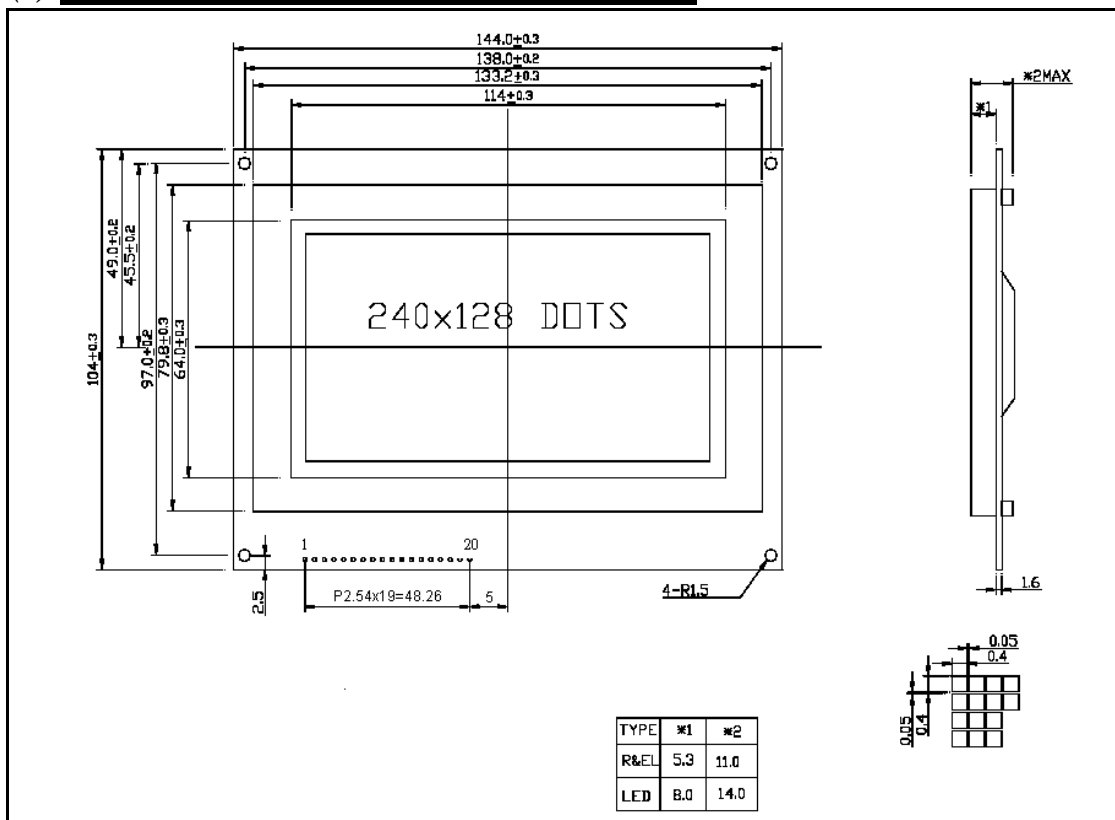


Datasheet For LCD Module – LKG-240128-A2

(1) General Specifications

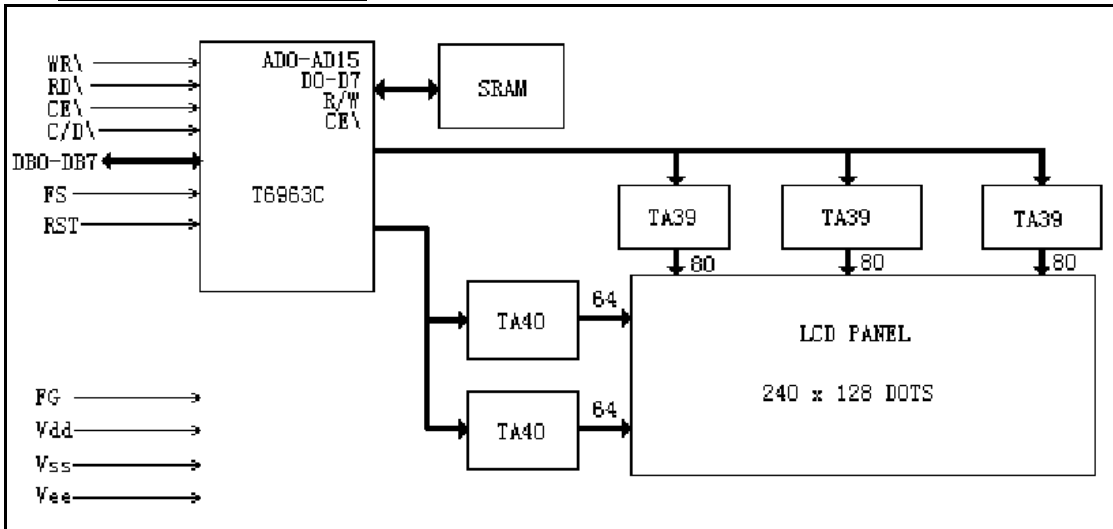
- 1.1 Display mode : STN yellow green
- 1.2 Pixel color : Black
- 1.3 Background color : Yellow green
- 1.4 Polarizer type : +ve Transflective
- 1.5 Viewing angle : 6:00
- 1.6 Driving method : 1/128 duty, 1/14 bias
- 1.7 Backlight : Yellow LED
- 1.8 Controller : T6963C
- 1.9 Data Transfer : 8 bit parallel
- 1.10 EL Driver : Built in
- 1.11 Operating temp. : 0 - 60° C
- 1.12 Storage temp. : -20 - 70° C
- 1.13 Resolution : 240 columns x 128 rows
- 1.14 -ve Voltage Generator : Built in
- 1.15 Evaluation Board : LKEB-G03-A (Optional)
- 1.16 Graphic Software : BHC240128MS1-0.1 (Optional)

(2) Mechanical Dimensions and Electrical Pin Out



1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
FG	GND	V _{CC}	V _O	/WR	/RD	/CE	C/D	/RST	DB0	DB1	DB2	DB3	DB4	DB5	DB6	DB7	FS	V _{EE}	LED+

(3) Circuit Block Diagram



(4) Absolute Maximum Ratings

Item	Symbol	Min.	Max.	Unit	Remark
Power Supply Voltage	V _{DD} - GND	-0.3	7.0	V	Allowable
LCD Driving Voltage	V _{LCD}	-0.3	25.0		
Operating Temperature Range	T _{op}	0	+60	°C	No Condensation
Storage Temperature Range	T _{st}	-20	+70		

(5) Electrical Characteristics

Item	Symbol	Min.	Typ.	Max.	Unit	
Supply Voltage (Logic)	V _{DD} - GND	4.5	5.0	5.5	V	
Supply Voltage (LCD drive)	V _{LCD}	-	18.0	-	V	
Supply Voltage (25 °C)	V _O	-	-13.0	-	V	
Input Signal Voltage	High	V _{IH} (V _{DD} = 5.0V)	0.7 V _{DD}	-	V _{DD}	V
	Low	V _{IL} (V _{DD} = 5.0V)	0.0	-	0.3 V _{DD}	V

(6) Pin Out Description

<i>Pin Number</i>	<i>Symbol</i>	<i>Level</i>	<i>Description</i>
1	FG	NC	Frame Ground
2	GND	0 V	Ground & LED Anode
3	V _{CC}	Var. V	Supply voltage for logic and LCD (+)
4	V _O	H/L	Contrast adjustment by different voltage
5	/WR	H/L	Write select signal, L = active & H = inactive
6	/RD	H/L	Read select signal, L = active & H = inactive
7	/CE	H/L	H : Chip enable, H [®] L : Data write into or read from
8	C/D	H/L	Data (L) and command (H) register
9	/RST	L [®] H	Reset the system (Keep at 1 after reset)
10	DB0	H/L	Data bit 0
11	DB1	H/L	Data bit 1
12	DB2	H/L	Data bit 2
13	DB3	H/L	Data bit 3
14	DB4	H/L	Data bit 4
15	DB5	H/L	Data bit 5
16	DB6	H/L	Data bit 6
17	DB7	H/L	Data bit 7
18	FS	H/L	Font selection, H = 6 x 8 & L = 8 x 8
19	V _{EE}	H/L	Output from built in -ve voltage generator
20	LED+	4.0 - 4.2 V	LED Cathode, Setting depend on light intensity

(7) MCU Interface

The **LKG-240128-A2** uses 8 bits of bi-directional data bus (D0-D7) and control line for reading or writing through an MCU interface. It has a built in **8K** bytes static RAM. Allocation of text, graphics and external generator RAM can be made easily and the display window can be moved freely within the allocated memory range. The device supports a very broad range of LCD formats by allowing selection of different combinations via a set of programmable inputs. It can be used in text, graphic and combination text-and-graphic modes, and includes various attribute functions.

The **LKG-240128-A2** have been hardware pin pre-set as follow :

Pins for selection of LCD size : 1 screen (single scan), 16 lines, 128 V-dots.

Pins for selection of number of columns : 80 columns.

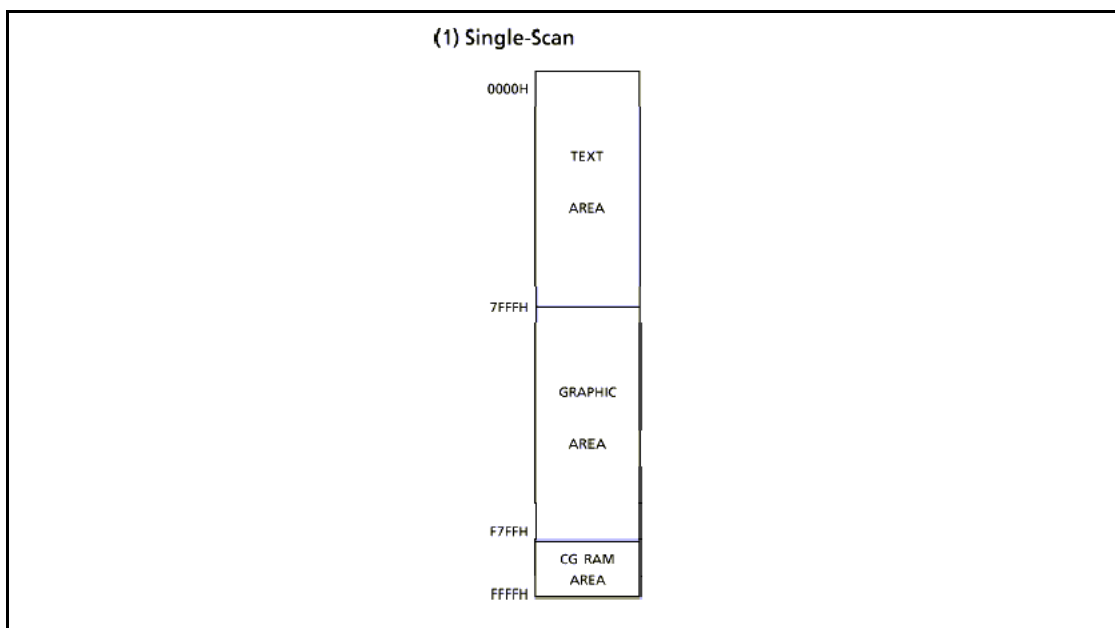
Pins for selection of font : 6 x 8 or 8 x 8 (With the input combination of FS).

7.1 Functional Definition

- After power on, it is necessary to reset. RES is kept L between 5 clock up (oscillation clock).
- The column / line counter and display register are cleared by RES. (Other registers are not cleared.) Disable the display using the clear-display register.
- The status must be checked before data or commands are sent. The MSB = 0 status check must be done in particular. There is a possibility of erroneous operation due to a hard interrupt.
- STA0 and STA1 must be checked at the same time. When a command is executed, data transmission errors may occur.
- The **LKG-240128-A2** can only handle one byte per machine cycle (16 clocks). It is impossible to send more than two data in a machine cycle.
- When using a command with operand data, it is important to send the data first, and then execute the command.
- The characters codes used by **LKG-240128-A2** are different from ASCII codes.

7.2 RAM Interface

The external RAM is used to store display data (text, graphic and external CG data). Since **LKG-240128-A2** is a single scan display, text data, graphic data and external CG data can be freely allocated.



7.3 Flowchart of Communications with MCU

1. Status Read

A status check must be performed before data is read or written.

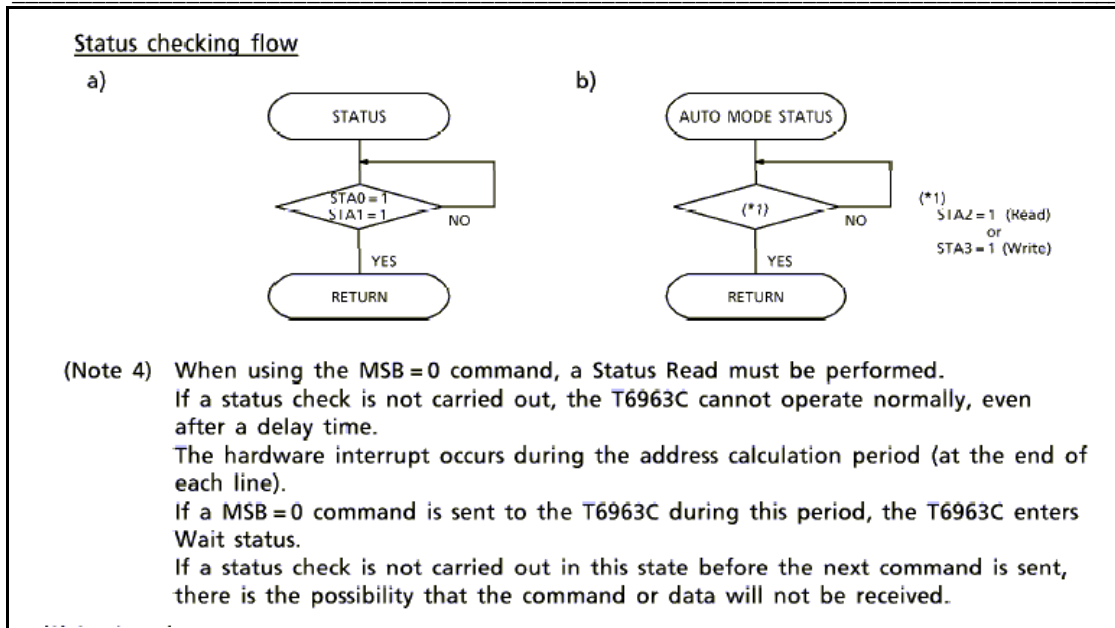
Status check

The Status of **LKG-240128-A2** can be read from the data lines.

/RD **L**
/WR **H**
/CE **L**
C/D **H**
DB0 to DB7 **Status word**

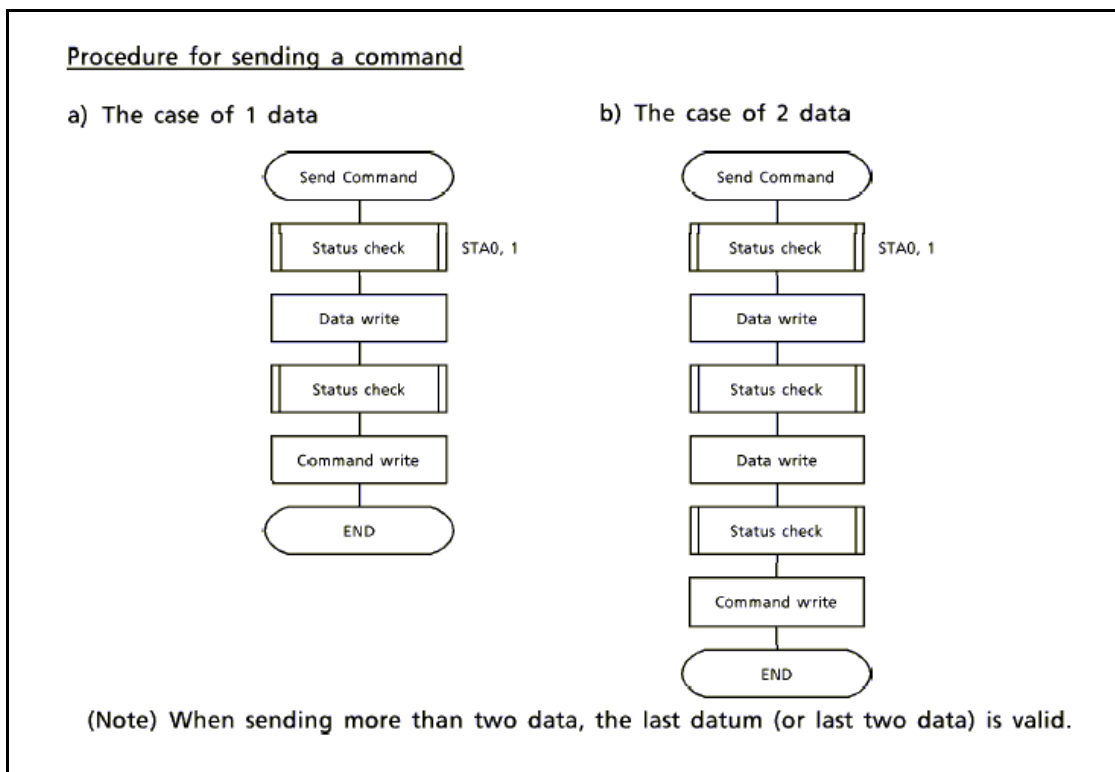
MSB		LSB					
STA7 D7	STA6 D6	STA5 D5	STA4 D4	STA3 D3	STA2 D2	STA1 D1	STA0 D0
STA0	Check command execution capability					0 : Disable 1 : Enable	
STA1	Check data read / write capability					0 : Disable 1 : Enable	
STA2	Check Auto mode data read capability					0 : Disable 1 : Enable	
STA3	Check Auto mode data write capability					0 : Disable 1 : Enable	
STA4	Not used						
STA5	Check controller operation capability					0 : Disable 1 : Enable	
STA6	Error flag. Used for Screen Peek and Screen copy commands.					0 : No error 1 : Error	
STA7	Check the blink condition					0 : Display off 1 : Normal display	

(Note 1) It is necessary to check STA0 and STA1 at the same time.
 There is a possibility of erroneous operation due to a hardware interrupt.
 (Note 2) For most modes STA0/STA1 are used as a status check.
 (Note 3) STA2 and STA3 are valid in Auto mode; STA0 and STA1 are invalid.



2. Setting data

When using **LKG-240128-A2**, first set the data, then set the command.



COMMAND	CODE	D1	D2	FUNCTION
Registers 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

COMMAND	CODE	D1	D2	FUNCTION
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)	

Pls. Refer to the datasheet of Toshiba T6963C LCD controller for the using of above command.