

## Features

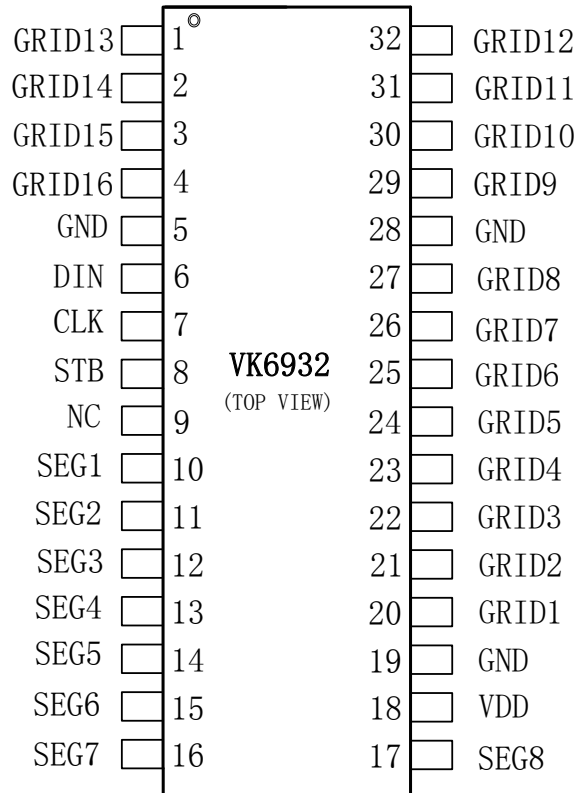
- Operating voltage 3.0-5.5V
  - Built-in RC oscillator
  - 8SEG pins,16 GRID pins
  - SEG pins connect to LED Anode , GRID pins connect to LED Cathode
  - 4-wire interface
  - 8-level brightness control
  - Built-in 8×16 bit display RAM
  - Power-On Reset(POR)
- 
- Package:  
SOP32. (21.00mm x 7.50mm PP=1.27mm)

## 1 General Description

VK6932 is a RAM Mapping LED display driver with key scan, The Display segment numbers in the device is 8SEGx16GRID.it suitable for multiple LED applications including LED modules and display subsystems. The device communicates with host microcontrollers via a 3 line serial Interface,it is used to configure display parameters and transfer display data.SOP32 package.

## 2 Pinouts and pin description

### 2.1 VK6932 SOP32 Pin Assignment

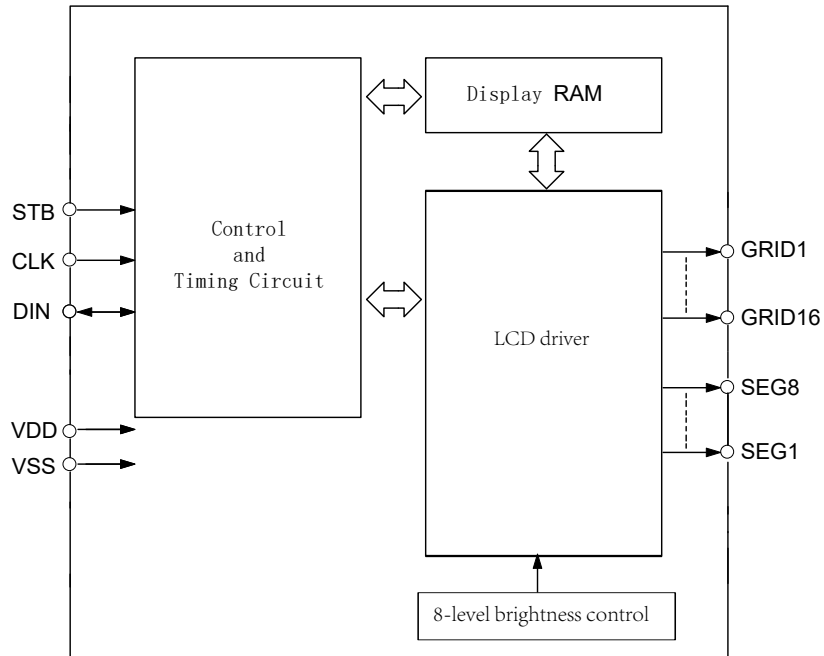


## 2.2 VK6932 SOP32 Pin Description

No.	Name	I/O	Function
1-4 20-27 29-32	GRID1-GRID16	O	LED GRID outputs (N-MOS open drain )
5,19 28	GND	GND	Negative power supply
6	DIN	I	data in pin, data input from low bit. Read the data of the DIN pin to the display RAM at the rising edge of the CLK.
7	CLK	I	CLK signal input pin, reads the data of the DIN pin to the display RAM on the rising edge.
8	STB	I	Chip selection signal input pin, 1-disable, 0-enable.
18	VDD	VDD	Positive power supply
10-17	SEG1-SEG8	O	LED SEG outputs (P-MOS open drain )

### 3 Functional Description


#### 3.1 Block diagram



## 3.2 Display RAM

The static display memory (RAM) is organized into  $8 \times 16$  bits and stores the displayed data. The contents of the RAM are directly mapped to the contents of the LCD driver. Display address is 0xC0-0xCF, the RAM size is 16 bytes. If you want to lighted on or off an LED, only set or clear the corresponding display RAM bit to 1 or 0. For example, if LED1 driven by SEG1 pin and GRID1 pin is on or off, only set bit0 to 1 or 0 of the corresponding display RAM (0xc0). The ram bit corresponding to the unused SEG pin is cleared to 0.

The following is a mapping from the RAM to the LED pattern:

SEG GRID	SEG8	SEG7	SEG6	SEG5	SEG4	SEG3	SEG2	SEG1	Address
GRID1									0xC0
GRID2									0xC1
GRID3									0xC2
GRID4									0xC3
GRID5									0xC4
GRID6									0xC5
GRID7									0xC6
GRID8									0xC7
GRID9									0xC8
GRID10									0xC9
GRID11									0xCA
GRID12									0xCB
GRID13									0xCC
GRID14									0xCD
GRID15									0xCE
GRID16									0xCF
	D7	D6	D5	D4	D3	D2	D1	D0	

Note:

At the initial system power on, the value stored in the chip display RAM may be random. It is recommended to clear the display RAM after power on, write 0x00 to the all display RAM ( 0xc0-0xcf).

SEG pins connect to LED Anode, GRID pins connect to LED Cathode, Reverse connection is not allowed.

## 3.3 Serial communication command

### 3.3.1 Serial Interface

3 lines are required to interface with the VK6932

STB is the chip select pin. it is used to enable / disable communication with the controller, high level disable (prohibits and initializes internal timing), low level enables. The first byte input by the DIN pin after the falling edge of the STB is used as the command. If the STB is set to high level during instruction or data transmission, the serial communication is initialized and the command or data being transmitted is invalid.

CLK is the clock signal pin. It reads the data of DIN pin to display RAM on the rising edge.

DIN is the data IN pin. It is used to write data or write commands.

### 3.3.2 Command Format

Command is used to set the Display Mode or write the Display Data or read Key data. After the falling edge of STB, the first byte input by DIO is used as the command byte. After decoding, Bit7 and bit6 of the byte are the command bits, as shown in the following table:

bit7	bit6	Command Function
0	1	Data Read/Write&Set Command
1	0	Display Control Command
1	1	Address Set Command

### 3.3.3 Command Description

#### 3.3.3.1 Data Read/Write&Set Command

This command is used to write Display data and related commands. Bit1 and bit0 bits are not allowed to be set to 01 or 11.

when powered on, bit3-bit0 data is 0.

bit7	bit6	bit5	bit4	bit3	bit2	bit1	bit0	Function	Note
0	1	---				0	0	Write data	Write data to the RAM
0	1				0			Address mode set	address increase
0	1				1				address fixed
0	1			0				work mode set	normal mode
0	1			1					test mode

#### 3.3.3.2 Address Set Command

Set the address of the Display RAM (0xC0 - 0xCF). When powered on, the address is set to 0xC0(default).

bit7	bit6	bit5	bit4	bit3	bit2	bit1	bit0	RAM Address
1	1	---		0	0	0	0	0xC0
1	1			0	0	0	1	0xC1
1	1			0	0	1	0	0xC2
1	1			0	0	1	1	0xC3
1	1			0	1	0	0	0xC4
1	1			0	1	0	1	0xC5
1	1			0	1	1	0	0xC6
1	1			0	1	1	1	0xC7
1	1			1	0	0	0	0xC8
1	1			1	0	0	1	0xC9
1	1			1	0	1	0	0xCA
1	1			1	0	1	1	0xCB
1	1			1	1	0	0	0xCC
1	1			1	1	0	1	0xCD
1	1			1	1	1	0	0xCE
1	1			1	1	1	1	0xCF



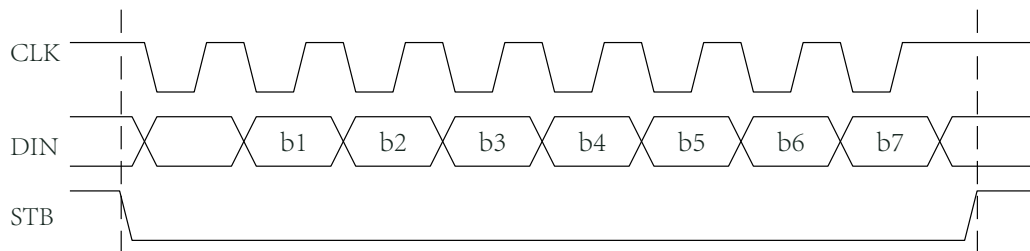
### 3.3.3.3 Display Control Command

Set the Display ON or OFF and select the Display brightness (level 8).

bit7	bit6	bit5	bit4	bit3	bit2	bit1	bit0	Function	Note
1	0	---			0	0	0	Set GRID Pulse Width	1/16 duty
1	0				0	0	1		2/16 duty
1	0				0	1	0		4/16 duty
1	0				0	1	1		10/16 duty
1	0				1	0	0		11/16 duty
1	0				1	0	1		12/16 duty
1	0				1	1	0		13/16 duty
1	0				1	1	1		14/16 duty
1	0				0				
1	0		1					Display on	

### 3.4.4 Command Timing Diagrams

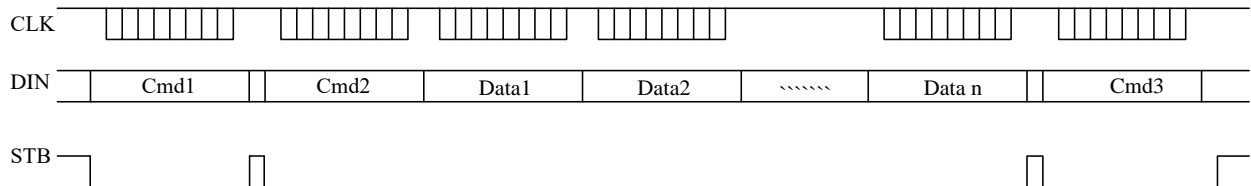
Write command or display data



## 4 Command application

### 4.1 Send Display data(Address auto Increment)

Using the address auto-increase mode, First set the starting address of the data to be transmitted (Display RAM address). After the start address command byte is sent, the display data is directly transmitted, up to 16 bytes. STB is set high after data transmission.



Cmd1: Data Read/Write&Set Cmd -Set address auto-increase mode (0x40)

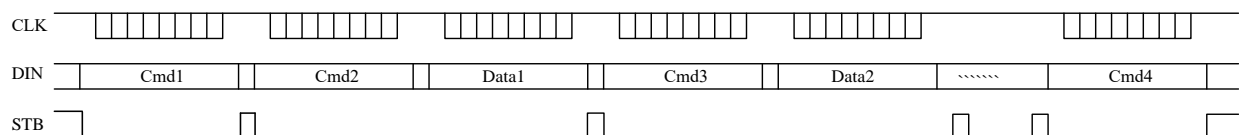
Cmd2: Address Set Cmd -Set the start address of the display RAM (0xc0-0xcf)

Data1-Data n: Send display data to the start address set by Cmd2 and the subsequent address (up to 16 bytes)

Cmd3: Display Control Cmd -Display ON and select the Display brightness

### 4.2 Send Display data(Fixed Address)

Using the fixed address mode, first set the address of the data to be transmitted (Display RAM address), After sending the address, directly transmit 1 byte of display data, STB is set high after data transmission; Then transfer the address of the next display data, and directly transfer 1 byte of display data STB is set high after data transmission; ... Until the last byte of display data is transmitted, Up to 16 bytes, STB is set high after data transmission.



Cmd1: Data Read/Write&Set Cmd -Set fixed address mode (0x44)

Cmd2: Address Set Cmd -Set Display RAM address (0xC0-0xCF. )

Data1: Send the Display data to the display RAM address set by Cmd2

CmdN: Address Set Cmd -Set Display RAM address (0xC0-0xCF)

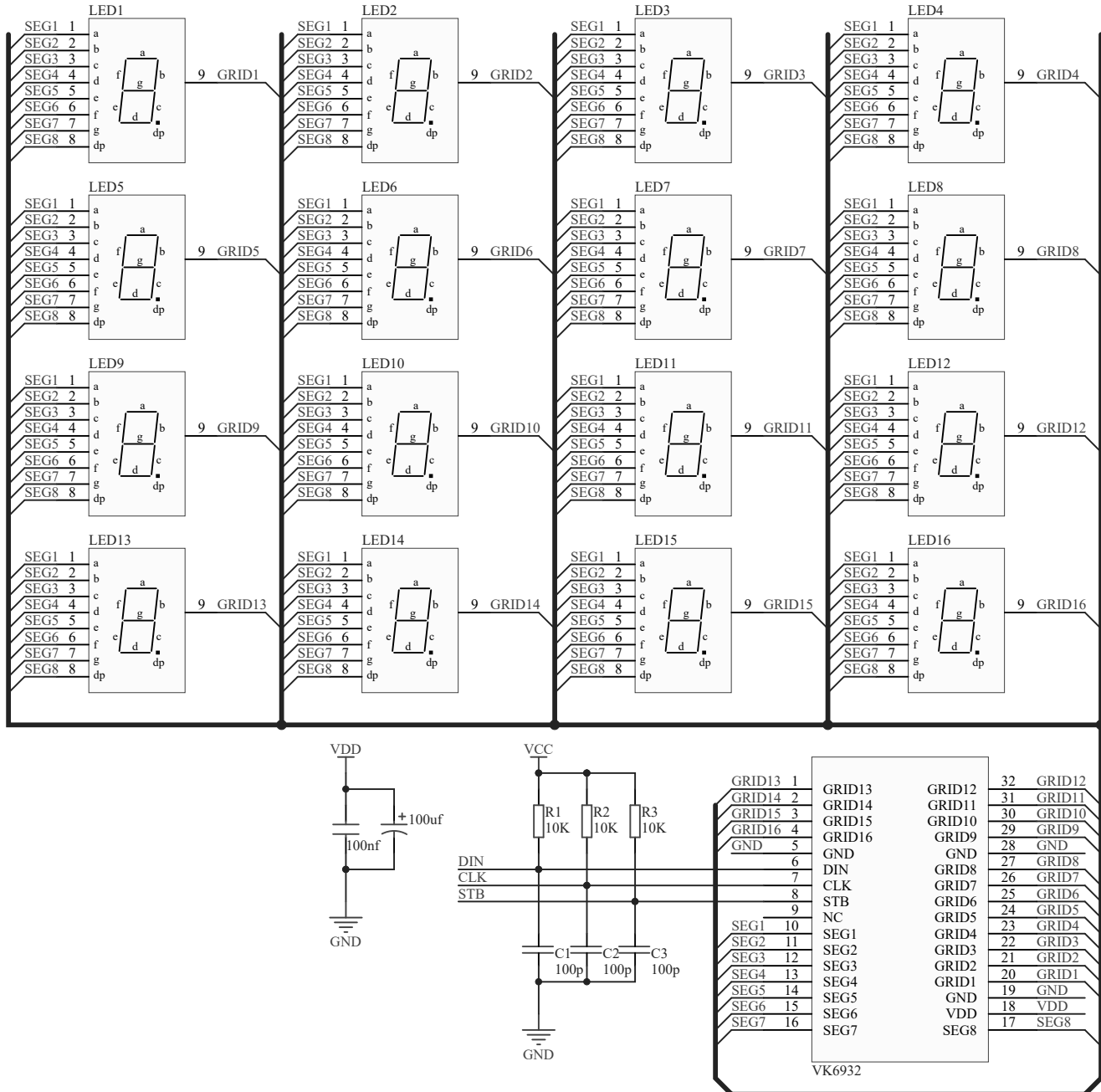
DataN: Send the Display data to the display RAM address set by CmdN

.... up to 16 bytes of data to be send

Cmd3: Display Control Cmd -Display ON and select the Display brightness

## 5 Application Circuits

8-SEG LED Display shared Cathode



## 6 Electrical characteristics

### 6.1 Absolute Maximum Ratings

Item	Symbol	Ratings	Unit
Power voltage	VDD	-0.5 ~ +7.0	V
Input Voltage	VIN	$V_{SS}-0.5 \sim V_{DD}+0.5$	V
Storage Temperature	T <sub>STG</sub>	-50 ~ +125	°C
Operating Temperature	T <sub>OTG</sub>	-40 ~ +85	°C

### 6.2 DC Characteristics

Item	Symbol	Min.	Typ.	Max.	Unit	Test Conditions	
						VDD	Conditions
Operating Voltage	VDD	3.0	—	5.5	V	—	—
Quiescent Current	I <sub>DD</sub>	—	—	0.1	μA	5V	Noload/LED OFF
High Level output Current	I <sub>OHSEG1</sub>	-32	-34	-38	mA	5V	VO=VDD-2V SEG1- SEG8
	I <sub>OHSEG2</sub>	-25	-30	-44			VO=VDD-3V SEG1- SEG8
Low Level input Current	I <sub>OLGRID</sub>	80	140	—	mA	5V	VO=0.3V GRID1- GRID16
High level output current tolerance	I <sub>TOLSEG</sub>	—	—	5	%	VDD	VO=VDD-3V(VDD=5V) VO=VDD-2V(VDD=3V) SEG1-SEG8
Input Low Voltage	V <sub>IL</sub>	0	—	0.3	VDD	VDD	STB, CLK, DIN
Input High Voltage	V <sub>IH</sub>	0.7	—	1.0		VDD	

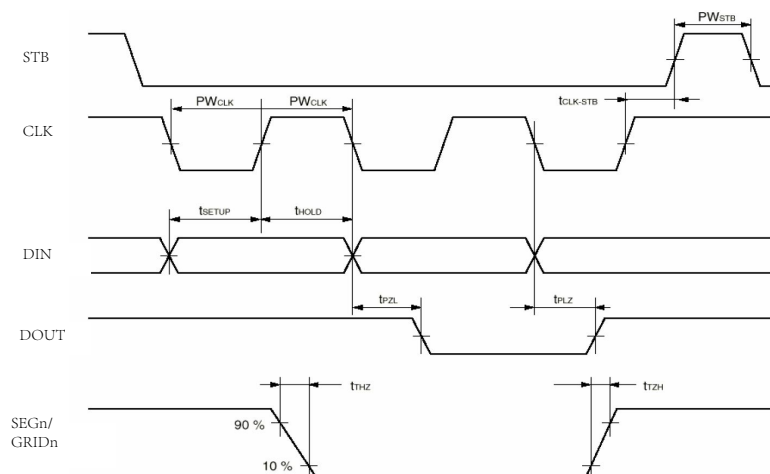
## 6.3 AC Characteristics

### Switch Parameters

Item	Symbol	Min.	Typ.	Max.	Unit	Test Conditions
oscillation frequency	$F_{osc}$	-	500	-	KHz	
Transmission delay time	$t_{PLZ}$	-	-	300	nS	CLK → DOUT
	$t_{PZL}$	-	-	100	nS	CL = 15pF, RL = 10K Ω
Rise Time	$t_{ZH1}$	-	-	2	μS	CL=300pF SEG1-SEG8 GRID1-GRID16
	$t_{TZH2}$	-	-	0.5	μS	CL=300pF GRID1-GRID16
Fall Time	$t_{THZ}$	-	-	120	μS	CL = 300pF SEGn,GRIDn
Max. input Freq	$F_{MAX}$	-	-	1	MHz	Duty 50%
Input Capacitance	$C_i$	-	-	15	pF	-

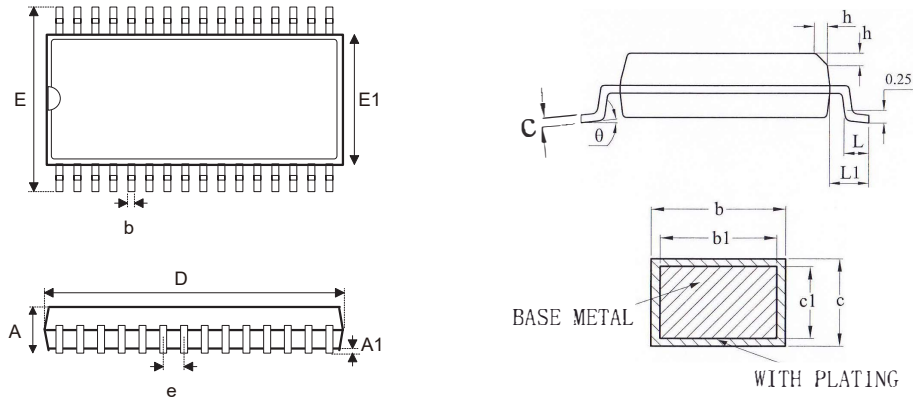
### Timing Parameters

Item	Symbol	Min.	Typ.	Max.	Unit	Test Conditions
Clock pulse width	$PW_{CLK}$	400	-	-	nS	-
STB pulse width	$PW_{STB}$	1	-	-	μS	-
Data Setup Time	$t_{SETUP}$	100	-	-	nS	-
Data Hold Time	$t_{HOLD}$	100	-	-	nS	-
CLK→STB Time	$t_{CLK-STB}$	1	-	-	μS	CLK ↑ → STB ↑
Wait Time	$T_{wait}$	1	-	-	μS	CLK ↑ → CLK ↓



## 7 Package Information

### 7.1 SOP32(21.00mm x 7.50mm PP=1.27mm):



SYMBOL	MILLIMETER		
	MIN	NOM	MAX
A	--	--	2.34
A1	0.10	0.20	0.25
b	0.30	--	0.50
b1	0.27	0.30	0.33
c	0.13	--	0.17
c1	0.12	0.13	0.14
D	20.90	21.00	21.10
E	7.40	7.50	7.60
E1	10.2	10.4	10.6
e	1.27BSC		
$\theta$	0	--	8°
L	0.70	--	1.00
L1	1.40REF		

## 8 Revision history

No.	Version	Date	Modify the content	Check
1	1.0	2018-08-10	Original version	Yes
2	1.1	2019-07-11	Add Ref circuits	Yes
3	1.2	2020-02-11	Update content	Yes

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