■ General Description

The GT9128A is a memory mapped segment-type LCD driver which has 128 patterns . It can easily interface to microprocessor or microcontroller via a serial interface like accessing the serial EEPROM. There are only three or four lines required for communication with the host CPU.

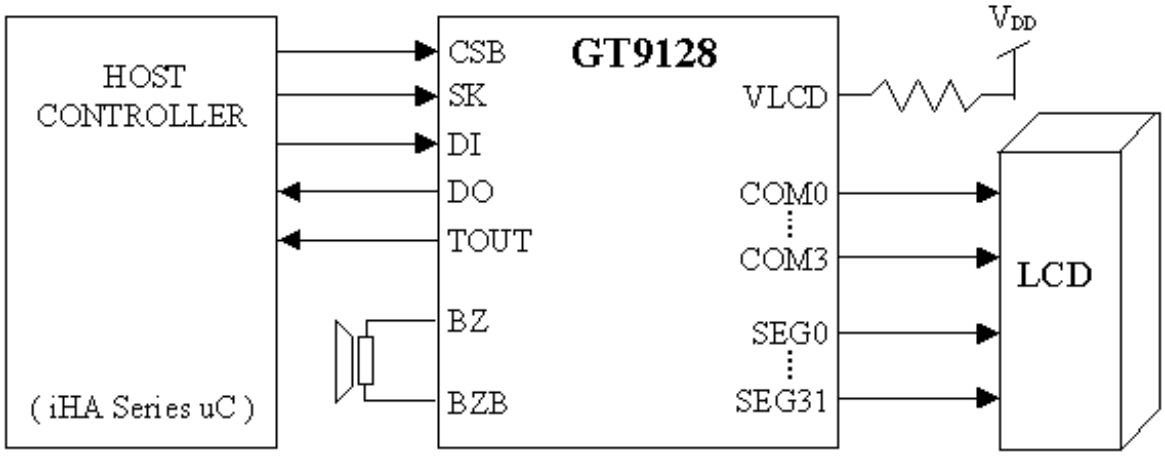
■ Features

1) Operates on 2.4V to 5.25V
2) Lower power CMOS process.
3) Compact package. (7.0x7.0 mm^2 square)
4) On chip built-in 256kHz oscillator
5) Serial EEPROM like access interface
6) Up to 4 common and 32 segment output.
7) Support 1/2,1/3, or 1/4 duty display.
8) Support 1/2 ,1/3 bias for LCD power display.
9) Programmable timer output for external control.
10) Selectable 2kHz or 4kHz base frequency output.
11) Power down mode to reduce power consumption.

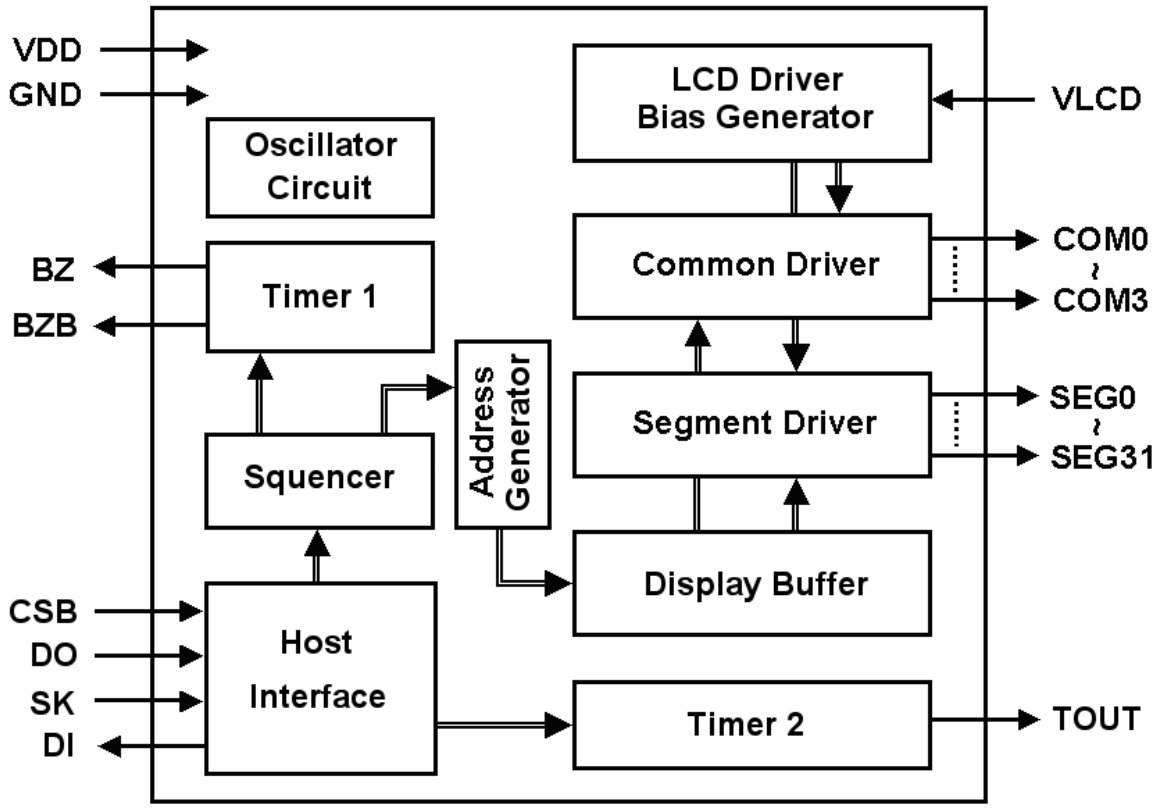
■ Applications

Portable sets, cameras, telephones, radio, VCD players, DVD players, MP3 players, digital recorder, home appliance and those applications using LCD display.

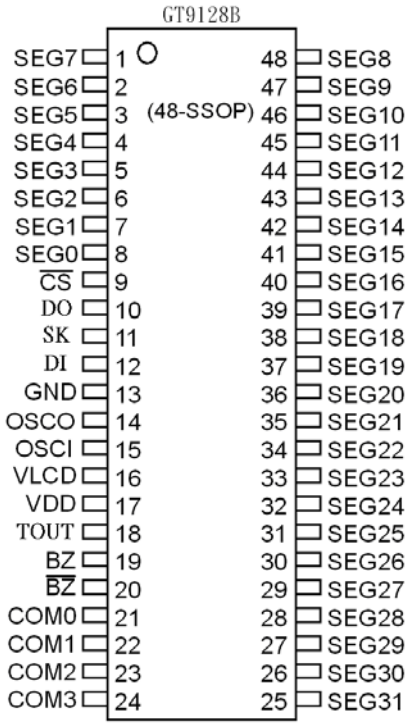
■ Typical Application Block Diagram

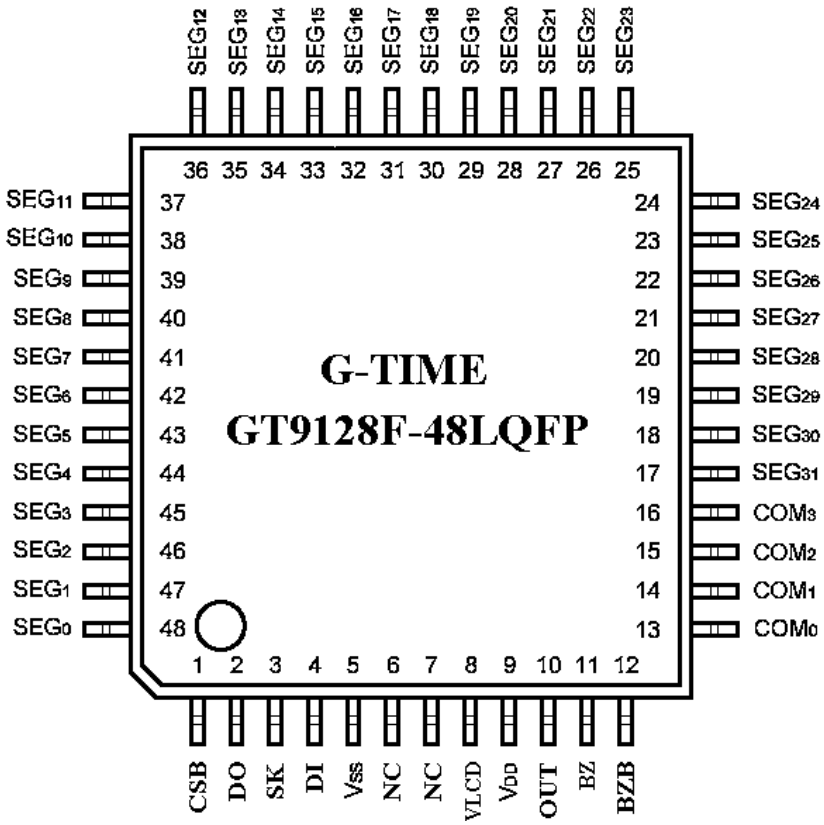


■ Block Diagram



■ Pin Assignment





■ Pin Descriptions

Pad No	Pad Name	I/O	Function
1	CSB	I	Chip select input
2	DO	O	Data output
3	SK	I	Shift clock
4	DATA	I	Data input
5	VSS	--	Power ground
6, 7	NC	--	Not connection (left open on application)
8	VLCD	I	Power input for LCD voltage divider
9	VDD	--	Power supply input
10	TOUT	O	Timer output
11, 12	BZ, BZB	O	2KHz or 4KHz frequency output pins
13~16	COM0~ COM 3	O	LCD common driver outputs
17~48	SEG0~SEG31	O	LCD segment driver outputs

■ Absolute Maximum Ratings (Ta=25℃, VSS=0V)

Symbol	Parameter	Rating	Unit
V_{DD}	Power Supply Voltage	-0.3 ~ 5.5	V
V_{LCD}	LCD Supply Voltage	-0.3 ~ VDD	V
T_{IN}	Input voltage	V_{SS} – 0.3 ~ V_{DD}+0.3	V
T_A	Operating Temperature	-20 ~ 75	^{O}C
T_{STG}	Storage Temperature	-55 ~ +125	^{O}C

■ D.C. Characteristics (Ta=25°C, VSS=0V)

Symbol	Parameter	Test Condition		Min.	Typ.	Max.	Unit
V_{DD}	Operating Voltage	—	—	2.4	—	5.25	V
I_{DD}	Operating Current	3V	LCD on	—	150	300	μA
		5V		—	300	600	μA
I_{STB}	Standby Current	3V	Power down mode	—	0.1	5	μA
		5V		—	0.3	10	μA
V_{IL}	Input Low Voltage	3V	CSB, SK, DI, DO	0	—	0.6	V
		5V		0	—	0.8	V
V_{IH}	Input High Voltage	3V	CSB, SK, DI, DO	2.0	—	3.0	V
		5V		2.4	—	5.0	V
I_{OL}	TOUT, BZ, BZB, DO	3V	V_{OL}=0.5V	0.5	1.873	—	mA
		5V	V_{OL}=1V	1.5	4.71	—	mA
I_{OH}	TOUT, BZ, BZB, DO	3V	V_{OH}=2.3V	-0.3	-0.762	—	mA
		5V	V_{OH}=4V	-0.5	-1.09	—	mA
R_{PH}	Pull-high Resistor	3V		30	50	100	kΩ

■ A.C. Characteristics (Ta=25°C, VSS=0V)

Symbol	Parameter	Test Condition	Min.	Typ.	Max.	Unit
F_{SYS}	System Clock	On chip oscillator	—	256	—	kHz
F_{LCD}	LCD Clock	On chip oscillator	—	F_{SYS} / 1024	—	Hz
F_{BZ}	Buzzer Frequency	On chip oscillator	1.8/3.6	2.0 or 4.0	2.4/4.8	kHz
T_{CS}	CSB Pulse width	—	—	250	—	ns
T_{CLK}	SK Pulse width	—	2.0	—	—	μs
T_R	Rise time of SK	90% of VDD	—	20	—	ns
T_F	Fall time of SK	10% of VDD	—	20	—	ns
T_{SU}	Data setup time to SK	—	—	120	—	ns
T_H	Data hold time to SK	—	—	120	—	ns
T_{SU1}	CSB setup time to SK	—	—	100	—	ns
T_{H1}	CSB hold time to SK	—	—	100	—	ns

■ Timing Diagrams

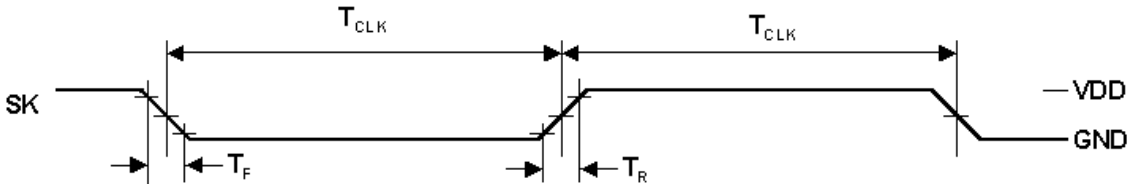


Fig. 1

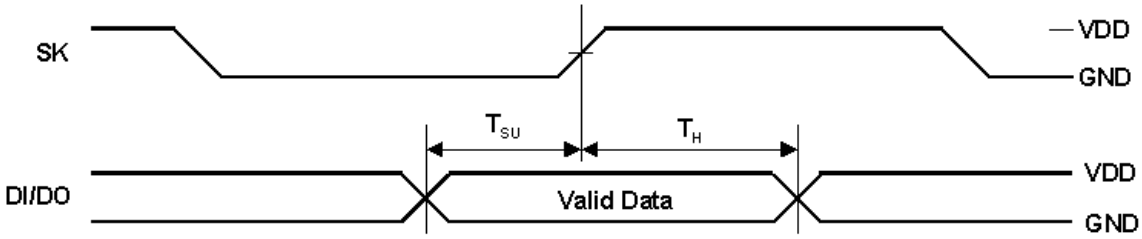


Fig. 2

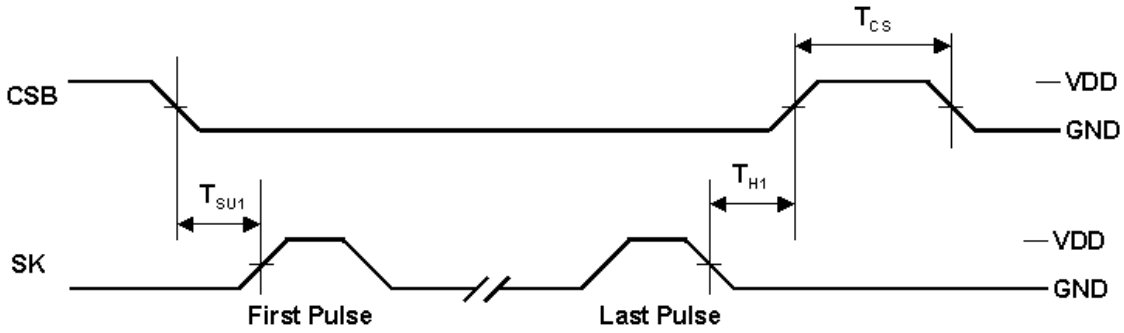
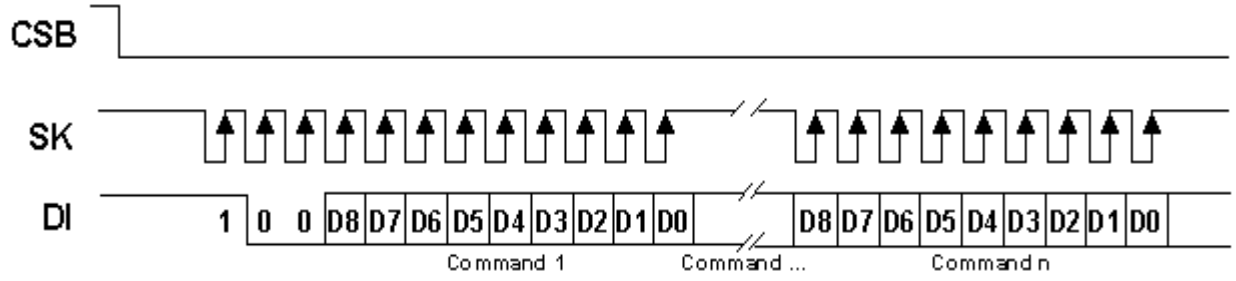
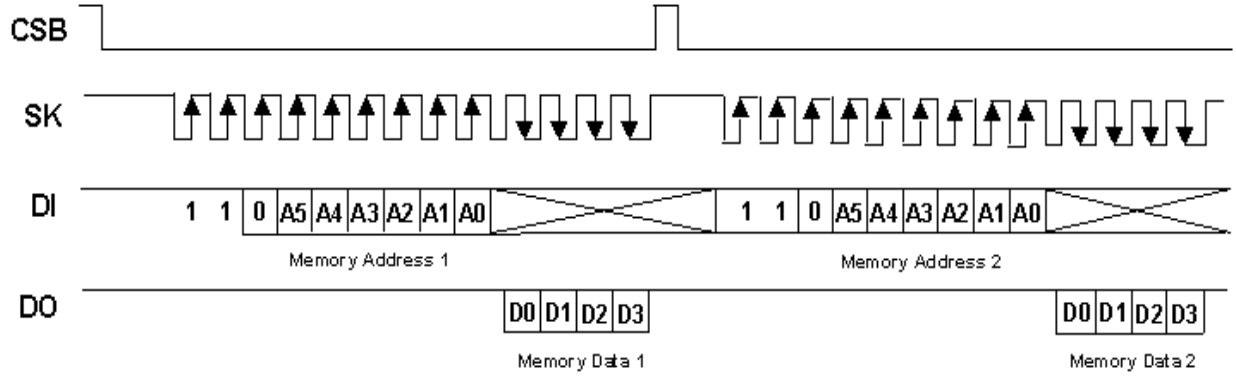


Fig. 3

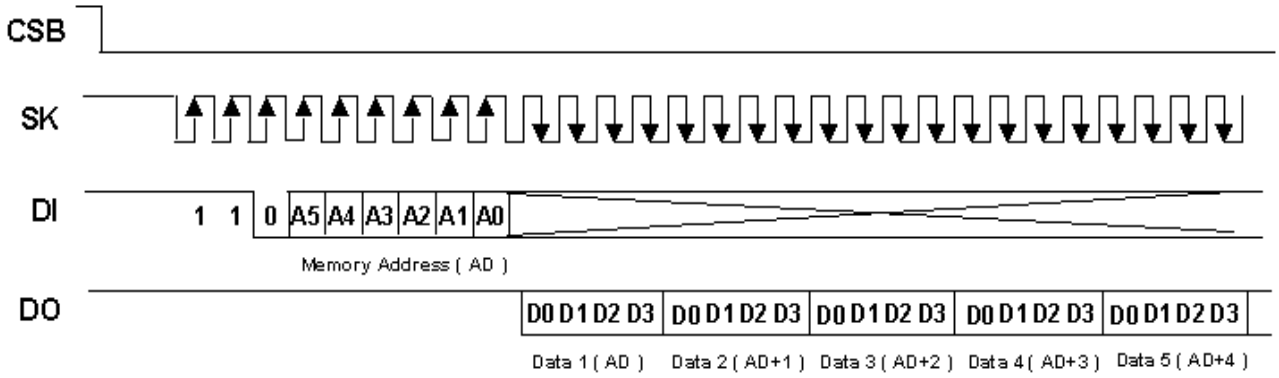
Functional Commands Setting



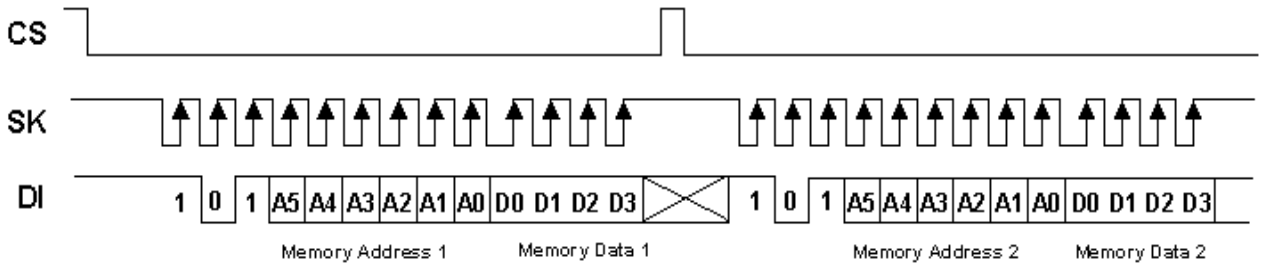
READ mode



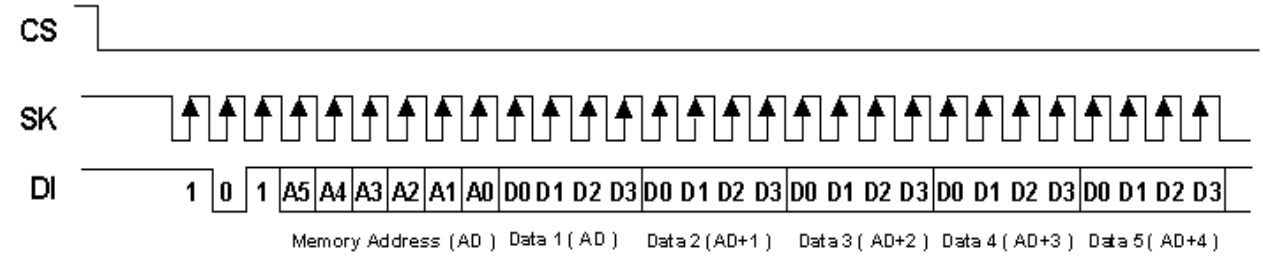
READ mode (successive reading)



WRITE Mode



WRITE Mode (successive write)



■ Display Buffer to LCD Segments Mapping

		SEG0	SEG1	SEG2	SEG3	.....	SEG31
	Data \ Addr	0	1	2	3	.....	31
COM0	D0					.....	
COM1	D1					.....	
COM2	D2					.....	
COM3	D3					.....	

Table 1

■ Function Table & Descriptions

Function Listing

Operation	ID	Address	Data	Comments
Read	110	A5-A0	D0-D3	Read Data from the display RAM.
Write	101	A5-A0	D0-D3	Write Data to The RAM.
Command Write	100			See command operations

Command operations

Function	ID	Command Code	Description
CHIP DISABLE	100	1000-01X0-X	Turn off oscillator and LCD bias generator (Default)
OSC ENABLE 1	100	1000-10X0-X	System oscillator enable 1
OSC ENABLE 2	100	1001-01X0-X	System oscillator enable 2
LCD OFF	100	1010-1101-X	Turn off LCD bias generator
LCD ON	100	1010-1111-X	Turn on LCD bias generator
BIAS & DUTY	100	1010-*xyz*0-X	*xy*={0,1,2} : {1/2,1/3,1/4}duty; *z*={0,1}: {1/3,1/2}bias
TONE OFF	100	1011-0000-X	Turn off tone outputs
TONE ON	100	1011-0010-X	Turn on tone outputs
TONE 2K	100	1011-0110-X	Tone frequency, 2kHz
TONE 4K	100	1011-0100-X	Tone frequency, 4kHz
BEEPER OFF	100	1011-1X10-X	Beeper disable
BEEPER ON	100	1011-1X00-X	Beeper enable
TIMER DIS	100	1100-1000-X	Disable time base output
TIMER EN	100	1100-1001-X	Enable time base output
CLR TIMER	100	1100-1011-X	Clear the contents of time base generator
TOUT DUTY	100	1100-110X-X	TOUT 50/50 Duty
TOUT DUTY	100	1100-111X-X	1/128 duty of TOUT (not including TOUT 16K and 32K)
TOUT 0.5	100	1100-0000-X	TOUT output 0.5Hz cycle
TOUT 1	100	1100-0001-X	TOUT output 1Hz cycle
TOUT 2	100	1100-0010-X	TOUT output 2Hz cycle
TOUT 4	100	1100-0011-X	TOUT output 4Hz cycle
TOUT 8	100	1100-0100-X	TOUT output 8Hz cycle
TOUT 16	100	1100-0101-X	TOUT output 16Hz cycle
TOUT 16K	100	1100-0110-X	TOUT output 16kHz cycle
TOUT 32K	100	1100-0111-X	TOUT output 32kHz cycle