

# AVNET EMBEDDED SPECIFICATION.

## Datasheet TOSHIBA LT089AC29000

## FEATURES

- (1) 8.9" WIDE-XGA(1280x768 pixels) Display Size
- (2) Replaceable LED Backlight including driving circuit
- (3) Wide Viewing Angle with No Color Inversion
- (4) LVDS Interface

## MECHANICAL SPECIFICATIONS

Item	Specifications
Dimensional Outline (typ.)	223.5(W) x 134.5(H) x 7.0(D) mm
Number of Pixels	1280(W) x 768(H) pixels
Active Area	193.92(W) x 118.352(H) mm
Pixel Pitch	0.1515(W) x 0.1515(H) mm
Weight (approximately)	TBD g
Backlight	Side Light LED(Replaceable)
Polarizer Surface Treatment	Anti Glare (Hardness : 3H)

## ABSOLUTE MAXIMUM RATINGS

Item	Min.	Max.	Unit
Supply Voltage ( $V_{DD}$ )	-0.3	4.0	V
( $V_{LED}$ )	-	TBD	kV(rms)
Input Signal Voltage ( $V_{IN}$ )	-0.3	$V_{DD}+0.3$	V
Operating Temperature (*1)	-20	80	°C
Storage Temperature	-30	80	°C
Storage Humidity	10	90	%RH

(\*1) : Only operation is guaranteed at Operating Temperature. Display quality is evaluated at +25°C.

ELECTRICAL SPECIFICATION ( $T_a=25^\circ\text{C}$ ) (RECOMMENDED OPERATION CONDITION)

Item	Min.	Typ.	Max.	Unit	Remarks	
Supply Voltage	( $V_{DD}$ )	3.0	3.3	3.6	V	
	( $V_{LED}$ )	(10.8)	12.0	(13.2)	V	
Differential Input Amplitude	( $V_{IA}$ )	0.1	—	0.8	V	
Common Mode Input Voltage	( $V_{CM}$ )	1.0	1.25	2.0	V	
Differential Input Voltage	( $V_{ID}$ )	$V_{CM} - (V_{IA})/2$	—	$V_{CM} + (V_{IA})/2$		
High Level Input Voltage	( $V_{IH}$ )	2.2	—	$V_{DD}$	V	
Low Level Input Voltage	( $V_{IL}$ )	0	—	0.7	V	
Backlight ON/OFF signal	( $V_{ON/OFF}$ )	2.0	—	$V_{DD}$	V	
		0	—	0.8	V	
Luminance control signal	( $V_{PWM}$ )	0	—	3.3	V	
Current Consumption	( $I_{DD}$ )*1	—	(240)	—	mA	
	( $I_{LED}$ )	—	(188)	—	mA	$V_{LED}=12V$
Power Consumption*1		—	(3.95)	—	W	PWM=100%

(\*2) : 8 color bars pattern

OPTICAL SPECIFICATION ( $T_a=25^\circ\text{C}$ )

Item	Min.	Typ.	Max.	Unit	Remarks
Contrast Ratio (CR)	TBD	400	—	—	
Viewing Angle (CR>=10)	(Upper/Lower)	TBD/TBD	80/80	—	deg.
	(Left/Right)	TBD/TBD	80/80	—	deg.
Response Time	( $t_{ON}$ )	—	(11.1)	50	ms
	( $t_{OFF}$ )	—	(8.5)	50	ms
Luminance (L)	240	300	—	cd/m <sup>2</sup>	PWM=100%
Lamp Life Time (MTBF) *4 *5		25,000		h	PWM=100%

(\*4) : Conditions ;  $T_a=25^\circ\text{C}$ , continuous lighting

(\*5) : Definitions of failure ; 1) LCD luminance becomes half of the minimum value. 2) Lamp doesn't light normally.

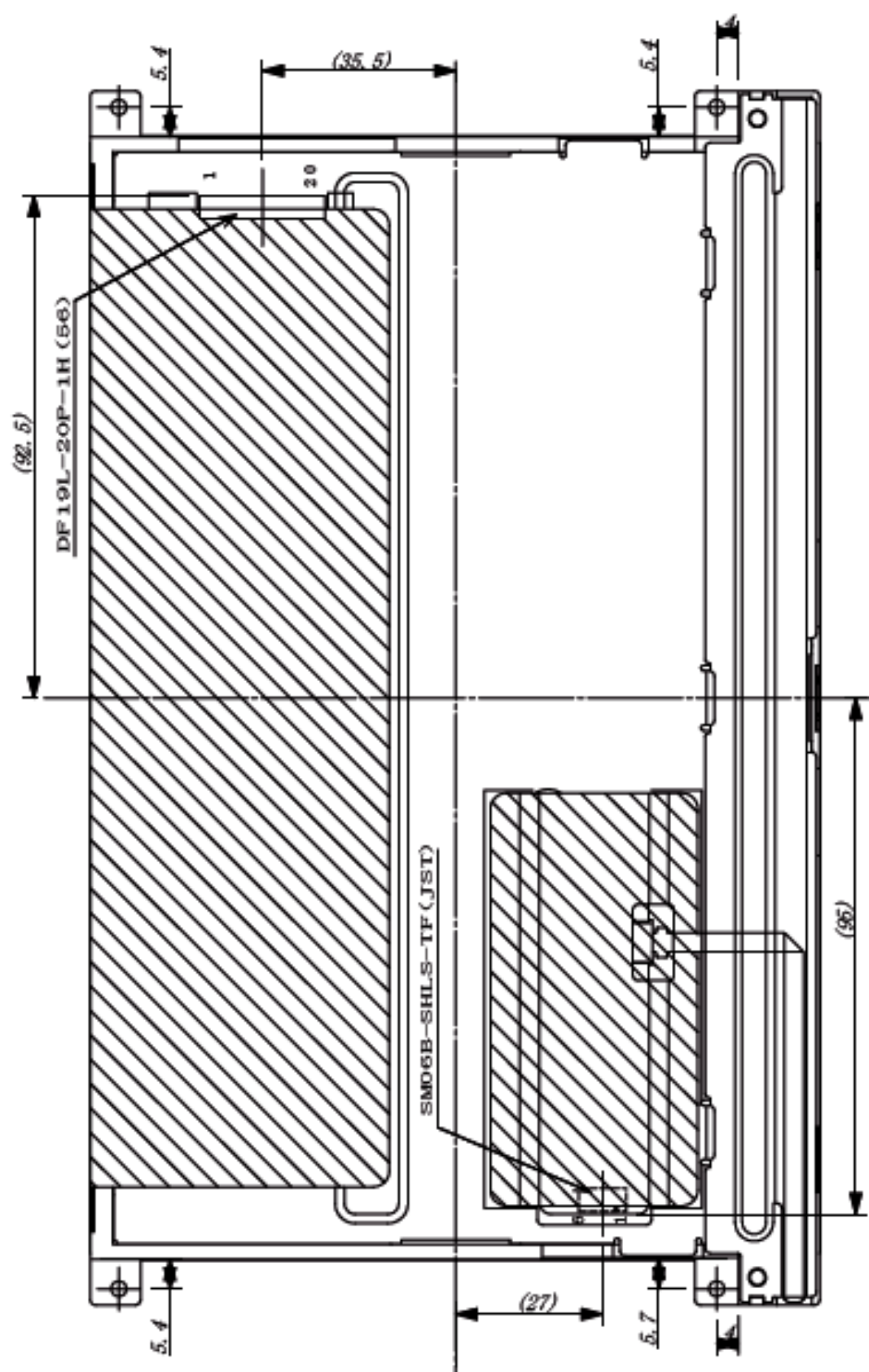
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\*The information contained herein may be changed without prior notice. It is therefore advisable to contact Toshiba Mobile Display before proceeding with the design of equipment incorporating this product.

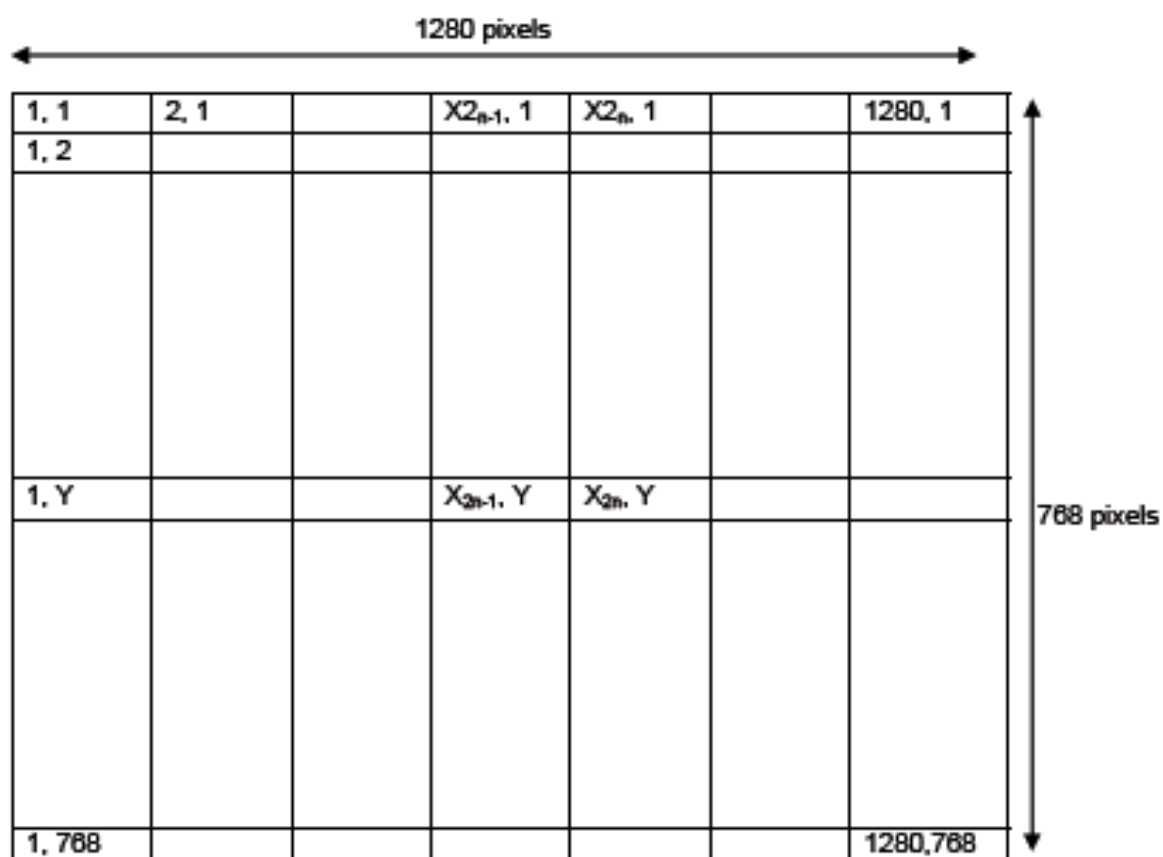
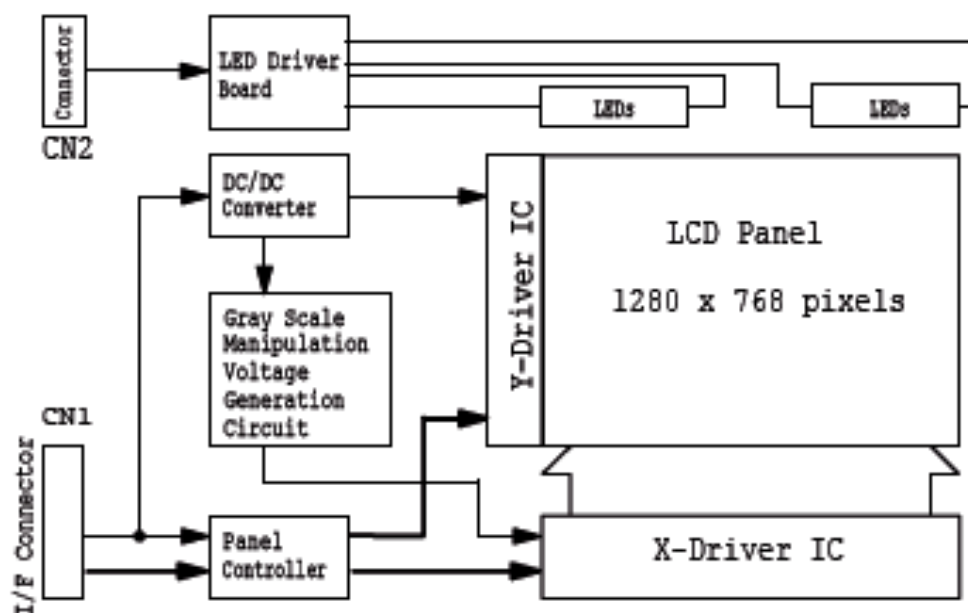


(Front side)

Unit : mm

Standard tolerance :  $\pm 0.5$ 

**BLOCK DIAGRAM**





TIMING SPECIFICATION <sup>1) 2) 3) 4) 5) 6)</sup>

Item	Symbol	min.	typ.	max.	unit
Horizontal Scanning Term	$t_h$	1560 x $t_c$	1664 x $t_c$	1712 x $t_c$	clock
H-sync Pulse Width	$t_{hw}$	4 x $t_c$	128 x $t_c$	-	clock
Horizontal Front Porch	$t_{hfp}$	8 x $t_c$	64 x $t_c$	-	clock
Horizontal Back Porch	$t_{hbp}$	8 x $t_c$	192 x $t_c$	-	clock
Horizontal Data Sync Period	$t_{hds}$	12 x $t_c$	320 x $t_c$	-	clock
Horizontal Display Term	$t_{hd}$	1280 x $t_c$	1280 x $t_c$	1280 x $t_c$	clock
Frame Period	$t_v$	771 x $t_h$	798 x $t_h$	825 x $t_h$	line
V-sync Pulse Width	$t_{vw}$	1 x $t_h$	7 x $t_h$	-	line
V-sync Set Up Time (to H-sync)	$t_{vsu}$	4 x $t_c$	-	-	clock
V-sync Hold Time	$t_{vhd}$	4 x $t_c$	-	-	clock
Vertical Front Porch	$t_{vfp}$	1 x $t_h$	3 x $t_h$	-	line
Vertical Back Porch	$t_{vbp}$	1 x $t_h$	20 x $t_h$	-	line
Vertical Data Sync Period	$t_{vds}$	2 x $t_h$	27 x $t_h$	-	line
Vertical Display Term	$t_{vd}$	768 x $t_h$	768 x $t_h$	768 x $t_h$	line
Clock Period	$t_c$	12.20 (82.0MHz)	12.58 (79.5MHz)	13.33 (75.0MHz)	ns

Note 1) Refer to "Timing Chart" and LVDS specifications in TIA/EIA-844.

Note 2) If DE is fixed to "H" or "L" level for certain period while NCLK is supplied, the panel displays black with some flicker.

Note 3) If NCLK is fixed to "H" or "L" level for certain period while DE is supplied, the panel may be damaged.

Note4)  $t_{vb} = t_{vw} + t_{vfp} + t_{vbp}$

$t_{hb} = t_{hw} + t_{hfp} + t_{hbp}$

Note5) In case of using the long frame period, the deterioration of display quality, noise etc. may be occurred.

Note6) NCLK count of each Horizontal Scanning Time should be always the same.

V-Blanking period should be "n" X "Horizontal Scanning Time". (n: integer)

Frame period should be always the same.

## CONNECTOR PIN ASSIGNMENT FOR INTERFACE

CN1 INPUT SIGNAL

Connector : 20268-020E-12E / I-PEX

Mating Connector : DF19G-20S-1F (FPC), DF19G-20S-1C (Cable)

Terminal No.	Symbol	Function
1	V <sub>cc</sub>	Power Supply : +3.3V
2	V <sub>cc</sub>	Power Supply : +3.3V
3	V <sub>cc</sub>	Power Supply : +3.3V
4	V <sub>cc</sub>	Power Supply : +3.3V
5	NC	Non-Connection
6	V <sub>ss</sub>	GND
7	V <sub>ss</sub>	GND
8	V <sub>ss</sub>	GND
9	V <sub>ss</sub>	GND
10	RxIND-	Negative LVDS differential data input (R0-R5,G0)
11	RxIND+	Positive LVDS differential data input (R0-R5,G0)
12	V <sub>ss</sub>	GND
13	RxIN1-	Negative LVDS differential data input (G1-G5, B0-B1)
14	RxIN1+	Positive LVDS differential data input (G1-G5, B0-B1)
15	V <sub>ss</sub>	GND
16	RxIN2-	Negative LVDS differential data input (B2-B5, HS, VS, DE)
17	RxIN2+	Positive LVDS differential data input (B2-B5, HS, VS, DE)
18	V <sub>ss</sub>	GND
19	RxCLKIN-	Clock Signal(-)
20	RxCLKIN+	Clock Signal(+)

Note 1) Please connect GND pin to ground. Don't use it as no-connect nor connection with high impedance.

Note 2) Please connect NC to nothing. Don't connect it to ground nor to other signal input.

CN2 LED INPUT SIGNAL

Connector: SM08B-SHLS-TF(LF)(SN) / JAPAN SOLDERLESS TERMINAL MFG CO., LTD.

Mating Connector: SHLP-08V-S-B (housing), SSHL-003T-P02 (contact pin)

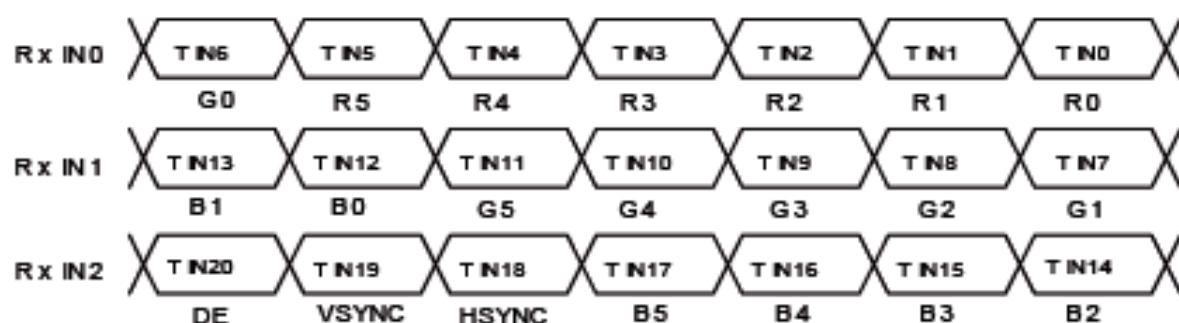
/ JAPAN SOLDERLESS TERMINAL MFG CO., LTD.

Terminal No.	Symbol	Function
1	VLED	Power Supply : +12V
2	VLED	Power Supply : +12V
3	VSS	GND
4	VSS	GND
5	ON/OFF	"H(+3.3V)":ON, "L(GND or Open)":OFF
6	PWM	1-100%(200Hz)

**RECOMMENDED TRANSMITTER TRANSMITTER (THC63LVDF83A,THC63LVDM83A,THC63LVDM83A-85)  
TO LT089AC29000 INTERFACE ASSIGNMENT**

# Case1: 6Bit TRANSMITTER

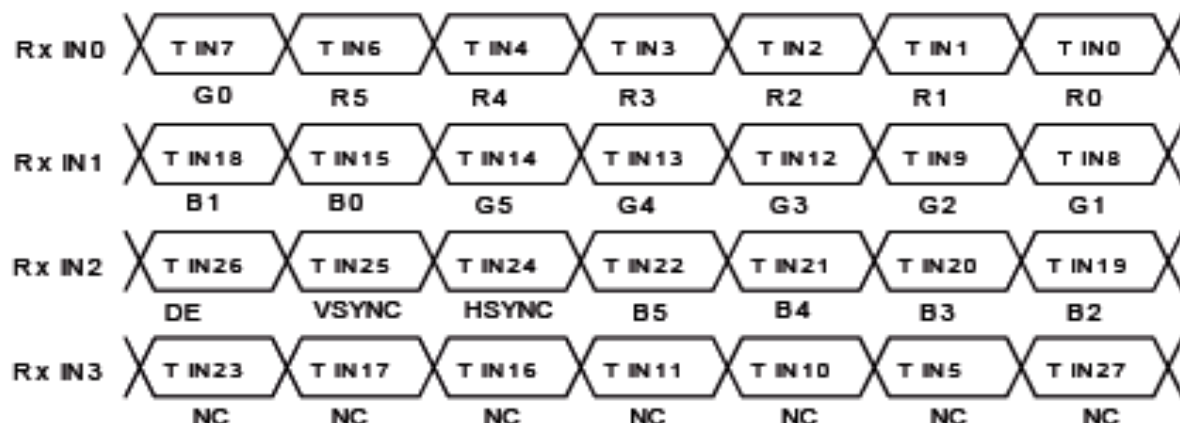
Input Terminal No.		Input Signal (Graphics controller output signal)		Output Signal Symbol	To LT089AC29000 Interface(CN1)	
Symbol	Terminal	Symbol	Function		Terminal	Symbol
TA0	44	R0	Red Pixels Display Data (LSB)	TA- TA+	No.5 No.6	RxIN0- RxIN0+
TA1	45	R1	Red Pixels Display Data			
TA2	47	R2	Red Pixels Display Data			
TA3	48	R3	Red Pixels Display Data			
TA4	1	R4	Red Pixels Display Data			
TA5	3	R5	Red Pixels Display Data (MSB)			
TA6	4	G0	Green Pixels Display Data (LSB)	TB- TB+	No.8 No.9	RxIN1- RxIN1+
TB0	6	G1	Green Pixels Display Data			
TB1	7	G2	Green Pixels Display Data			
TB2	9	G3	Green Pixels Display Data			
TB3	10	G4	Green Pixels Display Data			
TB4	12	G5	Green Pixels Display Data (MSB)			
TB5	13	B0	Blue Pixels Display Data (LSB)	TC- TC+	No.11 No.12	RxIN2- RxIN2+
TB6	15	B1	Blue Pixels Display Data			
TC0	16	B2	Blue Pixels Display Data			
TC1	18	B3	Blue Pixels Display Data			
TC2	19	B4	Blue Pixels Display Data			
TC3	20	B5	Blue Pixels Display Data (MSB)			
TC4	22	HSYNC	H-Sync	TCLK - TCLK +	No.14 No.15	CLK IN- CLK IN+
TC5	23	VSYNC	V-Sync			
TC6	25	DE	Compound Synchronization Signal			
CLK IN	26	NCLK	Data Sampling Clock			



**RECOMMENDED TRANSMITTER (THC63LVDF83A, THC63LVDM83A, THC63LVDM83A-85)  
TO LT089AC29000 INTERFACE ASSIGNMENT**

## Case2: 8Bit TRANSMITTER

Input Terminal No.		Input Signal (Graphics controller output signal)		Output Signal Symbol	To LT089AC29000 Interface(CN1)	
Symbol	Terminal	Symbol	Function		Terminal	Symbol
TA0	51	R0	Red Pixels Display Data (LSB)	TA- TA+	No.5 No.6	RxDIN0- RxDIN0+
TA1	52	R1	Red Pixels Display Data			
TA2	54	R2	Red Pixels Display Data			
TA3	55	R3	Red Pixels Display Data			
TA4	56	R4	Red Pixels Display Data			
TA5	3	R5	Red Pixels Display Data (MSB)			
TA6	4	G0	Green Pixels Display Data(LSB)	TB- TB+	No.8 No.9	RxDIN1- RxDIN1+
TB0	6	G1	Green Pixels Display Data			
TB1	7	G2	Green Pixels Display Data			
TB2	11	G3	Green Pixels Display Data			
TB3	12	G4	Green Pixels Display Data			
TB4	14	G5	Green Pixels Display Data(MSB)			
TB5	15	B0	Blue Pixels Display Data (LSB)	TC- TC+	No.11 No.12	RxDIN2- RxDIN2+
TB6	19	B1	Blue Pixels Display Data			
TC0	20	B2	Blue Pixels Display Data			
TC1	22	B3	Blue Pixels Display Data			
TC2	23	B4	Blue Pixels Display Data			
TC3	24	B5	Blue Pixels Display Data (MSB)			
TC4	27	HSYNC	H-Sync	TD- TD+	-	-
TC5	28	VSYNC	V-Sync			
TC6	30	DE	Compound Synchronization Signal			
TD0	50	NC	Non Connection (open)			
TD1	2	NC	Non Connection (open)			
TD2	8	NC	Non Connection (open)			
TD3	10	NC	Non Connection (open)			
TD4	16	NC	Non Connection (open)			
TD5	18	NC	Non Connection (open)			
TD6	25	NC	Non Connection (open)			
CLK IN	31	NCLK	Data Sampling Clock	TCLK- TCLK+	No.14 No.15	CLK- CLK+



256k (k=1024) COLORS COMBINATION TABLE

	Display	R5 R4 R3 R2 R1 R0	G5 G4 G3 G2 G1 G0	B5 B4 B3 B2 B1 B0	Gray Scale Level
Basic Color	Black	L L L L L L L	L L L L L L L	L L L L L L L	-
	Blue	L L L L L L L	L L L L L L L	H H H H H H H	-
	Green	L L L L L L L	H H H H H H H	L L L L L L L	-
	Light Blue	L L L L L L L	H H H H H H H	H H H H H H H	-
	Red	H H H H H H H	L L L L L L L	L L L L L L L	-
	Purple	H H H H H H H	L L L L L L L	H H H H H H H	-
	Yellow	H H H H H H H	H H H H H H H	L L L L L L L	-
Gray Scale of Red	White	H H H H H H H	H H H H H H H	H H H H H H H	-
	Black	L L L L L L L	L L L L L L L	L L L L L L L	L 0
	Dark ↑ ↓ Light	L L L L L L H	L L L L L L L	L L L L L L L	L 1
		L L L L L H L	L L L L L L L	L L L L L L L	L 2
		⋮	⋮	⋮	L3... L60
		H H H H L H	L L L L L L L	L L L L L L L	L61
		H H H H H L	L L L L L L L	L L L L L L L	L62
Red	H H H H H H	L L L L L L L	L L L L L L L	Red L63	
Gray Scale of Green	Black	L L L L L L L	L L L L L L L	L L L L L L L	L 0
	Dark ↑ ↓ Light	L L L L L L L	L L L L L L H	L L L L L L L	L 1
		L L L L L L L	L L L L L H L	L L L L L L L	L 2
		⋮	⋮	⋮	L3... L60
		L L L L L L L	H H H H L H	L L L L L L L	L61
		L L L L L L L	H H H H H L	L L L L L L L	L62
	Green	L L L L L L L	H H H H H H	L L L L L L L	Green L63
Gray Scale of Blue	Black	L L L L L L L	L L L L L L L	L L L L L L L	L 0
	Dark ↑ ↓ Light	L L L L L L L	L L L L L L L	L L L L L H L	L 1
		L L L L L L L	L L L L L L L	L L L L L H L	L 2
		⋮	⋮	⋮	L3... L60
		L L L L L L L	L L L L L L L	H H H H L H	L61
		L L L L L L L	L L L L L L L	H H H H H L	L62
	Blue	L L L L L L L	L L L L L L L	H H H H H H	Blue L63
Gray Scale of White & Black	Black	L L L L L L L	L L L L L L L	L L L L L L L	L 0
	Dark ↑ ↓ Light	L L L L L L H	L L L L L L H	L L L L L L H	L 1
		L L L L L H L	L L L L L H L	L L L L L H L	L 2
		⋮	⋮	⋮	L3... L60
		H H H H L H	H H H H L H	H H H H L H	L61
		H H H H H L	H H H H H L	H H H H H L	L62
	White	H H H H H H	H H H H H H	H H H H H H	White L63

**FOR SAFETY**

LCD module is generally designed with precise parts to achieve light weighted thin mechanical dimensions. In using our Modules, make certain that you fully understand and put into practice the warnings and safety precautions detailed in Engineering Information No.EE-D-001A, "CAUTIONS AND INSTRUCTIONS FOR TOSHIBA MOBILE DISPLAY CO., LTD LCD MODULES". Refer to individual specifications and TECHNICAL DATA sheets (hereinafter called "TD") for more detailed technical information.

**1) SPECIAL PURPOSES**

A) Toshiba Mobile Display's Standard LCD Modules have not been customized for operation in extreme environments or for use in applications where performance failures could be life-threatening or otherwise catastrophic.

B) Since Toshiba Mobile Display's Standard LCD Modules have not been designed for operation in extreme environments, they must never be used in devices that will be exposed to abnormally high levels of vibration or shock which exceed Toshiba Mobile Display's published specification limits.

C) In addition, since Toshiba Mobile Display Standard LCD Modules have not been designed for use in applications where performance failures could be life-threatening or catastrophic, they must never be installed in aircraft navigation control systems (such as, but not limited to Traffic Collision Avoidance System and Air Traffic Indicator), in military defense or weapons systems, in critical industrial process-control systems (e.g., those involved in the production of nuclear energy), or in critical medical device or patient life-support systems.

**2) DISASSEMBLING OR MODIFICATION**

DO NOT DISASSEMBLE OR MODIFY the module. It may damage sensitive parts inside LCD module, and may cause scratches or dust on the display. Toshiba Mobile Display does not warrant the module, if customer disassembled or modified it.

**3) BREAKAGE OF LCD PANEL**

DO NOT INGEST liquid crystal material, DO NOT INHALE this material, and DO NOT CONTACT the material with skin, if LCD panel is broken and liquid crystal material spills out. If liquid crystal material comes into mouth or eyes, rinse mouth or eyes out with water immediately. If this material contact with skin or cloths, wash it off immediately with alcohol and rinse thoroughly with water.

**4) GLASS OF LCD PANEL**

BE CAREFUL WITH CHIPS OF GLASS that may cause injuring fingers or skin, when the glass is broken.

**5) ELECTRIC SHOCK**

DISCONNECT POWER SUPPLY before handling LCD module. DO NOT TOUCH the parts inside LCD module and the connector or cables in order to prevent electric shock, because high voltage is supplied to these parts from power supply is turned on.

**6) ABSOLUTE MAXIMUM RATINGS AND POWER PROTECTION CIRCUIT**

DO NOT EXCEED the absolute maximum rating values under the worst probable conditions caused by the supply voltage variation, input voltage variation, variation in parts' constants, environmental temperature, etc., otherwise LCD module may be damaged. Employ protection circuit for power supply, whenever the specification or TD specifies it. Suitable protection circuit should be applied for each system design.

**7) DISPOSAL**

When dispose LCD module, obey to the applicable environmental regulations.

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