

AZ DISPLAYS, INC.

SPECIFICATIONS FOR LIQUID CRYSTAL DISPLAY

PART NUMBER:

AGM1248A

DATE:

July 1, 2005

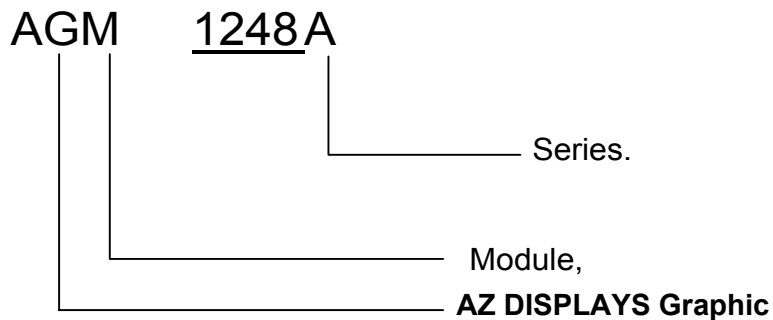
1.0 INTRODUCTION

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

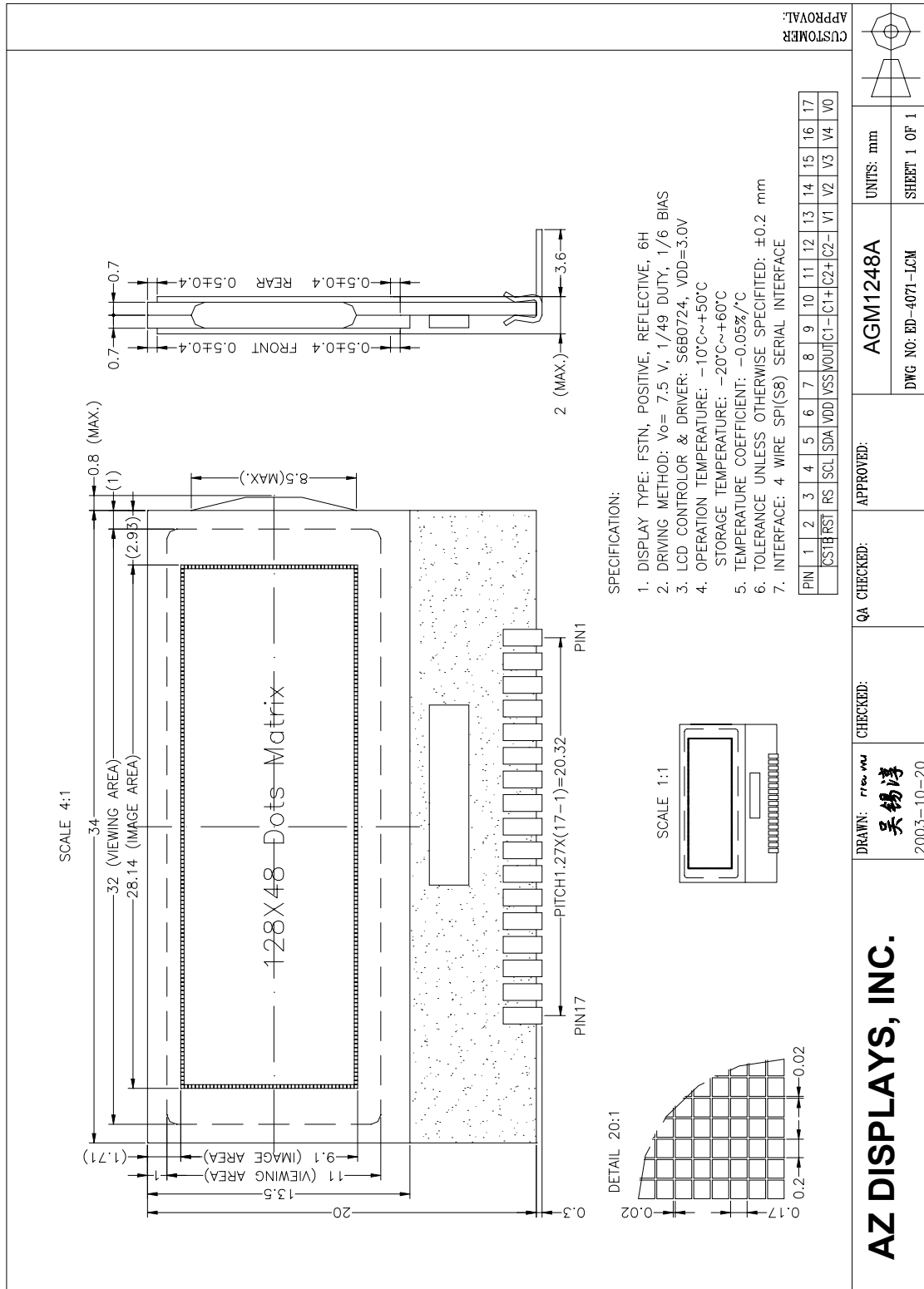
1.1 FEATURES

- (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;

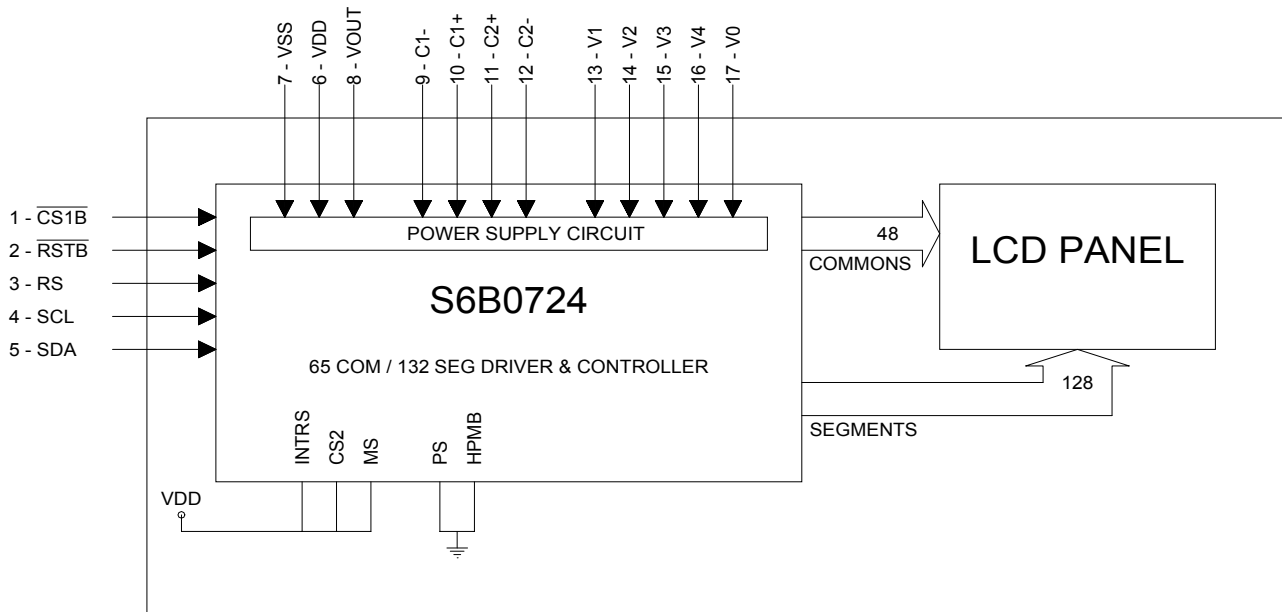
2.0 CLASSIFICATION OF MODULE



AZ DISPLAYS, INC.



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

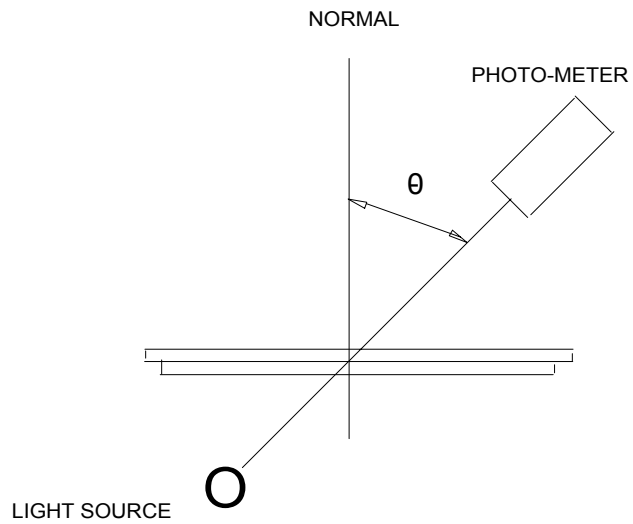
8.0 LCD SPECIFICATIONS

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

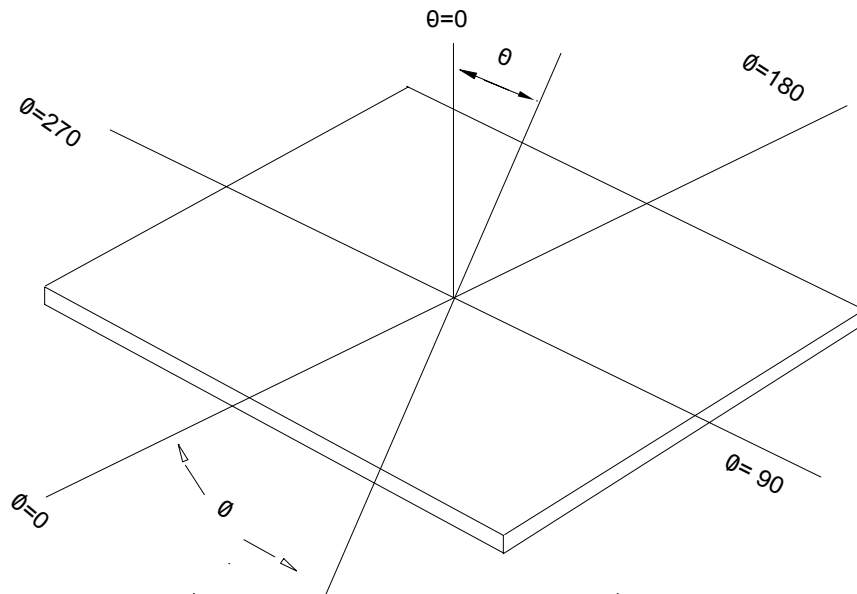
8.1 OPTICAL CHARACTERISTICS

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

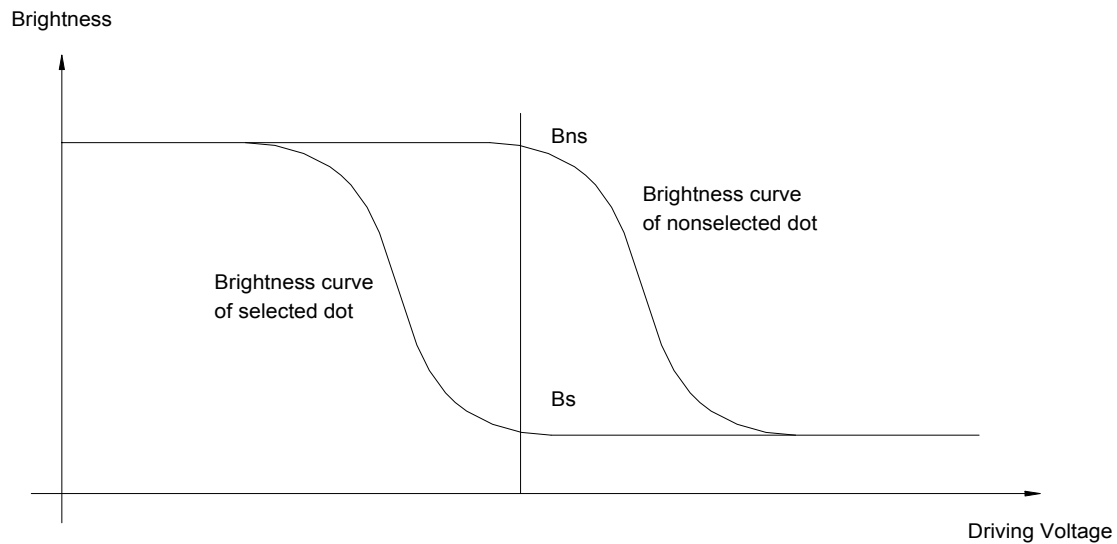
8.2 DEFINITION OF MEASUREMENT SYSTEM



8.5 DEFINITION OF θ AND ϕ

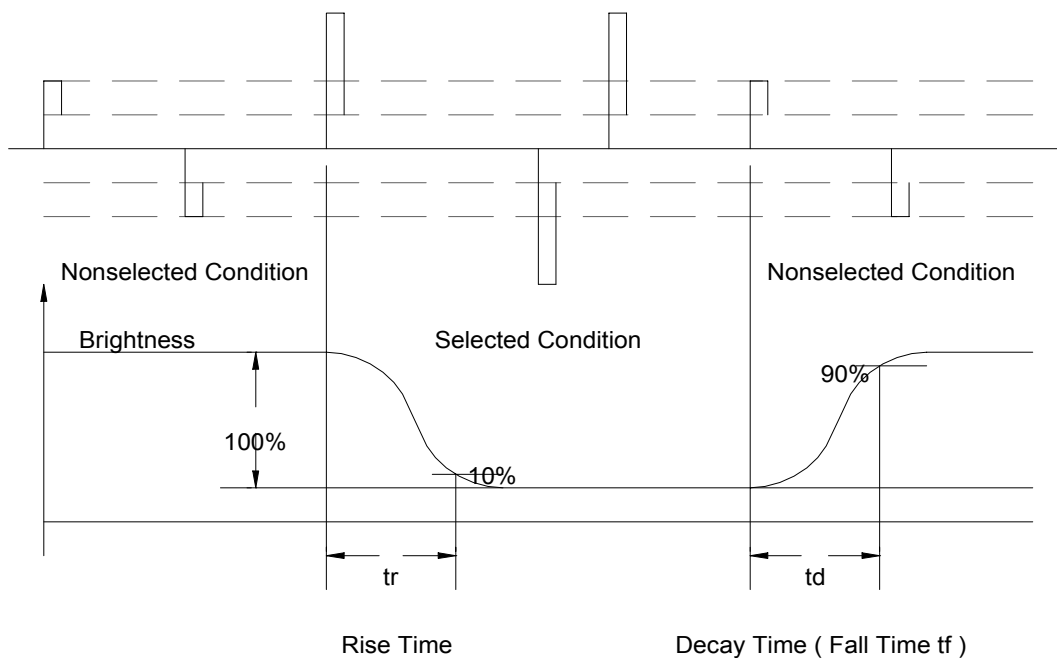


8.4 DEFINITION OF CONTRAST RATIO Cr



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

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	VOOUT	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

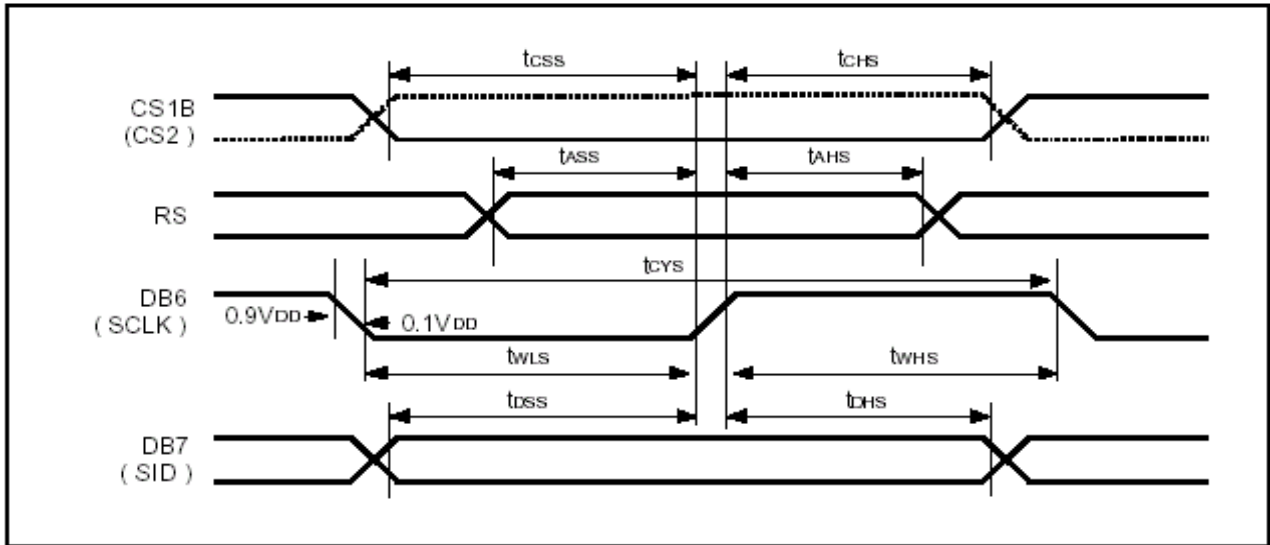
S6B0724 INSTRUCTION TABLE											
Instruction	Instruction Code										Description Instruction Code
	RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0	
Display ON / OFF	0	0	1	0	1	0	1	1	1	DON	Turn ON/OFF LCD panel When DON=0: display OFF When DON=1: display ON
Initial display line	0	0	0	1	ST5	ST4	ST3	ST2	ST1	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:

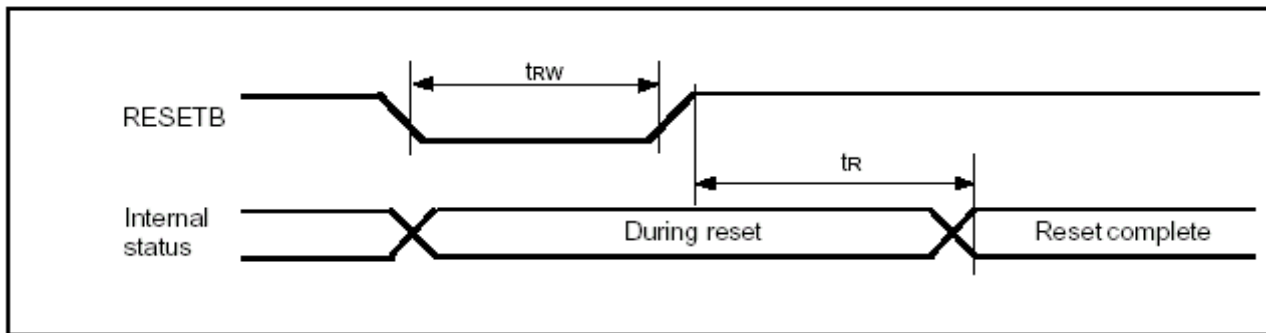


Serial Interface Characteristics

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	trw	1.0	-	-	μs	
Reset time	-	tr	-	-	1.0	μs	

Item	Signal	Symbol	Min.	Typ.	Max.	Unit	Remark
Reset low pulse width	RESETB	trw	0.5	-	-	μs	
Reset time	-	tr	-	-	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.
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)	Total current consumption should be below double of initial value.
5	VIBRATION (NON OPERATION STATE)	Random wave: 10-55 Hz, Amplitude: 1.5 mm, 15 minutes, each direction. (x, y, z)	The contrast ratio must be larger than half of initiated test.
6	SHOCK TEST (DROP TEST) (NON OPERATION STATE)	70cm high onto wood board of 3cm thick each direction. (x, y, z)	Normal condition: 20±5 °C, 60%RH
7	DAMP PROOF TEST	40±2 °C, 90~95%RH, 96~100hrs, then measure after 4 hrs. (Normal condition)	