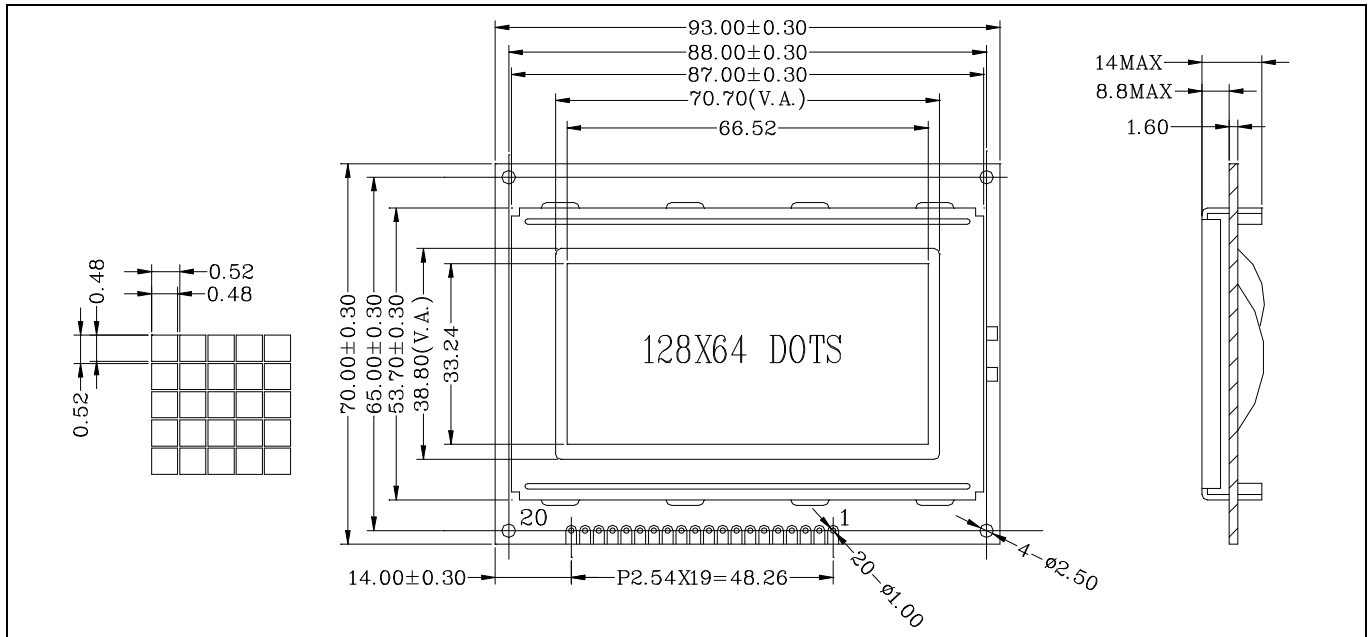




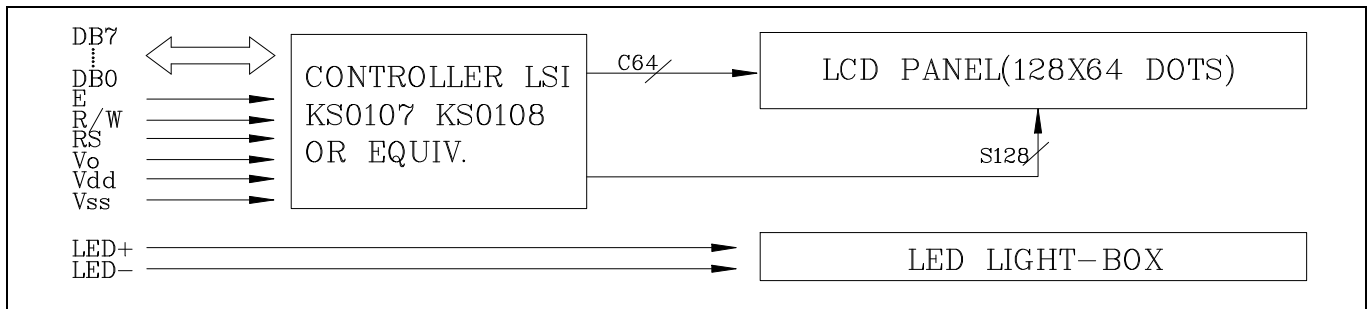
TQ12864BNL-1

128x64 DOTS GRAPHIC LCD MODULE
1/64 DUTY, 1/9 BIAS

EXTERNAL DIMENSIONS



BLOCK DIAGRAM



LED BACKLIGHT SPECIFICATIONS

LED Color : Yellow Green				
Suggested LED Power Supply to PIN 15, 16 5.0V DC	Current Consumption			
	MIN	TYP	MAX	UNIT
---	155	200	---	mA

*(With built on board current limited resistor version) *

MECHANICAL DATA

ITEM	DIMENSIONS	UNIT
Module Size (WxH)	93.0 x 70.0	mm
Viewing Area (WxH)	70.7 x 38.8	mm
Dot Pitch (WxH)	0.52 x 0.52	mm
Dot Size (WxH)	0.48 x 0.48	mm

INTERFACE PIN CONNECTIONS

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
V _{SS}	V _{DD}	V _O	RS	R/W	E	DB0	DB1	DB2	DB3	DB4	DB5	DB6	DB7	CS1	CS2	RST	VEE	A	K

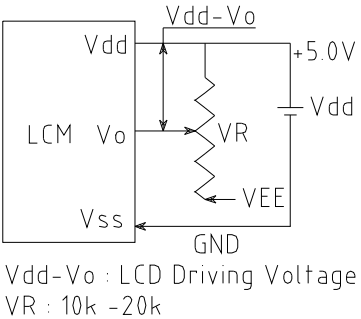
ELECTRICAL CHARACTERISTICS

ITEM	SYMBOL	CONDITION	MIN	TYP	MAX	UNIT
LCD Operating Voltage	V _{DD} - V _O (V _{LCD})	T = -20°C	-	9.2	-	V
		T = 0°C	-	9.1	-	V
		T = 25°C	-	9	-	V
		T = 50°C	-	8.9	-	V
		T = 70°C	-	8.5	-	V
Supply Voltage	V _{DD} - V _{SS} (Logic)	-	4.5 ^{*1}	5	5.5	V
Supply Current	I _{DD}	-	-	2	6	mA
Input Voltage	"HIGH" Level, V _{HI}	-	2.2	-	V _{DD}	V
	"LOW" Level, V _{LI}	-	0	-	0.6	V
Output Voltage	"HIGH" Level, V _{OHI}	-	2.4	-	-	V
	"LOW" Level, V _{OVI}	-	-	-	0.4	V

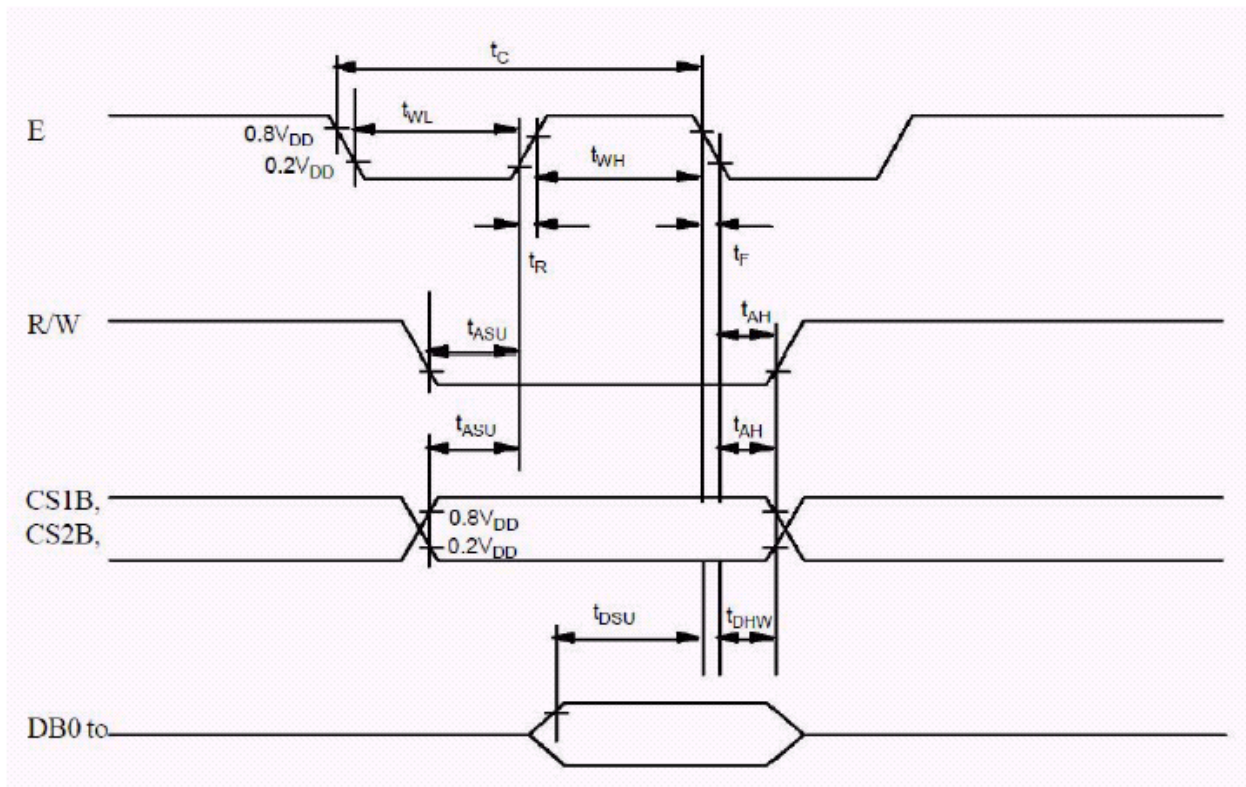
FEATURE

- STN BLUE LCD
- 6 o'clock viewing angle
- NEGATIVE mode
- Transmissive type
- Normal temperature operation (0°C to +50°C)
- 128 x 64 DOTS
- Built-in controller (KS0107, KS0108 OR equivalent)
- 4.5 - 5.5V logic power supply
- 1/64 duty cycle, 1/9 bias
- Standard V_{LCD} series

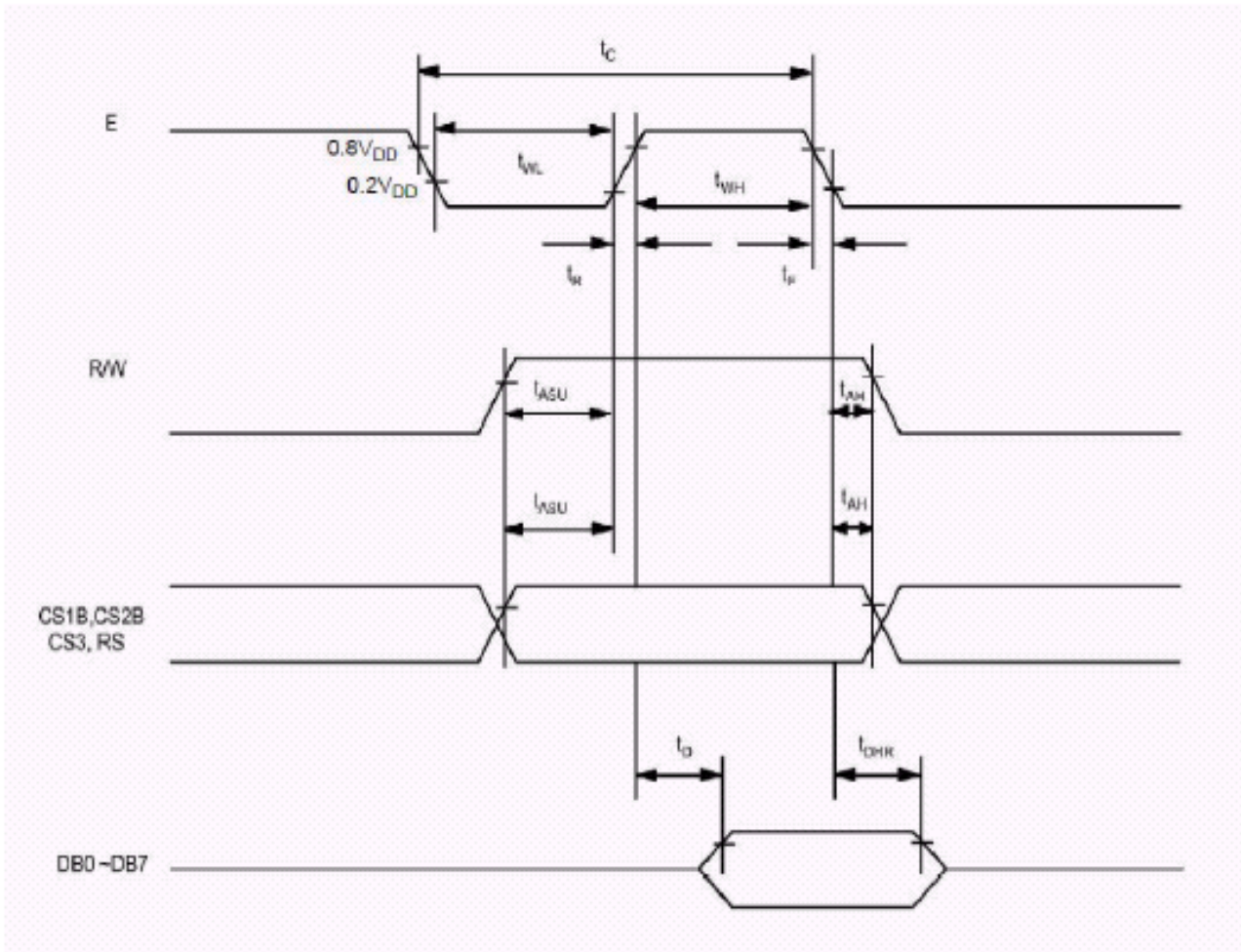
INTERFACE PIN CONNECTIONS

PIN NO.	SYMBOL	LEVEL	FUNCTION	DUAL SUPPLY VOLTAGE TYPES
1	Vss	0V	Ground	 <p>Vdd-Vo : LCD Driving Voltage VR : 10k -20k</p>
2	Vdd	5.0	Supply voltage for logic	
3	Vo	---	Input voltage for LCD	
4	RS	H/L	H : Data signal , L: Instruction signal	
5	R/W	H/L	H : Read mode , L: Write mode	
6	E	H,H->L	Chip enable signal	
7	DB0	H/L	Data bit 0	
8	DB1	H/L	Data bit 1	
9	DB2	H/L	Data bit 2	
10	DB3	H/L	Data bit 3	
11	DB4	H/L	Data bit 4	
12	DB5	H/L	Data bit 5	
13	DB6	H/L	Data bit 6	
14	DB7	H/L	Data bit 7	
15	CS1	H	Chip select signal for IC1	
16	CS2	H	Chip select signal for IC2	
17	RST	L	Reset signal	
18	VEE	-5V	Output voltage for LCD	
19	A	5V	Backlight anode	
20	K	0V	Backlight cathode	

The MPU write timing waveform is given below.



The MPU read timing waveform is shown below.



Parameter	Symbol	Min.	Typ.	Max.	Unit
E Cycle	t_C	1000	-	-	ns
E High Level Width	t_{WH}	450	-	-	ns
E Low Level Width	t_{WL}	450	-	-	ns
E Rise Time	t_R	-	-	25	ns
E Fall Time	t_F	-	-	25	ns
Address Set-up Time	t_{ASU}	140	-	-	ns
Address Hold Time	t_{AH}	10	-	-	ns
Data Set-up Time	t_{SU}	200	-	-	ns
Data Delay Time	t_D	-	-	320	ns
Data Hold Time (Write)	t_{DHW}	10	-	-	ns
Data Hold Time (Read)	t_{DHR}	20	-	-	n

DISPLAY CONTROL INSTRUCTION

Instruction	RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0	Function
DISPLAY ON/OFF	L	L	L	L	H	H	H	H	H	L/H	Controls the DISPLAY ON or OFF. Internal status and display RAM data are not affected. L:OFF, H:ON
SET ADDRESS (Y-ADDRESS)	L	L	L	H	Y-ADDRESS (0 ~ 63)					Sets the Y-address in the Y counter.	
SET PAGE (X-ADDRESS)	L	L	H	L	H	H	H	PAGE (0 ~ 7)		Sets the X-address in the X-address register	
DISPLAY START LINE (Z-ADDRESS)	L	L	H	H	DISPLAY START LINE (0 ~ 63)					Determines the display data RAM displayed at the top of the screen	
STATUS READ	L	H	B U S Y	L	O N / O F F	R E S E T	L	L	L	L	Reads status BUSY : L=READY H=IN OPERATION ON/OFF: L=DISPLAY ON H=DISPLAY OFF RESET: L=NORMAL H=RESET
WRITE DISPLAY DATA	H	L	WRITE DATA								Writes data (DB0 to DB7) to the display data RAM. After writing instruction, Y-address is automatically incremented by 1.
READ	H	H	READ DATA								Reads data (DB0 to DB7) from display data RAM to the data bus.

DISPLAY ON/OFF

The Display ON/OFF instruction is shown below:

RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
0	0	0	0	1	1	1	1	1	D

DB0 is given the value of D. When D is "1", the display data appears on the screen. When D is "0", the display data is not shown on the screen; however, the display data is still present in the Display Data RAM. Thus, by changing D="0" to D="1", the display data can reappear.

SET ADDRESS (Y-ADDRESS)

The Set Address instruction is shown below:

RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
0	0	0	1	AC5	AC4	AC3	AC2	AC1	AC0

The Display Data RAM's Y-Address (AC0 to AC5) is set in the Y-Address Counter. AC0 to AC5 are set by instruction and are automatically incremented by 1 by the read or write operations.

SET PAGE (X-ADDRESS)

The Set Page instruction is shown below:

RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
0	0	1	0	1	1	1	AC2	AC1	AC0

The Display Data RAM's X-Address (AC0 to AC2) are set in the X-Address counter. Writing or reading to or from the MPU is executed in this specified page until the next page is set.

STATUS READ

The Status Read instruction is shown below:

RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
0	1	BUSY	0	ON/OFF	RESET	0	0	0	0

BUSY

When BUSY is "1", no instructions can be accepted since PT6608 is busy executing an internal operation. When BUSY is "0", PT6608 is ready to accept any instruction.

ON/OFF

When the ON/OFF is "1", display is turned ON. Conversely, when ON/OFF is "0", display is turned OFF.

RESET

When RESET is "1", the system is being restarted or initialized. Under this condition, with the exception of the Status Read instruction, no instructions can be accepted. When RESET is "0", the reset or initializing operation has been completed and the system is in its normal operating condition.

WRITE DISPLAY DATA

The Write Display Data instruction is shown below:

RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
1	0	D7	D6	D5	D4	D3	D2	D1	D0

The data bits D0 to D7 are written into the Display Data RAM. After writing instruction is completed, the Y-Address is incremented automatically by 1.

READ DISPLAY DATA

The Read Display Data instruction is shown below:

RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
1	1	D7	D6	D5	D4	D3	D2	D1	D0

The data bits D0 to D7 are read from the Display Data RAM. After the reading operation is completed, the Y-Address is incremented automatically by 1.