

AZ DISPLAYS, INC.

SPECIFICATIONS FOR LIQUID CRYSTAL DISPLAY

PART NUMBER:

AGM1248A

DATE:

July 1, 2005

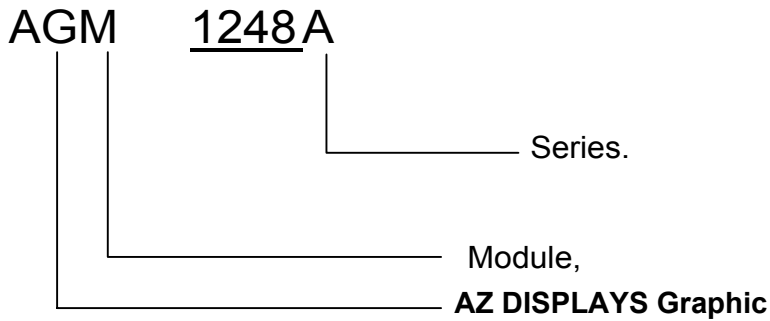
1.0 INTRODUCTION

This specification includes the outside dimensions, optical characteristics, electrical characteristics, interface, controller commands, etc., of the standard LCD module.

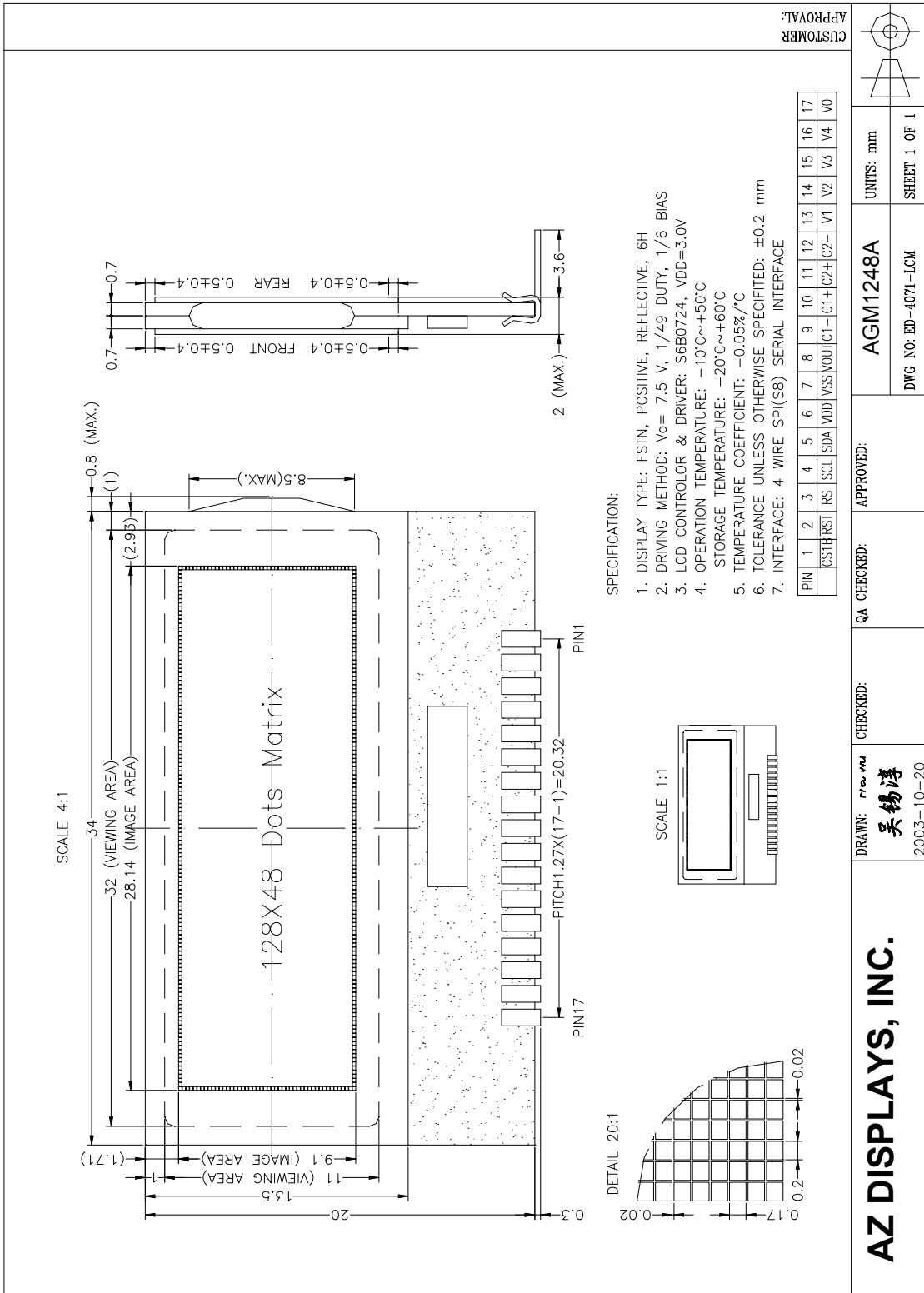
1.1 FEATURES

- (1) Compact, integral display module;
- (2) Low power consumption;
- (3) 128X48 Dot matrix LCD module;
- (4) 4 LINE SPI(S8) Serial Interface;
- (5) FSTN LCD, Positive, Reflective mode;

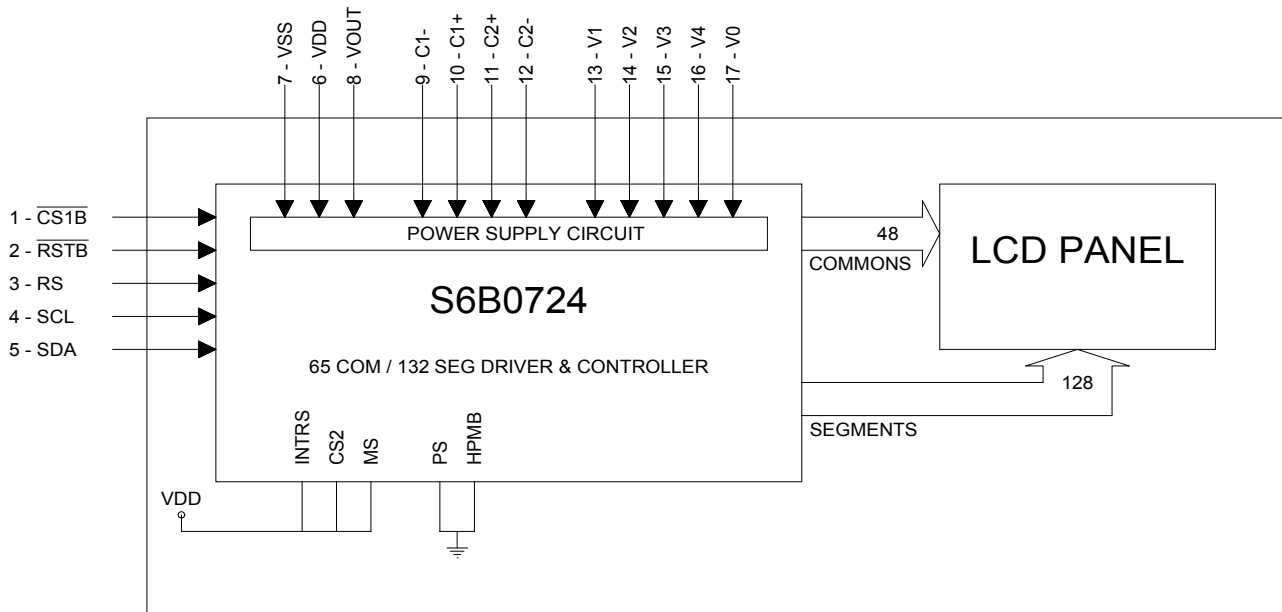
2.0 CLASSIFICATION OF MODULE



3.0 DIMENSIONAL DIAGRAM



4.0 BLOCK DIAGRAM



5.0 MECHANICAL SPECIFICATIONS

ITEM	STANDARD VALUE	UNIT
DISPLAY TYPE	128X48 Dot Matrix	Dots
MODULE DIMENSION	34.8(W) X 20.3(H) X 5.6(T)	mm
VIEW AREA	32.0(W) X 11.0(H)	mm
DOT SIZE	0.2(W) X 0.17(H)	mm
DOT GAP	0.02(W) X 0.02(H)	mm
DOT PITCH	0.22(W) X 0.19(H)	mm

6.0 ABSOLUTE MAXIMUM RATINGS

ITEM	SYMBOL	RATINGS	UNIT
OPERATING TEMPERATURE	T_{OP}	0 - 50	°C
STORAGE TEMPERATURE	T_{ST}	-20 - 60	°C
SUPPLY VOLTAGE FOR LOGIC	$V_{DD}-V_{SS}$	-0.3 - 7.0	V
SUPPLY VOLTAGE FOR LCD	V_{LCD}	-0.3 - 17	V
INPUT VOLTAGE	V_I	$V_{SS} - V_{DD}$	V

7.0 ELECTRICAL CHARACTERISTICS

LCD CONTROLOR & DRIVER: S6B0724, Ta = 25 °C						
ITEM	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT
SUPPLY VOLTAGE FOR LOGIC	$V_{DD}-V_{SS}$		2.4	3.0	3.6	V
SUPPLY VOLTAGE FOR LCD	V_{LCD}			7.5		V
INPUT VOLTAGE	V_{IH}		$0.8V_{DD}$	-	V_{DD}	V
	V_{IL}		V_{SS}	-	$0.2V_{DD}$	V
OUTPUT VOLTAGE	V_{OH}	$I_{OH}=-0.5mA$	$0.8V_{DD}$	-	V_{DD}	V
	V_{OH}	$I_{OL}=0.5Ma$	V_{SS}	-	$0.2V_{DD}$	V
SUPPLY CURRENT FOR LOGIC	I_{DD}	$V_{DD} = 3.0 V$			1.5	mA
FRAME FREQUENCY	f_M		33.4	44.5	55.6	Hz

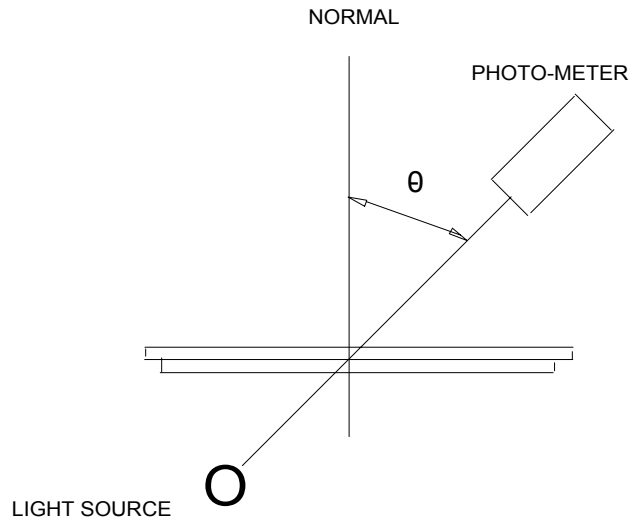
8.0 LCD SPECIFICATIONS

ITEM	STANDARD VALUE	UNIT
DUTY	1/49	
BIAS	1/6	
LCD TYPE	FSTN, Positive Mode	
DISPLAY MODE	Reflective	
VIEWING DIRECTION	6 O clock	

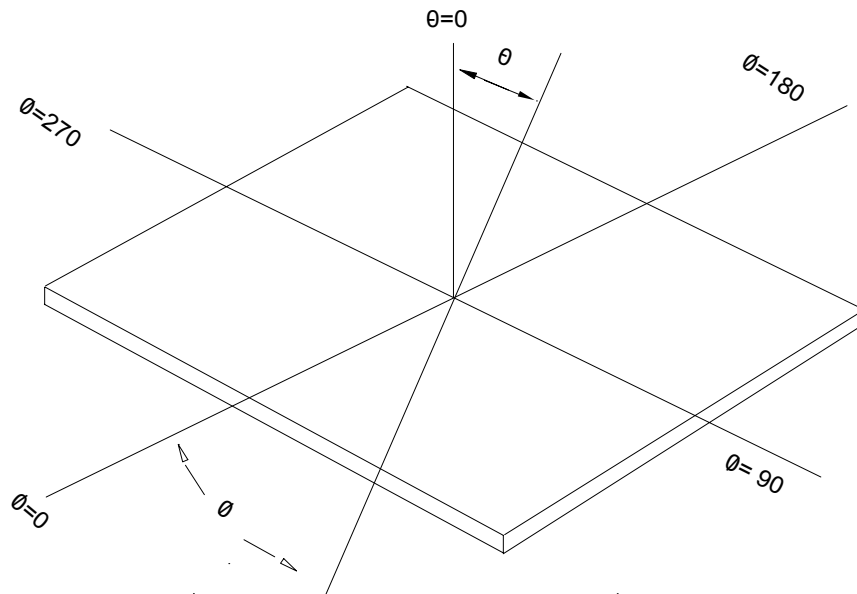
8.1 OPTICAL CHARACTERISTICS

ITEM	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT
VIEWING ANGLE ()	$\theta = 90$	$Cr > 2.0$ $Ta = 25^\circ C$	35	45	-	DEG
	$\theta = 270$		35	45	-	
	$\theta = 0$		40	50	-	
	$\theta = 180$		15	25	-	
CONTRAST RATIO	Cr	$\theta = 0$	-	7	-	-
RESPONSE TIME (RISE)	t_d	$\theta = 0$	-	100	150	ms
RESPONSE TIME (FALL)	t_f	$V_{LCD} = 7.5 V$ $Ta=25^\circ C$	-	200	300	ms

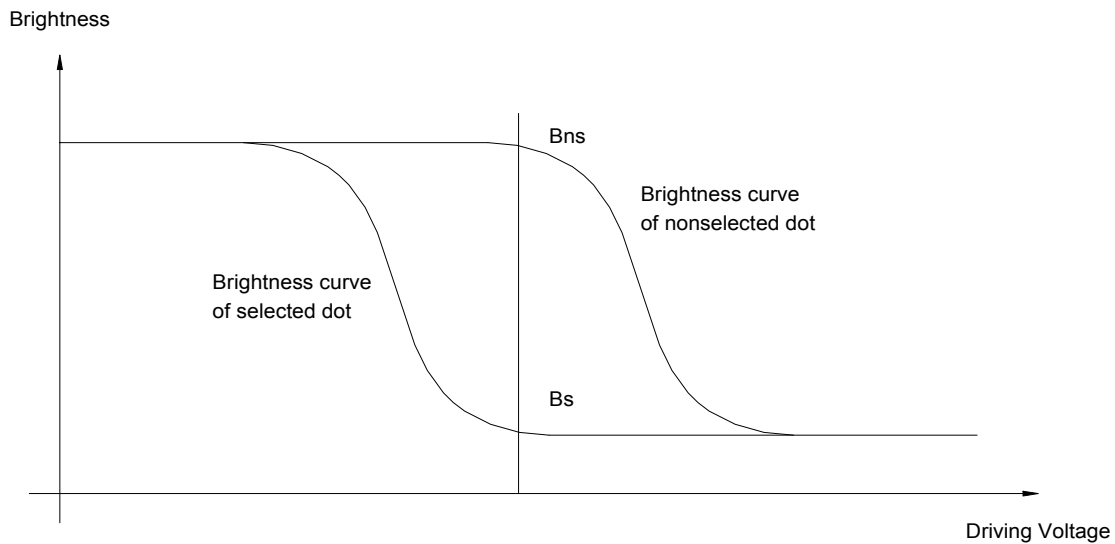
8.2 DEFINITION OF MEASUREMENT SYSTEM



8.5 DEFINITION OF θ AND ϕ

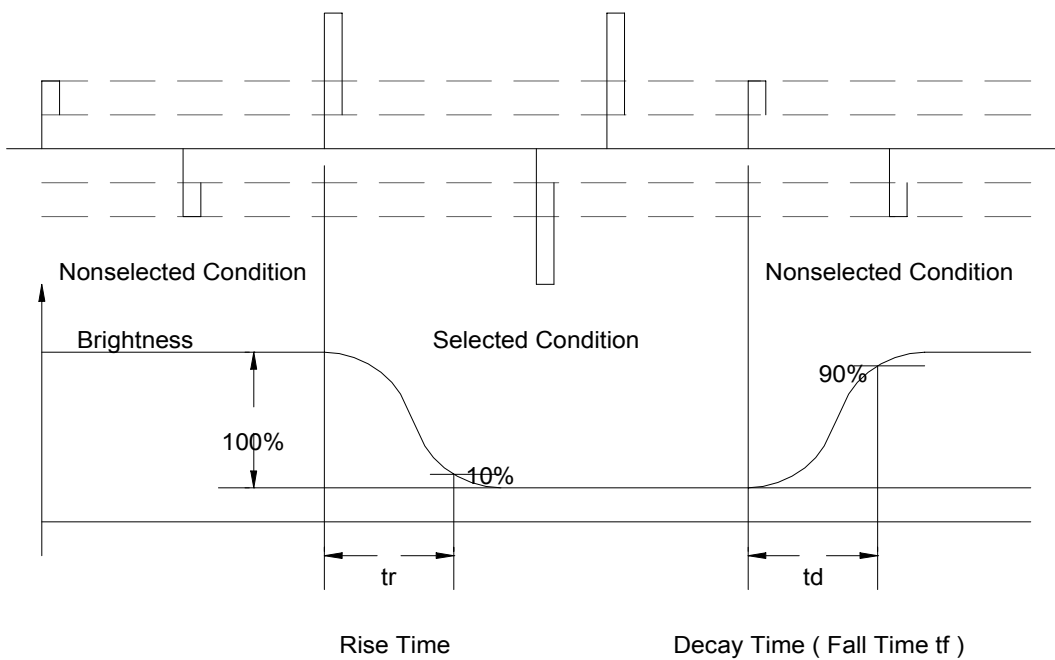


8.4 DEFINITION OF CONTRAST RATIO Cr



$$Cr = \frac{\text{Brightness at nonselected dot (} B_{ns} \text{)}}{\text{Brightness at selected dot (} B_s \text{)}}$$

8.5 DEFINITION OF OPTICAL RESPONSE TIME



9.0 INTERFACE

PIN	SYMBOL	I/O	FUNCTION
1	CS1B	I	Chip select input pin Data / instruction I/O is enabled only when CS1B is "L", When chip select is non-active, DB0 to DB7 may be high impedance.
2	RSTB	I	Reset input pin When RSTB is "L", initialization is executed.
3	RS	I	Register select input pin RS = "H": DB0 to DB7 are display data RS = "L": DB0 to DB7 are Instruction
4	SCL	I/O	Serial interface selected (PS ="L"); DB6: serial input clock (SCLK) DB7: serial input data (SID) When chip select is not active, DB6 and DB7 may be high impedance.
5	SDA		
6	VDD	Supply	Power supply
7	VSS	Supply	Ground
8	VOUT	I/O	Voltage converter input/output pin.
9	C1-	O	Capacitor 1 negative connection pin for voltage converter.
10	C1+	O	Capacitor 1 positive connection pin for voltage converter.
11	C2+	O	Capacitor 2 positive connection pin for voltage converter.
12	C2-	O	Capacitor 2 negative connection pin for voltage converter.
13	V1	I/O	LCD driver supply voltages. The voltage determined by LCD pixel is impedance-converted by an operational amplifier for application. Voltages should have the following relationship: $V0 \geq V1 \geq V2 \geq V3 \geq V4 \geq VSS$
14	V2		
15	V3		
16	V4		
17	V0		

10.0 APPLICATION OF LCD MODULE

10.1 COMMANDS

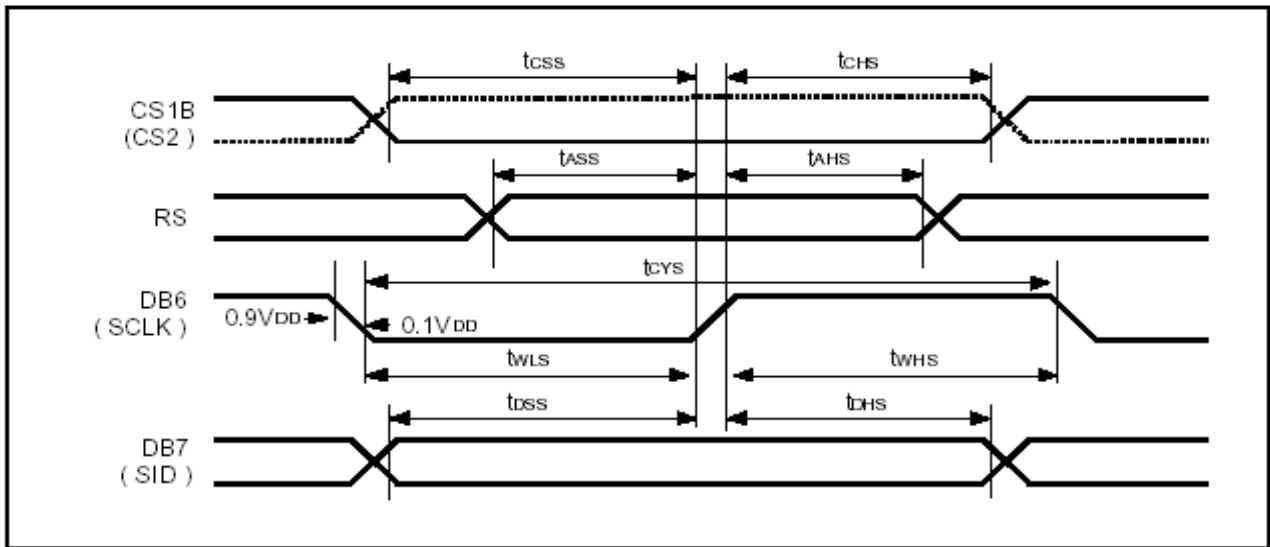
S6B0724 INSTRUCTION TABLE											
Instruction	Instruction Code										Description Instruction Code
	RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0	
Display ON / OFF	0	0	1	0	1	0	1	1	1	DON	Turn ON/OFF LCD panel When DON=0: display OFF When DON=1: display ON
Initial display line	0	0	0	1	ST5	ST4	ST3	ST2	ST1	ST0	Specify DDRAM line for COM0
Set Page address	0	0	1	0	1	1	P3	P2	P1	P0	Set page address
Set column address MSB	0	0	0	0	0	1	Y7	Y6	Y5	Y4	Set column address MSB
Set column address LSB	0	0	0	0	0	0	Y3	Y2	Y1	Y0	Set column address LSB
Read status	0	1	BUSY	ADC	ON/ OFF	RSTB	0	0	0	0	Read the internal status
Write display data	1	0	Write data							Write data into DDRAM	
Read display data	1	1	Read data							Read data from DDRAM	
ADC select	0	0	1	0	1	0	0	0	0	ADC	Select SEG output direction When ADC=0: normal direction When ADC=1: reverse direction
Reverse display ON/OFF	0	0	1	0	1	0	0	1	1	REV	Select normal/reverse display When REV=0: normal display When REV=1: reverse display
Entire display ON/OFF	0	0	1	0	1	0	0	1	0	EON	Select normal/entire display ON When EON=0:normal display When EON=1:entire display ON
LCD bias select	0	0	1	0	1	0	0	0	1	Bias	Select LCD bias

Set modify - read	0	0	1	1	1	0	0	0	0	0	Set modify-read mode
Reset Modify - read	0	0	1	1	1	0	1	1	1	0	Release modify-read mode
Reset	0	0	1	1	1	0	0	0	1	0	Initialize the internal functions
SHL select	0	0	1	1	0	0	SHL	x	x	x	Select COM output direction When SHL=0: normal direction When SHL-1:reverse direction
Power control	0	0	0	0	1	0	1	VC	VR	VF	Control power circuit operation
Regulator resistor select	0	0	0	0	1	0	0	R2	R1	R0	Select internal resistance ratio of the regulator resistor
Set reference voltage mode	0	0	1	0	0	0	0	0	0	1	Set reference voltage Mode
Set reference voltage register	0	0	x	x	SV5	SV4	SV3	SV2	SV1	SV0	Set reference voltage register
Set static indicator mode	0	0	1	0	1	0	1	1	0	SM	Set static indicator mode
Set static indicator register	0	0	x	x	x	x	x	x	S1	S0	Set static indicator register
NOP	0	0	1	1	1	0	0	0	1	1	Non-operation command

NOTE: "x": don't care.

10.2 TIMING CHARACTERISTICS

S6B0724 Serial Interface Characteristics:

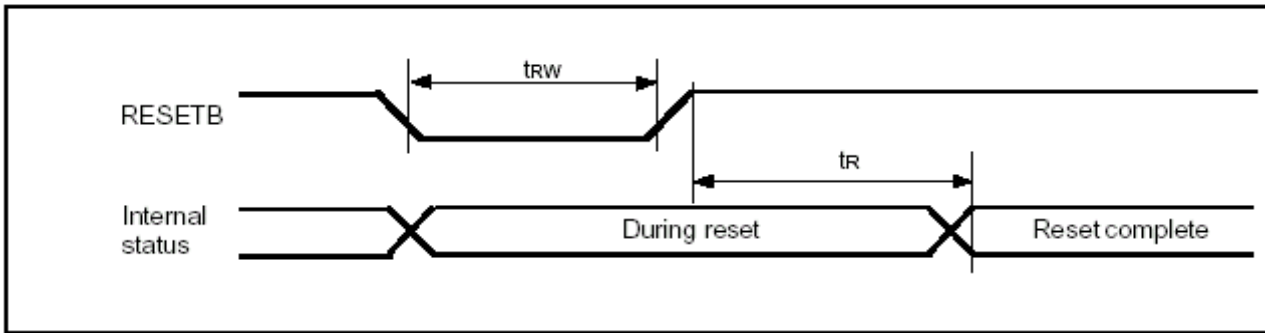


Serial Interface Characteristics

Item	Signal	Symbol	Min.	Typ.	Max.	Unit	Remark
Serial clock cycle	DB6 (SCLK)	tCYS	250	-	-	ns	
SCLK high pulse width		twHS	100	-	-		
SCLK low pulse width		twLS	100	-	-		
Address setup time	RS	tASS	150	-	-	ns	
Address hold time		tAHS	150	-	-		
Data setup time	DB7 (SID)	tDSS	100	-	-	ns	
Data hold time		tDHS	100	-	-		
CS1B setup time	CS1B	tCSS	150	-	-	ns	
CS1B hold time		tCHS	150	-	-		

Item	Signal	Symbol	Min.	Typ.	Max.	Unit	Remark
Serial clock cycle	DB6 (SCLK)	tCYS	200	-	-	ns	
SCLK high pulse width		twHS	75	-	-		
SCLK low pulse width		twLS	75	-	-		
Address setup time	RS	tASS	50	-	-	ns	
Address hold time		tAHS	100	-	-		
Data setup time	DB7 (SID)	tDSS	50	-	-	ns	
Data hold time		tDHS	50	-	-		
CS1B setup time	CS1B	tCSS	100	-	-	ns	
CS1B hold time		tCHS	100	-	-		

S6B0724 Reset Input Timing



Reset Input Timing

Item	Signal	Symbol	Min.	Typ.	Max.	Unit	Remark
Reset low pulse width	RESETB	t_{rw}	1.0	-	-	μs	
Reset time	-	t_r	-	-	1.0	μs	

Item	Signal	Symbol	Min.	Typ.	Max.	Unit	Remark
Reset low pulse width	RESETB	t_{rw}	0.5	-	-	μs	
Reset time	-	t_r	-	-	0.5	μs	

11.0 RELIABILITY

ITEM OF RELIABILITY TEST:

NO.	ITEM	CONDITION	CRITERION
1	HIGH TEMPERATURE OPERATING	50±2 °C, Operation after storage of 96~100 hrs.	No defects in cosmetic and operational function are allowable. Total current consumption should be below double of initial value. The contrast ratio must be larger than half of initiated test. Normal condition: 20±5 °C, 60%RH
2	LOW TEMPERATURE OPERATING	0±2 °C, Operation after storage of 96~100 hrs.	
3	HIGH TEMPERATURE STORAGE	60±2 °C, 96~100 hrs, then measure after 4 hrs. (Normal condition)	
4	LOW TEMPERATURE STORAGE	20±2 °C, 96~100 hrs, then measure after 4 hrs. (Normal condition)	
5	VIBRATION (NON OPERATION STATE)	Random wave: 10-55 Hz, Amplitude: 1.5 mm, 15 minutes, each direction. (x, y, z)	
6	SHOCK TEST (DROP TEST) (NON OPERATION STATE)	70cm high onto wood board of 3cm thick each direction. (x, y, z)	
7	DAMP PROOF TEST	40±2 °C, 90~95%RH, 96~100hrs, then measure after 4 hrs. (Normal condition)	