



LCD Module Specification

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2.0 Record of revision

Rev	Date	Item	Page	Comment



3.0 General specification

Dot pixels: 240 (W) x 128 (H) dots

View area: 114 x 64

General dimensions: 144 x 104

LCD type: STN Gray STN Yellow FSTN

Polarizer mode: Reflective Transflective
 Transmissive Negative

View angle: 6 O'clock 12 O'clock Others_____

Backlight: LED EL CCFL

Backlight colour: Yellow green Amber Blue green
 White Others

Controller: T6963 (Produced by Toshiba)

Temperature range: Normal temperature Wide temperature
Operating 0 to 50 C Operating -20 to 70 C
Storage -20 to 70 C Storage -30 to 80 C

**4.0 Absolute maximum rating** $V_{SS} = 0V, T_a = 25^{\circ}C$

NO	ITEM	SIMBOL	MIN	MAX	UNIT
1.	Power Supply voltage (Logic)	$V_{DD} - V_{SS}$	0	7	V
2.	Power Supply voltage (LCD Driver)	$V_{DD} - V_0$	-	17.5	V
3.	Operating Temperature	T_{op}	Refer page 3		$^{\circ}C$
4.	Storage Temperature	T_{st}	Refer page 3		$^{\circ}C$

5.0 Electrical characteristics

NO	ITEM	SYMBOL	CONDITION	MIN	TYP	MAX	UNIT
1.	Power Supply voltage (Logic)	$V_{DD} - V_{SS}$	-	4.5	5.0	5.5	V
2.	Power Supply voltage (V_{LCD})	$V_{DD} - V_0$	$25^{\circ}C$	17.3	17.5	17.7	V
3.	Input Voltage	V_{IH}	-	$V_{DD} - 0.2$	-	V_{DD}	V
		V_{IL}	-	0	-	0.8	V
4.	Current Supply	I_{DD}	$V_{DD} - V_{SS} = 5V$	-	20	-	mA

6.0 Environmental requirements

NO	ITEM	CONDITION
1.	Operating Temperature	$0^{\circ}C$ to $50^{\circ}C$
2.	Storage Temperature	$-20^{\circ}C$ to $70^{\circ}C$
3.	Operating Humidity	5% to 95%RH
4.	Cycle Test	0 C @ 30 min to 50 C @ 30min for 1 cycle run for 10 cycles

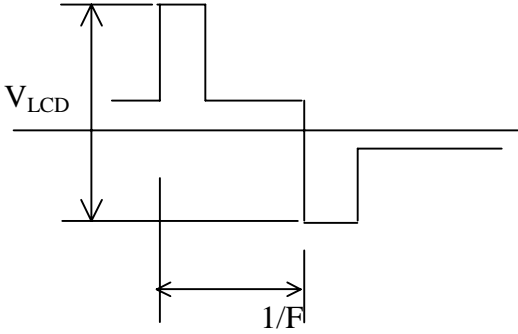
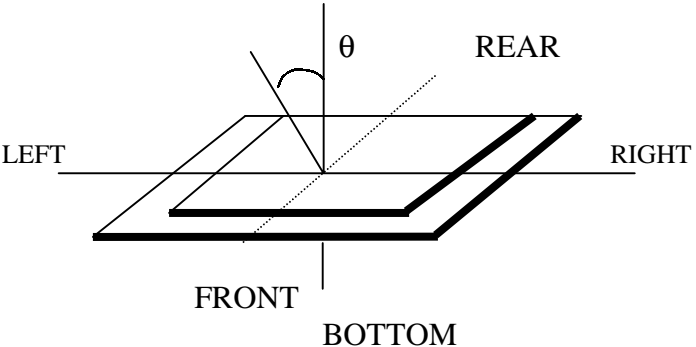
Note: The background on LCD has the possibility to be changed in different temperature range.



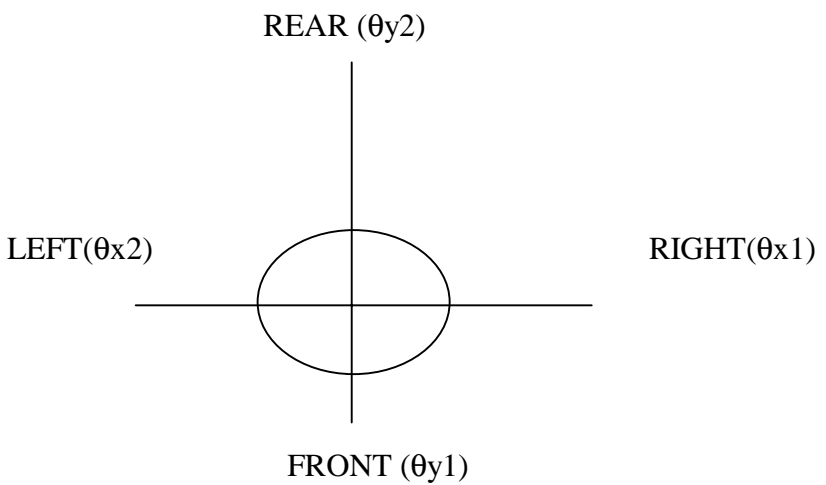
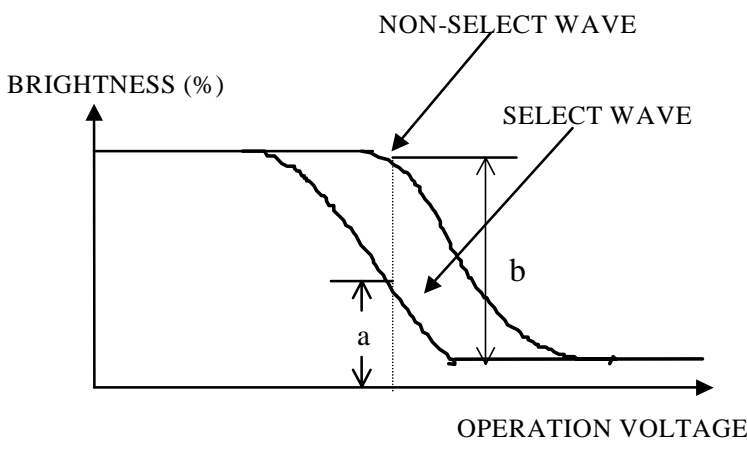
7.0 LCD specification

7.1 Electro-optical characteristics

NO	ITEM	SYMBOL	TEMP °C	CONDITION	COMMERCIAL			UNI	REF.
					MIN	TYP	MAX		
1	Operating Voltage	V_{LCD}	25	$\theta = 0$ $Cr = \max$	17.3	17.5	17.7	Volt	7.1.1
2	Viewing	θ_{x1}	25	$CR \geq 2$ $V_{LCD} = 17.5V$	-	50	-	Deg	7.1.2
		θ_{x2}			-	50	-		
		θ_{y1}			-	60	-		
		θ_{y2}			-	30	-		
3	Contrast Ratio	Cr	25	$\theta = 0^0, V_{LCD} = 17.5V$	-	7	-		7.1.3

NO	CHARACTERISTICS	DEFINITIONS
7.1.1	Definition of Operating Voltage (V_{LCD})	 <p>V_{LCD} : Operating Voltage F : Frame Frequency</p>
7.1.2	Definition of Viewing Angle	 <p>LEFT RIGHT FRONT BOTTOM REAR</p>



		
<p>7.1.3</p>	<p>Definition of Contrast Ratio</p>	 <p>Contrast Ratio = $\frac{\text{Brightness of non-selected state (b)}}{\text{Brightness of selected state (a)}}$</p> <p>Conditions</p> <ul style="list-style-type: none">(a) Operating Voltage: V_{LCD}(b) Temperature: $25^{\circ}C$(c) Viewing Angle, $\theta = 0^{\circ}$



8.0 Interface

8.1	<i>Controller</i>	T6963C	
8.2	<i>Display Driver</i>	T6A39 and T6A40	
8.3	<i>Duty Cycle</i>	1/128	
8.4	<i>Pin-out Assignments</i>		
	Pin No	Symbol	Description
	1	FG	Frame ground
	2 and 27	V _{SS}	Ground terminal of module
	3 and 28	V _{DD}	Supply terminal of module
	4 and 26	V _O	Power supply for Liquid Crystal Drive
	5	R/W	Write select (active low)
	6	RD	Read select (active low)
	7	CE	Chip enable (active low)
	8	C/D	Command/Data High = Command register Low = Data register
	9 and 29	NC	Non connected
	10	RST	Reset (active low)
	11 to 18	D0 to D7	Bi-directional Data Bus. Data Transfer is performed once, thru D0 to D7, in the case of interface data length is 8-bits.
	19	FS	Font selection
	20 and 25	V _{OUT}	Negative voltage from the LCD module
	21 and 24	SLA	Backlight positive voltage (4.1 V)
	22 and 23	SLK	Backlight ground
	30	HSCP	Shift clock pulse for column driver of upper area of LCD.
	31	LP	Latch pulse for column driver. Shift clock for row driver.
	32	FR	Frame signal
	33	CDATA	Synchronous signal for row driver
	34	ED	Data input for columns driver

***Font interface format selection:**

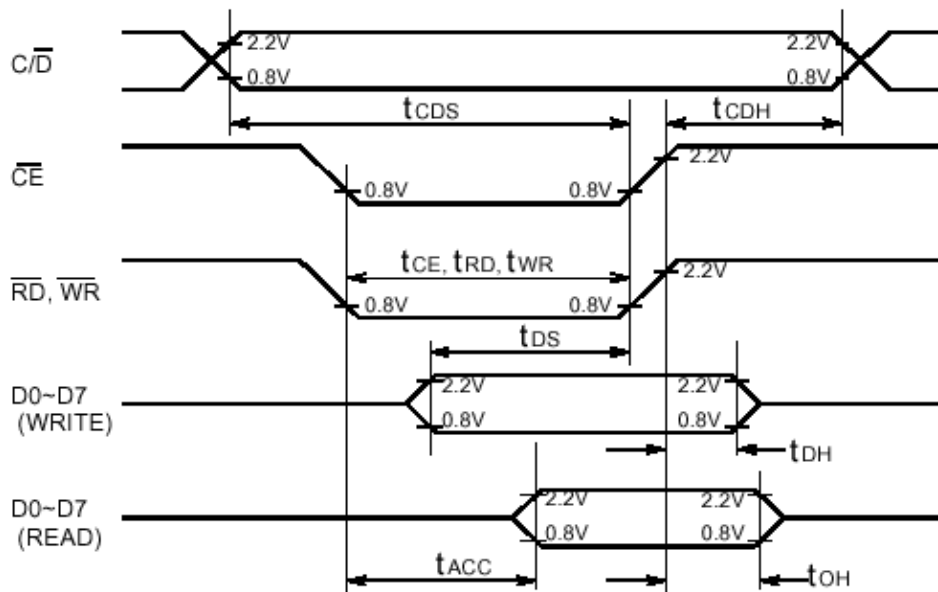
Font size	J1	J2	Pin FS
5x8	used	nc	high
6x8	nc	used	high
7x8	used	nc	low
8x8	nc	used	low

note: nc mean not connected



9. TIMING CHARACTERISTICS/TIMING DIAGRAMS

9.1 Timing Characteristics between MPU and T6963C



Item	Symbol	Min	Typ	Max	Unit
C/D Set Up Time	t_{CDS}	100	-	-	ns
C/D Hold Time	t_{CDH}	10	-	-	ns
CE, RD, WR Pulse Width	t_{CE}, t_{RD}, t_{WR}	80	-	-	ns
Data Set Up Time	t_{DS}	80	-	-	ns
Data Hold Time	t_{DH}	40	-	-	ns
Access time	t_{ACC}	-	-	150	ns
Output Hold Time	t_{OH}	10	-	50	ns



9.2 Relationship between character code and character pattern

CG ROM TYPE 0101

MSB \ LSB	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0		!	"	#	\$	%	&	'	()	*	+	,	-	.	/
1	0	1	2	3	4	5	6	7	8	9	:	;	<	=	>	?
2	@	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
3	P	Q	R	S	T	U	U	W	X	Y	Z	[\]	^	_
4	~	a	b	c	d	e	f	g	h	i	j	k	l	m	n	o
5	p	q	r	s	t	u	u	w	x	y	z	{		}	~	
6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

CG ROM TYPE 0201

MSB \ LSB	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0		!	"	#	\$	%	&	'	()	*	+	,	-	.	/
1	0	1	2	3	4	5	6	7	8	9	:	;	<	=	>	?
2	@	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
3	P	Q	R	S	T	U	U	W	X	Y	Z	[\]	^	_
4	~	a	b	c	d	e	f	g	h	i	j	k	l	m	n	o
5	p	q	r	s	t	u	u	w	x	y	z	{		}	~	
6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

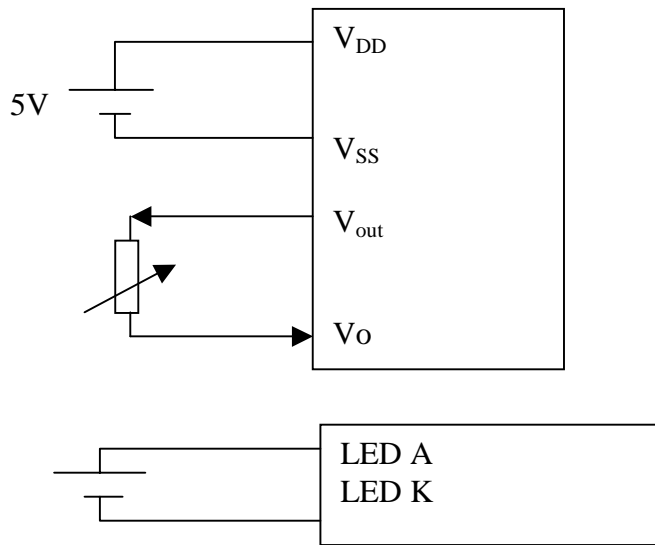


9.3 Command Definitions

COMMAND	CODE	D1	D2	FUNCTION
REGISTER SETTING	00100001	X address	Y address	Set Cursor Pointer
	00100010	Data	00H	Set Offset Register
	00100100	Low address	High address	Set Address Pointer
SET CONTROL WORD	01000000	Low address	High address	Set Text Home Address
	01000001	Columns	00H	Set Text Area
	01000010	Low address	High address	Set Graphic Home Address
	01000011	Columns	00H	Set Graphic Area
MODE SET	1000X000	-	-	OR mode
	1000X001	-	-	EXOR mode
	1000X011	-	-	AND mode
	1000X100	-	-	Text Attribute mode
	10000XXX	-	-	Internal CG ROM mode
	10001XXX	-	-	External CG RAM mode
DISPLAY MODE	10010000	-	-	Display off
	1001XX10	-	-	Cursor on, blink off
	1001XX11	-	-	Cursor on, blink on
	100101XX	-	-	Text on, graphic off
	100110XX	-	-	Text off, graphic on
	100111XX	-	-	Text on, graphic on
CURSOR PATTERN SELECT	10100000	-	-	1-line cursor
	10100001	-	-	2-line cursor
	10100010	-	-	3-line cursor
	10100011	-	-	4-line cursor
	10100100	-	-	5-line cursor
	10100101	-	-	6-line cursor
	10100110	-	-	7-line cursor
	10100111	-	-	8-line cursor
DATA AUTO READ / WRITE	10110000	-	-	Set Data Auto Write
	10110001	-	-	Set Data Auto Read
	10110010	-	-	Auto Reset
DATA READ / WRITE	11000000	Data	-	Data Write and Increment ADP
	11000001	-	-	Data Read and Increment ADP
	11000010	Data	-	Data Write and Decrement ADP
	11000011	-	-	Data Read and Decrement ADP
	11000100	-	-	Data Write and Nonvariable ADP
	11000101	Data	-	Data Read and Nonvariable ADP
SCREEN PEEK	11100000	-	-	Screen Peek
SCREEN COPY	11101000			Screen Copy
BIT SET / RESET	11110XXX	-	-	Bit Reset
	11111XXX	-	-	Bit set
	1111X000	-	-	Bit 0 (LSB)
	1111X001	-	-	Bit 1
	1111X010	-	-	Bit 2
	1111X011	--	--	Bit 3
	1111X100	-	-	Bit 4
	1111X101	-	-	Bit 5
	1111X110	-	-	Bit 6
	1111X111	-	-	Bit 7 (MSB)



10. Power Supply



11. Block Diagram

