX	tsc	SCL-CSX	20	-	ns	
	tch	CSX "H" Pulse Width	40	-	ns	
	tc	CSX-SCL Time	60	-	ns	
	tc		65	-	ns	

Note: $T_a = 25\text{ }^{\circ}\text{C}$, $V_{DDI}=1.65\text{V to }3.3\text{V}$, $V_{CI}=2.5\text{V to }3.3\text{V}$, $AGND=VSS=0\text{V}$

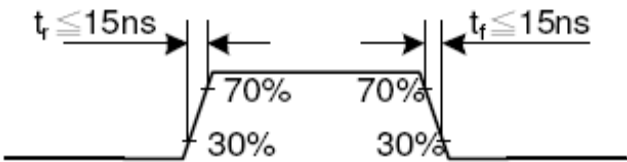


6.3 Display Serial Interface Timing Characteristics (4-line SPI system)

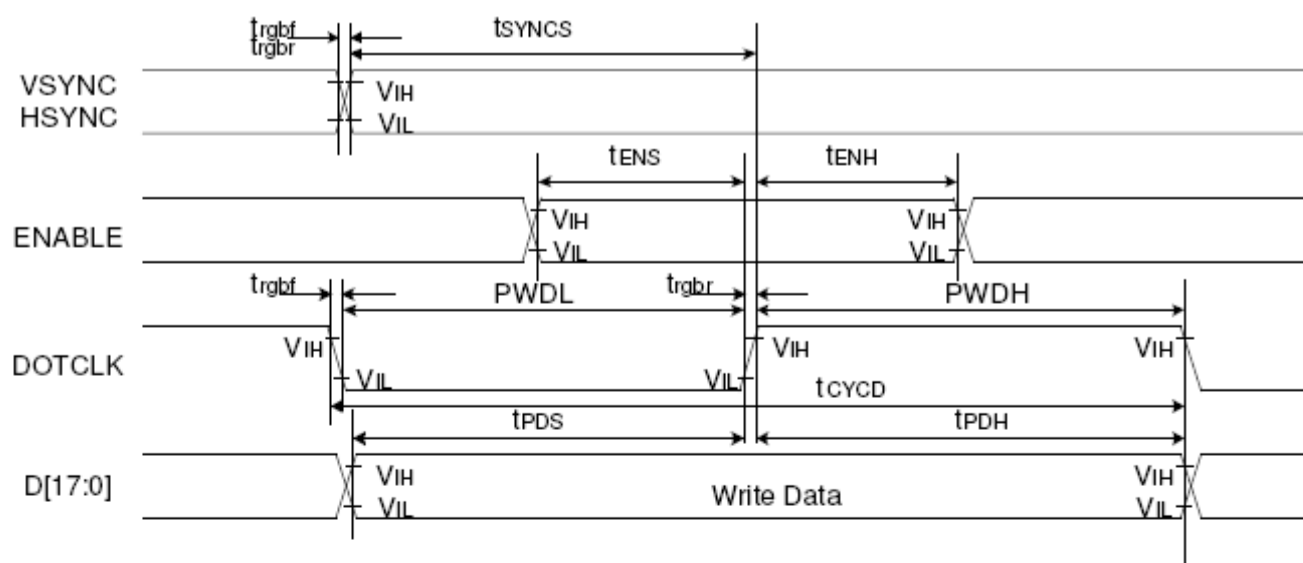


Signal	Symbol	Parameter	min	max	Unit	Description
CSX	t_{css}	Chip select time (Write)	40	-	ns	
	t_{csh}	Chip select hold time (Read)	40	-	ns	
SCL	t_{wc}	Serial clock cycle (Write)	100	-	ns	
	t_{wrh}	SCL "H" pulse width (Write)	40	-	ns	
	t_{wrl}	SCL "L" pulse width (Write)	40	-	ns	
	t_{rc}	Serial clock cycle (Read)	150	-	ns	
	t_{rdh}	SCL "H" pulse width (Read)	60	-	ns	
	t_{rdl}	SCL "L" pulse width (Read)	60	-	ns	
D/CX	t_{as}	D/CX setup time	10	-		
	t_{ah}	D/CX hold time (Write / Read)	10	-		
SDA / SDI (Input)	t_{ds}	Data setup time (Write)	30	-	ns	
	t_{dh}	Data hold time (Write)	30	-	ns	
SDA / SDO (Output)	t_{acc}	Access time (Read)	10	-	ns	For maximum CL=30pF
	t_{od}	Output disable time (Read)	10	50	ns	For minimum CL=8pF

Note: $T_a = 25\text{ }^{\circ}\text{C}$, $V_{DDI}=1.65\text{V to }3.3\text{V}$, $V_{CI}=2.5\text{V to }3.3\text{V}$, $AGND=VSS=0\text{V}$

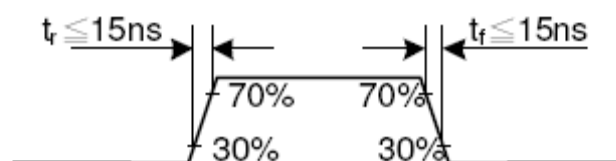


6.4 Parallel RGB Interface Timing Characteristics

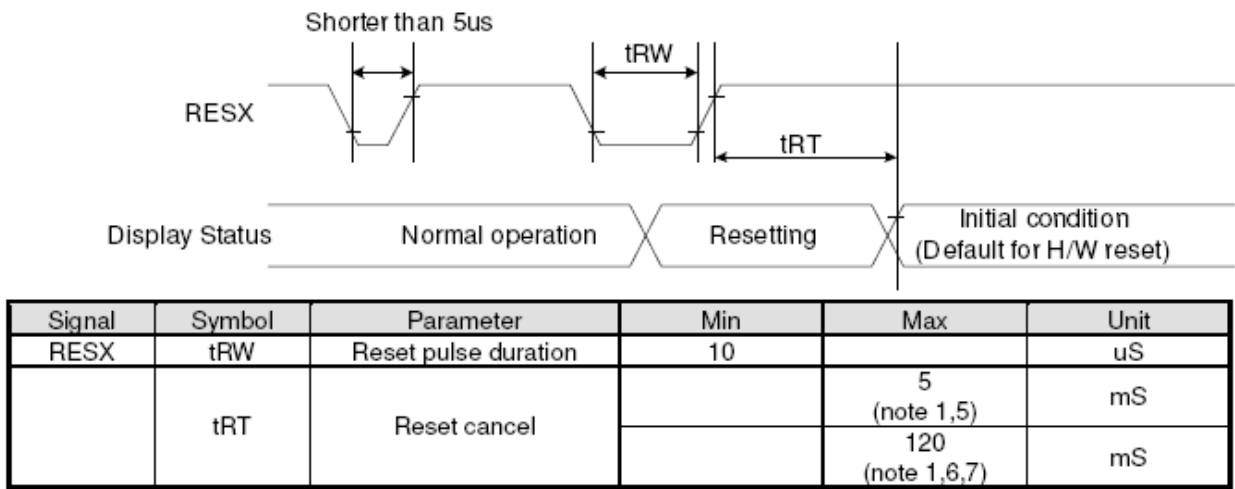


Signal	Symbol	Parameter	min	max	Unit	Description
VSYNC / HSYNC	t _{SYNCS}	VSYNC/HSYNC setup time	15	-	ns	18/16-bit bus RGB interface mode
	t _{SYNCH}	VSYNC/HSYNC hold time	15	-	ns	
DE	t _{ENS}	DE setup time	15	-	ns	
	t _{ENH}	DE hold time	15	-	ns	
D[17:0]	t _{POS}	Data setup time	15	-	ns	
	t _{PDH}	Data hold time	15	-	ns	
DOTCLK	PWDH	DOTCLK high-level period	15	-	ns	
	PWDL	DOTCLK low-level period	15	-	ns	
	t _{CYCP}	DOTCLK cycle time	100	-	ns	
	t _{rgb_r} , t _{rgb_g}	DOTCLK,HSYNC,VSYNC rise/fall time	-	15	ns	
VSYNC / HSYNC	t _{SYNCS}	VSYNC/HSYNC setup time	15	-	ns	6-bit bus RGB interface mode
	t _{SYNCH}	VSYNC/HSYNC hold time	15	-	ns	
DE	t _{ENS}	DE setup time	15	-	ns	
	t _{ENH}	DE hold time	15	-	ns	
D[17:0]	t _{POS}	Data setup time	15	-	ns	
	t _{PDH}	Data hold time	15	-	ns	
DOTCLK	PWDH	DOTCLK high-level pulse period	15	-	ns	
	PWDL	DOTCLK low-level pulse period	15	-	ns	
	t _{CYCP}	DOTCLK cycle time	100	-	ns	
	t _{rgb_r} , t _{rgb_g}	DOTCLK,HSYNC,VSYNC rise/fall time	-	15	ns	

Note: $T_a = -30$ to $70\text{ }^{\circ}\text{C}$, $V_{DD1} = 1.65\text{V}$ to 3.3V , $V_{CI} = 2.5\text{V}$ to 3.3V , $AGND = VSS = 0\text{V}$



6.5 Reset Timing Characteristics



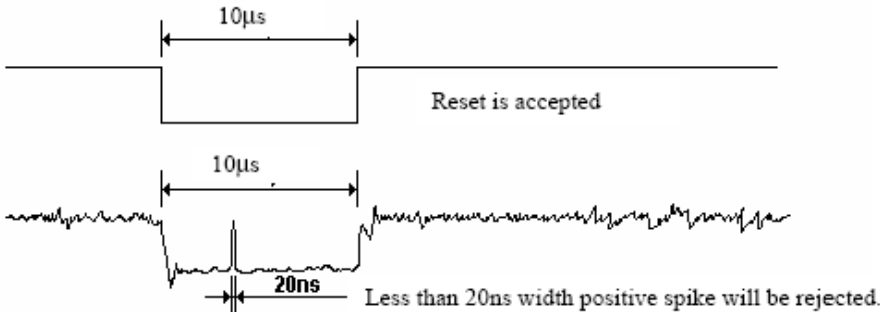
Note 1: The reset cancel includes also required time for loading ID bytes, VCOM setting and other settings from NV memory to registers. This loading is done every time when there is HW reset cancel time (tRT) within 5 ms after a rising edge of RESX.

Note 2: Spike due to an electrostatic discharge on RESX line does not cause irregular system reset according to the table below: -

RESX Pulse	Action
Shorter than 5us	Reset Rejected
Longer than 10us	Reset
Between 5us and 10us	Reset starts

Note 3: During the Resetting period, the display will be blanked (The display is entering blanking sequence, which maximum time is 120 ms, when Reset Starts in Sleep Out -mode. The display remains the blank state in Sleep In -mode.) And then return to Default condition for Hardware Reset.

Note 4: Spike Rejection also applies during a valid reset pulse as shown below:



Note 5: When Reset applied during Sleep In Mode.

Note 6: When Reset applied during Sleep Out Mode.

Note 7: It is necessary to wait 5msec after releasing RESX before sending commands. Also Sleep Out

7. LCD Module Out-Going Quality Level

7.1 VISUAL & FUNCTION INSPECTION STANDARD

7.1.1 Inspection conditions

Inspection performed under the following conditions is recommended.

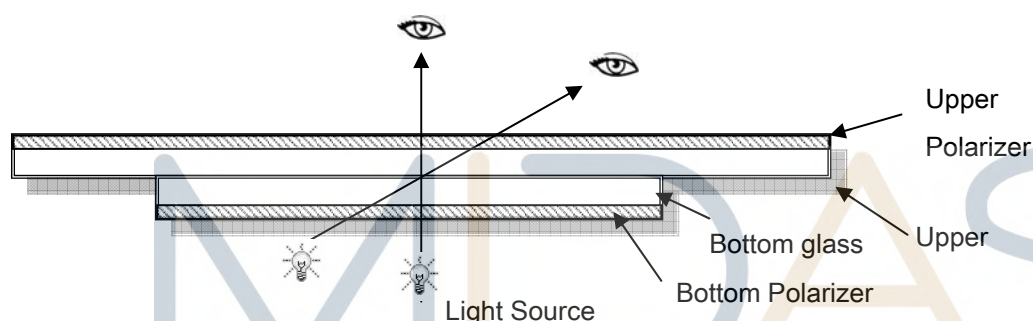
Temperature : $25 \pm 5^{\circ}\text{C}$

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

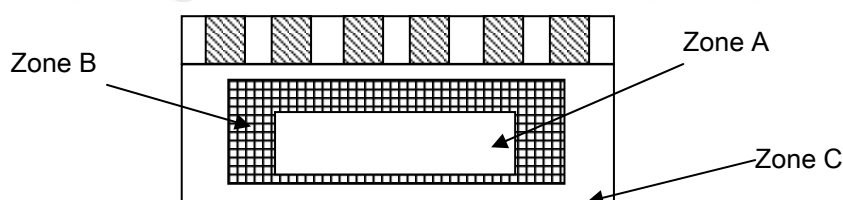
Viewing Angle : Normal viewing Angle.

Illumination: Single fluorescent lamp (300 to 700Lux)

Viewing distance: 30–50cm



7.1.2 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.

7.1.3 Sampling Plan

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

AQL:

Major defect	Minor defect
0.65	1.5

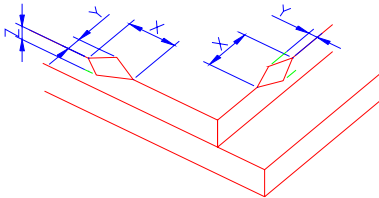
LCD: Liquid Crystal Display , TP: Touch Panel , LCM: Liquid Crystal Module

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.	

7

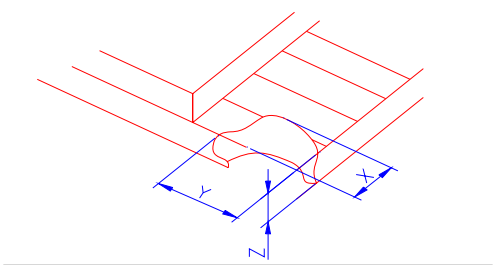
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.1.4 Criteria (Visual)

Number	Items	Criteria(mm)					
1.0 LCD Crack/Broken	(1) The edge of LCD broken						
NOTE: X: Length Y: Width		<table><tr><td>X</td><td>Y</td><td>Z</td></tr><tr><td>≤3.0mm</td><td><Inner border line of the seal</td><td>≤T</td></tr></table>	X	Y	Z	≤3.0mm	<Inner border line of the seal
X	Y	Z					
≤3.0mm	<Inner border line of the seal	≤T					

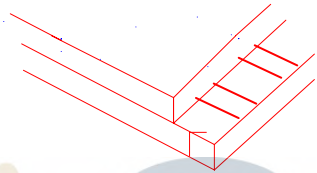
Z: Height
L: Length of
ITO,
T: Height of
LCD

(2)LCD corner broken



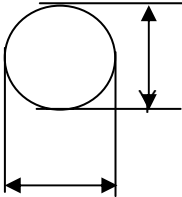
X	Y	Z
$\leq 3.0\text{mm}$	$\leq L$	$\leq T$

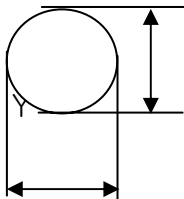
(3) LCD crack



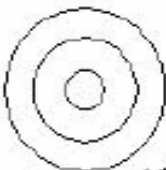
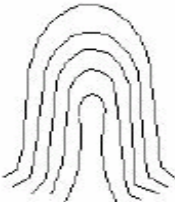
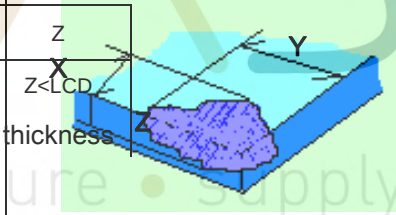
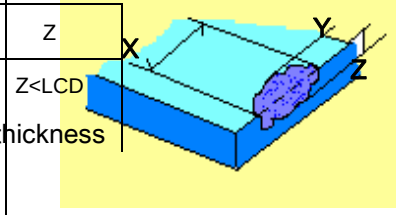
Crack
Not allowed

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Number	Items	Criteria (mm)																									
2.0	Spot defect  X Φ=(X+Y)/2	① light dot (LCD/TP/Polarizer black/white spot , light dot, pinhole, dent, stain)																									
		<table><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><tr><td>Φ≤0.10</td><td colspan="2">Ignore</td><td rowspan="4">Ignore</td></tr><tr><td>0.10<Φ≤0.15</td><td colspan="2">3(distance≥10mm)</td></tr><tr><td>0.15<Φ≤0.2</td><td colspan="2">1</td></tr><tr><td>0.2<Φ</td><td colspan="2">0</td></tr></table>	Zone Size (mm)	Acceptable Qty			A	B	C	Φ≤0.10	Ignore		Ignore	0.10<Φ≤0.15	3(distance≥10mm)		0.15<Φ≤0.2	1		0.2<Φ	0						
		Zone Size (mm)		Acceptable Qty																							
			A	B	C																						
		Φ≤0.10	Ignore		Ignore																						
		0.10<Φ≤0.15	3(distance≥10mm)																								
		0.15<Φ≤0.2	1																								
		0.2<Φ	0																								
		②Dim spot (LCD/TP/Polarizer dim dot, light leakage、dark spot)																									
		<table><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><tr><td>Φ≤0.1</td><td colspan="2">Ignore</td><td rowspan="4">Ignore</td></tr><tr><td>0.1<Φ≤0.2</td><td colspan="2">2(distance≥10mm)</td></tr><tr><td>0.2<Φ≤0.3</td><td colspan="2">1</td></tr><tr><td>Φ > 0.3</td><td colspan="2">0</td></tr></table>	Zone Size (mm)	Acceptable Qty			A	B	C	Φ≤0.1	Ignore		Ignore	0.1<Φ≤0.2	2(distance≥10mm)		0.2<Φ≤0.3	1		Φ > 0.3	0						
Zone Size (mm)	Acceptable Qty																										
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Zone Size (mm)		Acceptable Qty																									
	A	B	C																								
Φ≤0.2	Ignore		Ignore																								
0.2<Φ≤0.5	2(distance≥10mm)																										
Φ>0.5	0																										
Line defect (LCD/TP /Polarizer black/white line, scratch, stain)	<table><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><tr><td>Φ≤0.03</td><td>Ignore</td><td colspan="2">Ignore</td><td rowspan="3">Ignore</td></tr><tr><td>0.03<W≤0.05</td><td>L≤3.0</td><td colspan="2">N≤2</td></tr><tr><td>0.05<W≤0.08</td><td>L≤2.0</td><td colspan="2">N≤2</td></tr><tr><td>0.08<W</td><td colspan="4">Define as spot defect</td></tr></table>	Width(mm)	Length(mm)	Acceptable Qty			A	B	C	Φ≤0.03	Ignore	Ignore		Ignore	0.03<W≤0.05	L≤3.0	N≤2		0.05<W≤0.08	L≤2.0	N≤2		0.08<W	Define as spot defect			
Width(mm)	Length(mm)			Acceptable Qty																							
		A	B	C																							
Φ≤0.03	Ignore	Ignore		Ignore																							
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0.08<W	Define as spot defect																										

Items	Criteria (mm)																																																									
Spot defect	 X Y $\Phi=(X+Y)/2$ ① light dot (LCD/TP/Polarizer black/white spot , light dot, pinhole, dent, stain) <table><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><tr><td>$\Phi\leq0.10$</td><td colspan="2">Ignore</td><td rowspan="4">Ignore</td></tr><tr><td>$0.10<\Phi\leq0.15$</td><td colspan="2">3(distance $\geq 10\text{mm}$)</td></tr><tr><td>$0.15<\Phi\leq0.2$</td><td colspan="2">1</td></tr><tr><td>$0.2<\Phi$</td><td colspan="2">0</td></tr></table> ②Dim spot (LCD/TP/Polarizer dim dot, light leakage、dark spot) <table><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><tr><td>$\Phi\leq0.1$</td><td colspan="2">Ignore</td><td rowspan="4">Ignore</td></tr><tr><td>$0.1<\Phi\leq0.2$</td><td colspan="2">2(distance $\geq 10\text{mm}$)</td></tr><tr><td>$0.2<\Phi\leq0.3$</td><td colspan="2">1</td></tr><tr><td>$\Phi>0.3$</td><td colspan="2">0</td></tr></table> ③ Polarizer accidented spot <table><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><tr><td>$\Phi\leq0.2$</td><td colspan="2">Ignore</td><td rowspan="3">Ignore</td></tr><tr><td>$0.2<\Phi\leq0.5$</td><td colspan="2">2(distance $\geq 10\text{mm}$)</td></tr><tr><td>$\Phi>0.5$</td><td colspan="2">0</td></tr></table>	Zone Size (mm)	Acceptable Qty			A	B	C	$\Phi\leq0.10$	Ignore		Ignore	$0.10<\Phi\leq0.15$	3(distance $\geq 10\text{mm}$)		$0.15<\Phi\leq0.2$	1		$0.2<\Phi$	0		Zone Size (mm)	Acceptable Qty			A	B	C	$\Phi\leq0.1$	Ignore		Ignore	$0.1<\Phi\leq0.2$	2(distance $\geq 10\text{mm}$)		$0.2<\Phi\leq0.3$	1		$\Phi>0.3$	0		Zone Size (mm)	Acceptable Qty			A	B	C	$\Phi\leq0.2$	Ignore		Ignore	$0.2<\Phi\leq0.5$	2(distance $\geq 10\text{mm}$)		$\Phi>0.5$	0	
Zone Size (mm)	Acceptable Qty																																																									
	A	B	C																																																							
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	A	B	C																																																							
$\Phi\leq0.1$	Ignore		Ignore																																																							
$0.1<\Phi\leq0.2$	2(distance $\geq 10\text{mm}$)																																																									
$0.2<\Phi\leq0.3$	1																																																									
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	Line defect (LCD/TP /Polarizer black/white line, scratch, stain)	<table><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><tr><td>$\phi\leq0.03$</td><td>Ignore</td><td colspan="2">Ignore</td><td rowspan="3">Ignore</td></tr><tr><td>$0.03<W\leq0.05$</td><td>$L\leq3.0$</td><td colspan="2">$N\leq2$</td></tr><tr><td>$0.05<W\leq0.08$</td><td>$L\leq2.0$</td><td colspan="2">$N\leq2$</td></tr><tr><td>$0.08<W$</td><td colspan="4">Define as spot defect</td></tr></table>					Width(mm)	Length(mm)	Acceptable Qty			A	B	C	$\phi\leq0.03$	Ignore	Ignore		Ignore	$0.03<W\leq0.05$	$L\leq3.0$	$N\leq2$		$0.05<W\leq0.08$	$L\leq2.0$	$N\leq2$		$0.08<W$	Define as spot defect			
Width(mm)	Length(mm)	Acceptable Qty																														
		A	B	C																												
$\phi\leq0.03$	Ignore	Ignore		Ignore																												
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$0.08<W$	Define as spot defect																															
	Polarizer Bubble	<table><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><tr><td>$\phi\leq0.2$</td><td colspan="2">Ignore</td><td rowspan="4">Ignore</td></tr><tr><td>$0.2<\phi\leq0.4$</td><td colspan="2">2(distance$\geq10\text{mm}$)</td></tr><tr><td>$0.4<\phi\leq0.6$</td><td colspan="2">1</td></tr><tr><td>$0.6<\phi$</td><td colspan="2">0</td></tr></table>					Zone Size (mm)	Acceptable Qty			A	B	C	$\phi\leq0.2$	Ignore		Ignore	$0.2<\phi\leq0.4$	2(distance $\geq10\text{mm}$)		$0.4<\phi\leq0.6$	1		$0.6<\phi$	0							
Zone Size (mm)	Acceptable Qty																															
	A	B	C																													
$\phi\leq0.2$	Ignore		Ignore																													
$0.2<\phi\leq0.4$	2(distance $\geq10\text{mm}$)																															
$0.4<\phi\leq0.6$	1																															
$0.6<\phi$	0																															
	SMT	According to IPC-A-610C class II standard . Function defect and missing part are major defect ,the others are minor defect.																														
		design • manufacture • supply																														
		TP bubble/ accidented spot	<table><tr><th rowspan="2">Size $\Phi(\text{mm})$</th><th colspan="3">Acceptable Qty</th></tr><tr><th>A</th><th>B</th><th>C</th></tr><tr><td>$\Phi\leq0.1$</td><td colspan="2">Ignore</td><td rowspan="4">Ignore</td></tr><tr><td>$0.1<\Phi\leq0.2$</td><td colspan="2">2</td></tr><tr><td>$0.2<\Phi\leq0.3$</td><td colspan="2">1</td></tr><tr><td>$0.3<\Phi$</td><td colspan="2">0</td></tr></table>			Size $\Phi(\text{mm})$	Acceptable Qty			A	B	C	$\Phi\leq0.1$	Ignore		Ignore	$0.1<\Phi\leq0.2$	2		$0.2<\Phi\leq0.3$	1		$0.3<\Phi$	0								
Size $\Phi(\text{mm})$	Acceptable Qty																															
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$\Phi\leq0.1$	Ignore		Ignore																													
$0.1<\Phi\leq0.2$	2																															
$0.2<\Phi\leq0.3$	1																															
$0.3<\Phi$	0																															
	Assembly deflection	beyond the edge of backlight $\leq0.15\text{mm}$																														

5.0	TP Related	Newton Ring	Newton area>1/3 NG Newton area≤1/3 OK	Ring area TP Ring area TP	 1 规律性  2 非规律性  似牛顿环			
		TP corner broken X : length Y : width Z : height	<table><tr><th>X</th><th>Y</th></tr><tr><td>X≤3.0mm</td><td>Y≤3.0mm</td></tr></table> * Circuitry broken is not allowed.	X	Y	X≤3.0mm	Y≤3.0mm	Z X Y Z<LCD thickness 
X	Y							
X≤3.0mm	Y≤3.0mm							
		TP edge broken X : length Y : width Z : height	<table><tr><th>X</th><th>Y</th></tr><tr><td>X≤6.0mm</td><td>Y≤2.0mm</td></tr></table> * Circuitry broken is not allowed.	X	Y	X≤6.0mm	Y≤2.0mm	Z X Y Z<LCD thickness 
X	Y							
X≤6.0mm	Y≤2.0mm							

Criteria (functional items)

Number	Items	Criteria (mm)
1	No display	Not allowed
2	Missing segment	Not allowed
3	Short	Not allowed
4	Backlight no lighting	Not allowed
5	TP no function	Not allowed



8. Reliability Test Result

8.1 Condition

Item	Condition	Sample Size	Test Result	Note
Low Temperature Operating Life test	-20℃, 96HR	3ea	pass	-
Thermal Humidity Operating Life test	70℃, 90%RH, 96HR	3ea	pass	-
Temperature Cycle ON/OFF test	-20℃ ↔ 70℃, ON/OFF, 20CYC	3ea	pass	(1)
High Temperature Storage test	80℃, 96HR	3ea	pass	-
Low Temperature Storage test	– 30℃, 96HR	3ea	pass	-
Thermal Shock Resistance	The sample should be allowed to stand the following 5 cycles of operation: TSTL for 30 minutes -> normal temperature for 5 minutes -> TSTH for 30 minutes -> normal temperature for 5 minutes, as one cycle, then taking it out and drying it at normal temperature, and allowing it stand for 24 hours	3ea	pass	
Box Drop Test	1 Corner 3 Edges 6 faces, 66cm(MEDIUM BOX)	1box	pass	-

Note (1) ON Time over 10 seconds, OFF Time under 10 seconds



9. Cautions and Handling Precautions

9.1 Handling and Operating the Module

(1) When the module is assembled, it should be attached to the system firmly.

Do not warp or twist the module during assembly work.

(2) Protect the module from physical shock or any force. In addition to damage, this may cause improper operation or damage to the module and back-light unit.

(3) Note that polarizer is very fragile and could be easily damaged. Do not press or scratch the surface.

(4) Do not allow drops of water or chemicals to remain on the display surface.

If you have the droplets for a long time, staining and discoloration may occur.

(5) If the surface of the polarizer is dirty, clean it using some absorbent cotton or soft cloth.

(6) The desirable cleaners are water, IPA (Isopropyl Alcohol) or Hexane.

Do not use ketene type materials (ex. Acetone), Ethyl alcohol, Toluene, Ethyl acid or Methyl chloride. It might permanent damage to the polarizer due to chemical reaction.

(7) If the liquid crystal material leaks from the panel, it should be kept away from the eyes or mouth. In case of contact with hands, legs, or clothes, it must be washed away thoroughly with soap.

(8) Protect the module from static; it may cause damage to the CMOS ICs.

(9) Use finger-stalls with soft gloves in order to keep display clean during the incoming inspection and assembly process.

(10) Do not disassemble the module.

(11) Protection film for polarizer on the module shall be slowly peeled off just before use so that the electrostatic charge can be minimized.

(12) Pins of I/F connector shall not be touched directly with bare hands.

(13) Do not connect, disconnect the module in the "Power ON" condition.

(14) Power supply should always be turned on/off by the item 6.1 Power On Sequence & 6.2 Power Off Sequence

9.2 Storage and Transportation.

(1) Do not leave the panel in high temperature, and high humidity for a long time.

It is highly recommended to store the module with temperature from 0 to 35 °C and relative humidity of less than 70%

(2) Do not store the TFT-LCD module in direct sunlight.

(3) The module shall be stored in a dark place. When storing the modules for a long time, be sure to adopt effective measures for protecting the modules from strong ultraviolet radiation, sunlight, or fluorescent light.

(4) It is recommended that the modules should be stored under a condition where no condensation is allowed. Formation of dewdrops may cause an abnormal operation or a failure of the module.

In particular, the greatest possible care should be taken to prevent any module from being operated where condensation has occurred inside.

(5) This panel has its circuitry FPC on the bottom side and should be handled carefully in order not to be stressed.



10.Packing

