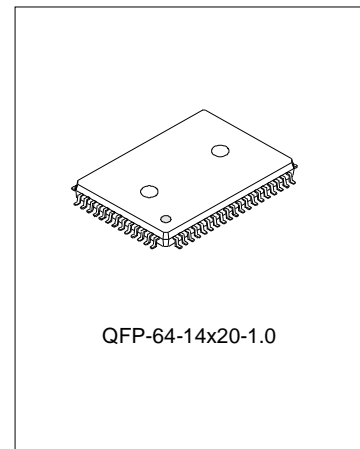


GENERAL 32X3 SEG LCD DISPLAY DRIVER WITH 1/3 DUTY**DESCRIPTIONS**

SC230 is a general-purpose external LCD driver.

FEATURES

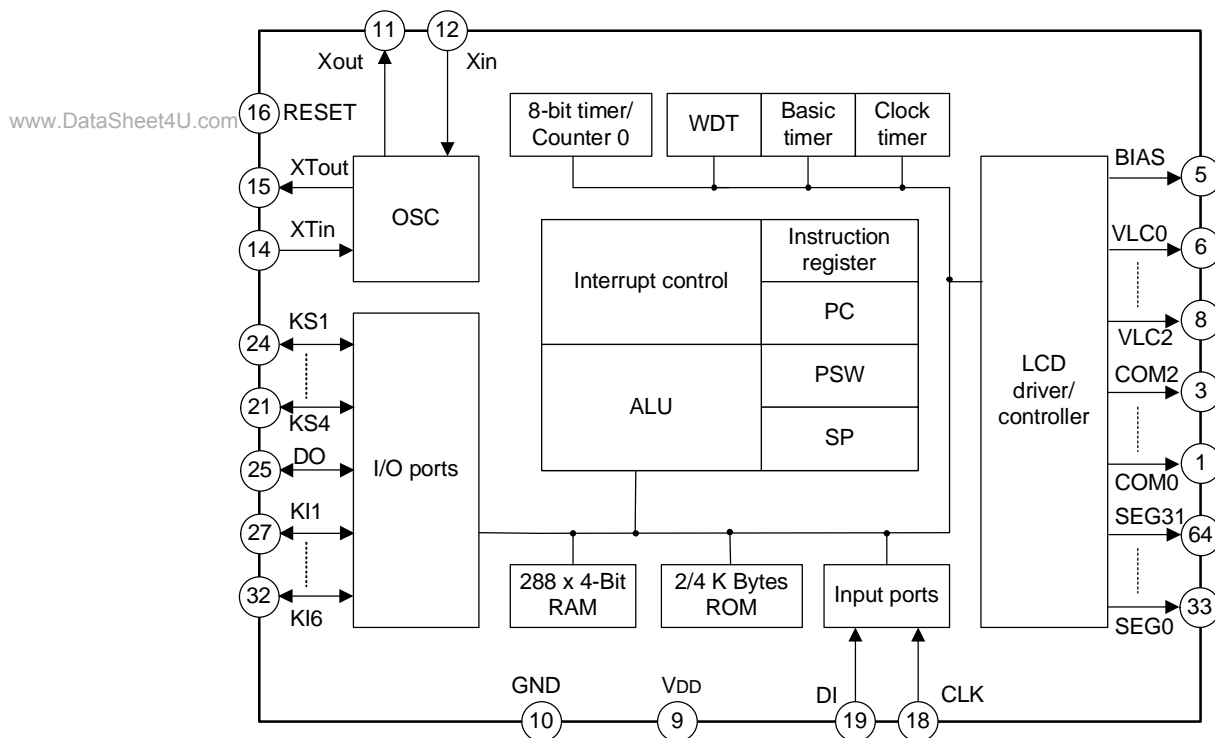
- * Support max. 32×3 LCD SEG
- * Support max. 24 keys input
- * 1/3 duty, 1/2 bias
- * Key input and LCD output can be processed at the same time
- * SEG0/P1~SEG3/P4 can be as LCD or common output

**APPLICATIONS**

- * LCD driver

ORDERING INFORMATION

Device	Package
SC230	QFP-64-14 X 20-1.0

BLOCK DIAGRAM

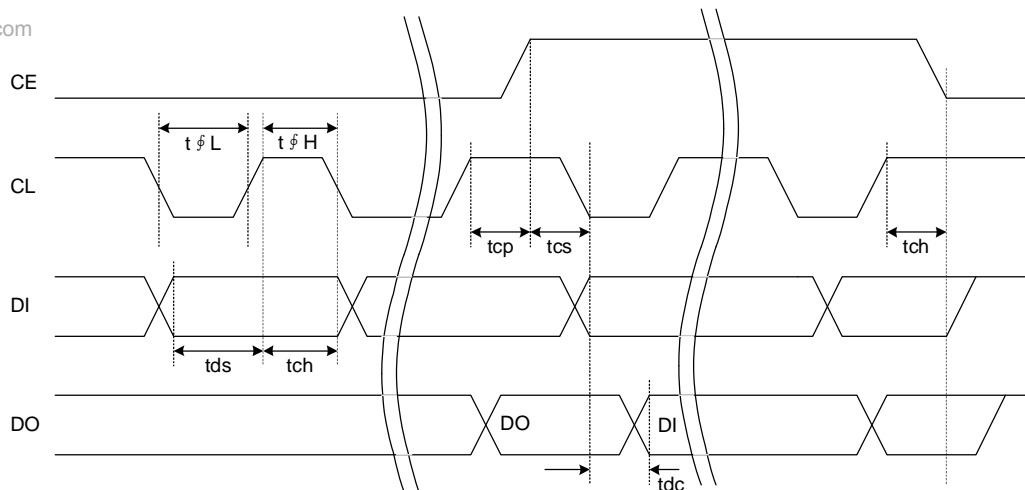
ABSOLUTE MAXIMUM RATING($T_{amb}=25^{\circ}\text{C}$)

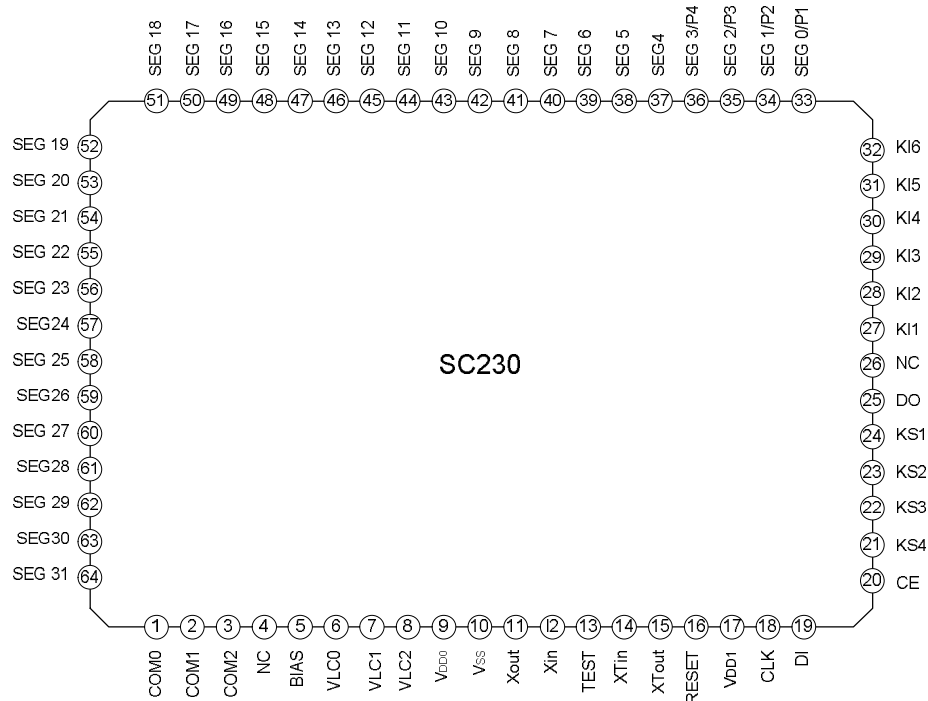
Characteristics	Symbol	Ratings	Unit
Power Supply	VDD	-0.3~6.5	V
Input Voltage	VI	-0.3~VDD+0.3	V
Output Voltage	VO	-0.3~VDD+0.3	V
Operating Temperature	Topr	-20~+70	$^{\circ}\text{C}$
Storage Temperature	Tstg	-40~+125	$^{\circ}\text{C}$

ELECTRICAL CHARACTERISTICS ($T_{amb}=25^{\circ}\text{C}, V_{SS}=0\text{v}$)

Characteristics	Symbol	Test Conditions	Min.	Typ.	Max.	Unit
Operating Voltage	VDD		4.5		6.0	V
Input VTG[H]	VIH1		0.8VDD		VDD	V
	VIH2	KI1~KI6	0.7VDD		VDD	V
Input VTG[L]	VIL		0		0.3VDD	V
Oscillator Frequency	fosc	VDD=5V, R=33k Ω		2.0		MHz
Data Set Time	tds		26		1524	μs
Data Hold Time	tdh		26		1524	μs
High Pulse Width	t ϕ H		26		1524	μs
Low Pulse Width	t ϕ L		26		1524	μs
CE Wait Time	tcp		26		1524	μs
CE Set Time	tcs		26		1524	μs
CE Hold Time	tch		26		1524	μs
DO Delay Time	tdc		10		20	μs

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PIN CONFIGURATION**PIN DESCRIPTIONS**

Pin No.	Symbol	Pin descriptions
1	COM0	LCD COM
2	COM1	
3	COM2	
4, 26	NC	No connection
5	BIAS	LCD bias control
6	VLC0	LCD voltage input
7	VLC1	
8	VLC2	
9	VDD0	Power supply(4.5V~6.0V)
17	VDD1	
10	VSS	Ground
11, 12	Xout, Xin	Crystal oscillator input/output
13	TEST	Connect to ground
14	XTIN	Connect to ground
15	XTOUT	No connection

(To be continued)

(Continued)

Pin No.	Symbol	Pin descriptions
16	RESET	Reset pin(low active)
18	CLK	Clock input
19	DI	Serial data input
20	CE	Enable
25	DO	Serial data output
21	KS1	Key scan signal output
22	KS2	
23	KS3	
24	KS4	
27	KI1	Key signal input
28	KI2	
29	KI3	
30	KI4	
31	KI5	
32	KI6	
33	SEG0/P1	Selectable LCD SEG
34	SEG1/P2	
35	SEG2/P3	
36	SEG3/P4	
37	SEG4	LCD SEG output
38	SEG5	
39	SEG6	
40	SEG7	
41	SEG8	
42	SEG9	
43	SEG10	
44	SEG11	
45	SEG12	
46	SEG13	
47	SEG14	
48	SEG15	
49	SEG16	
50	SEG17	
51	SEG18	
52	SEG19	
53	SEG20	
54	SEG21	
55	SEG22	

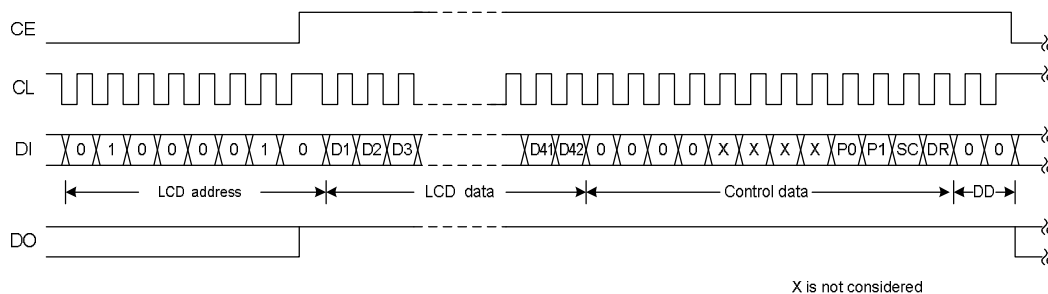
(To be continued)

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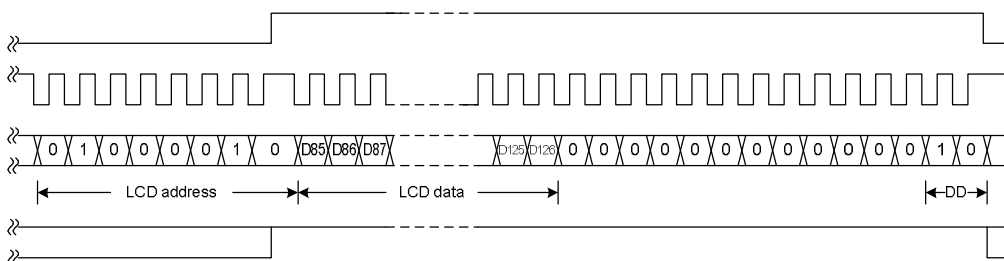
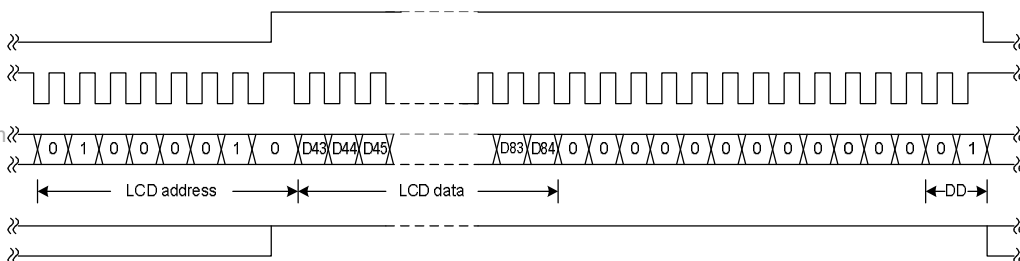
Pin No.	Symbol	Pin descriptions
56	SEG23	LCD SEG output
57	SEG24	
58	SEG25	
59	SEG26	
60	SEG27	
61	SEG28	
62	SEG29	
63	SEG30	
64	SEG31	

FUNCTION DESCRIPTIONS

SERIAL DATA INPUT



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- (1) DD : Frame data
 LCD address : 42H
 D1~D96 : LCD SEG data
 D97~D126 : 0
 P0,P1 : SEG0/P1~SEG3/P4 function selection
 SC : LCD switch selection
 DR : 1/2 bias or 1/3 bias selection
- (2) The control data is only in the first frame (DD=0)

CONTROL DATA DESCRIPTION**(1)P0,P1: SEG0/P1~SEG3/P4 function selection**

Control data		Port description			
P0	P1	SEG0/P1	SEG1/P2	SEG2/P3	SEG3/P4
0	0	S0	S1	S2	S3
1	1	P1	P2	P3	P4
Port		Display data			
SEG0/P1		D1			
SEG1/P2		D4			
SEG2/P3		D7			
SEG3/P4		D10			

(2)SC: LCD switch selection

SC	Function
0	LCD is on
1	LCD is off

(3) DR:1/2 bias or 1/3 bias selection

DR	Function
0	1/3 bias
1	1/2 bias

LCD DATA AND OUTPUT

Use SEG0/P1~SEG3/P4 as display ports

Port	COM0	COM1	COM2
SEG0/P1	D1	D2	D3
SEG1/P2	D4	D5	D6
SEG2/P3	D7	D8	D9
SEG3/P4	D10	D11	D12
SEG4	D13	D14	D15
SEG5	D16	D17	D18
SEG6	D19	D20	D21
SEG7	D22	D23	D24
SEG8	D25	D26	D27
SEG9	D28	D29	D30
SEG10	D31	D32	D33
SEG11	D34	D35	D36
SEG12	D37	D38	D39
SEG13	D40	D41	D42
SEG14	D43	D44	D45
SEG15	D46	D47	D48

Port	COM0	COM1	COM2
SEG16	D49	D50	D51
SEG17	D52	D53	D54
SEG18	D55	D56	D57
SEG19	D58	D59	D60
SEG20	D61	D62	D63
SEG21	D64	D65	D66
SEG22	D67	D68	D69
SEG23	D70	D71	D72
SEG24	D73	D74	D75
SEG25	D76	D77	D78
SEG26	D79	D80	D81
SEG27	D82	D83	D84
SEG28	D85	D86	D87
SEG29	D88	D89	D90
SEG30	D91	D92	D93
SEG31	D94	D95	D96

Use SEG0/P1~SEG3/ P4 as general output port

Port	COM0	COM1	COM2
SEG0/P1	D1	X	X
SEG1/P2	D4	X	X
SEG2/P3	D7	X	X
SEG3/P4	D10	X	X
SEG4	D13	D14	D15
SEG5	D16	D17	D18
SEG6	D19	D20	D21
SEG7	D22	D23	D24
SEG8	D25	D26	D27
SEG9	D28	D29	D30
SEG10	D31	D32	D33
SEG11	D34	D35	D36
SEG12	D37	D38	D39
SEG13	D40	D41	D42
SEG14	D43	D44	D45
SEG15	D46	D47	D48

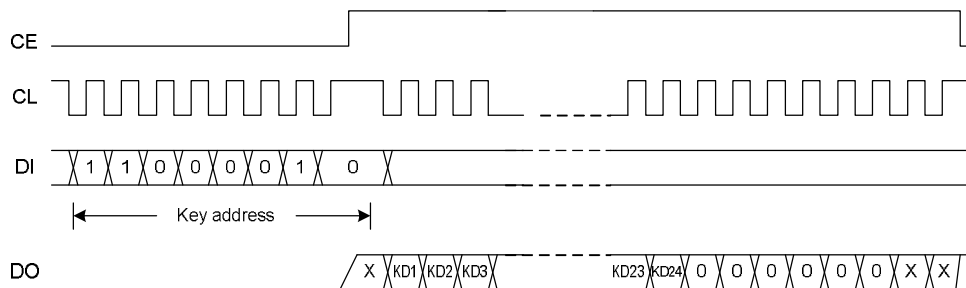
Port	COM0	COM1	COM2
SEG16	D49	D50	D51
SEG17	D52	D53	D54
SEG18	D55	D56	D57
SEG19	D58	D59	D60
SEG20	D61	D62	D63
SEG21	D64	D65	D66
SEG22	D67	D68	D69
SEG23	D70	D71	D72
SEG24	D73	D74	D75
SEG25	D76	D77	D78
SEG26	D79	D80	D81
SEG27	D82	D83	D84
SEG28	D85	D86	D87
SEG29	D88	D89	D90
SEG30	D91	D92	D93
SEG31	D94	D95	D96

X= is not considered

LCD data output (SEG10): When use SEGXX/P1~SEGXX/P4 as display port

LCD data			The function of input pins
D31	D32	D33	SEG10
0	0	0	COM0, 1, 2, LCD SEG off
0	0	1	COM2, LCD SEG on
0	1	0	COM1, LCD SEG on
0	1	1	COM1, 2, LCD SEG on
1	0	0	COM0, LCD SEG on
1	0	1	COM0, 2, LCD SEG on
1	1	0	COM0, 1, LCD SEG on
1	1	1	COM0, 1, 2, LCD SEG on

SERIAL DATA OUTPUT



*X = is not considered

KEY address: 43H

KD1~KD24 : key data

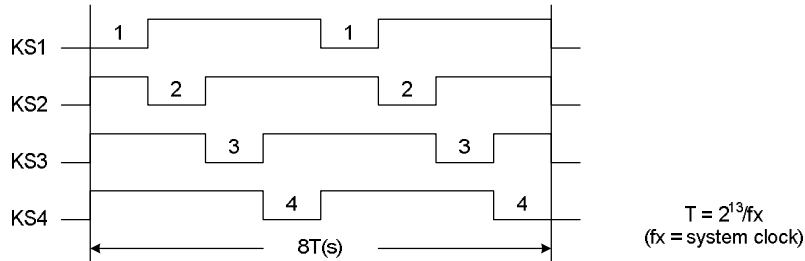
Input Selection	KI1	KI2	KI3	KI4	KI5	KI6
KS1	KD1	KD2	KD3	KD4	KD5	KD6
KS2	KD7	KD8	KD9	KD10	KD11	KD12
KS3	KD13	KD14	KD15	KD16	KD17	KD18
KS4	KD19	KD20	KD21	KD22	KD23	KD24

- If some key is pressed, the corresponding key data is high level keyboard scan.

KEYBOARD SCAN

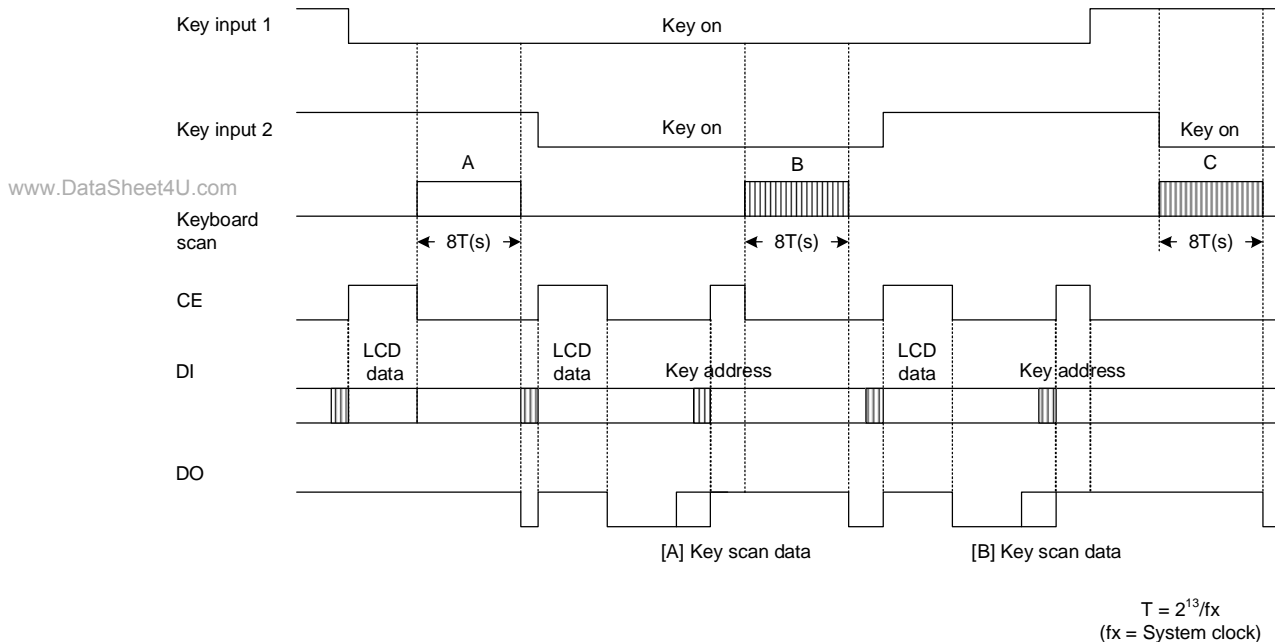
1. Keyboard scan time

Keyboard scan spends $4T$, and it should be executed twice. Press the corresponding key, then begin the key scan operation, and when the scan is completed ($8T$), output the signal which is needed by key data transmission.



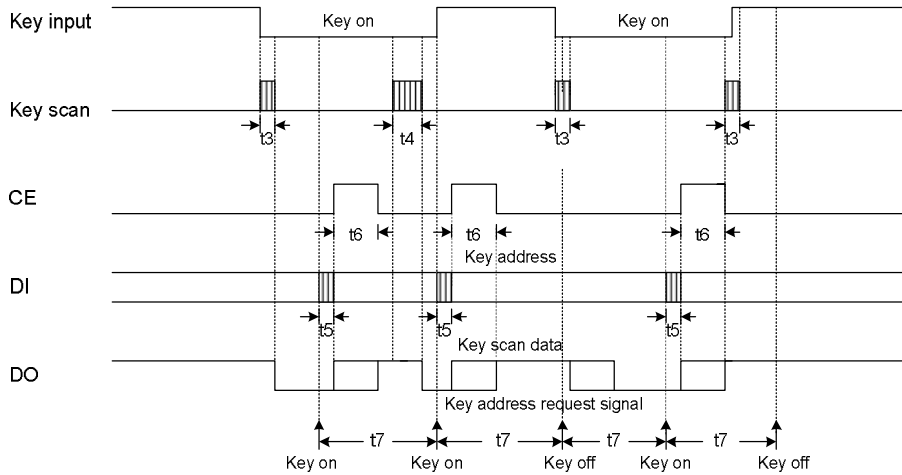
2. Key data transmission

- KS1~KS3 pins are low level
- If the key is pressed, execute the key scan
- If the key-press time is over $8T$, the output key data transmission request signal to the host, if the host transmits a key address, then begin to transmit the key data.
- If receive the display address when output the key data request signal to the host, then make $CE=H$, $DO=L$.
- If the key data transmission is completed, it will release the request and restore the key scan.



KEY DATA PROCESS

1. Suppose that the host receives the key data in normal period



t3: Key scan time (8T).....The data of the two key scan is different(new key data and already exist data)

t4: Key scan time(16T)...The data of the two key scan is the same(new key data and already exist data)

t5: Key address(43H)transmission time

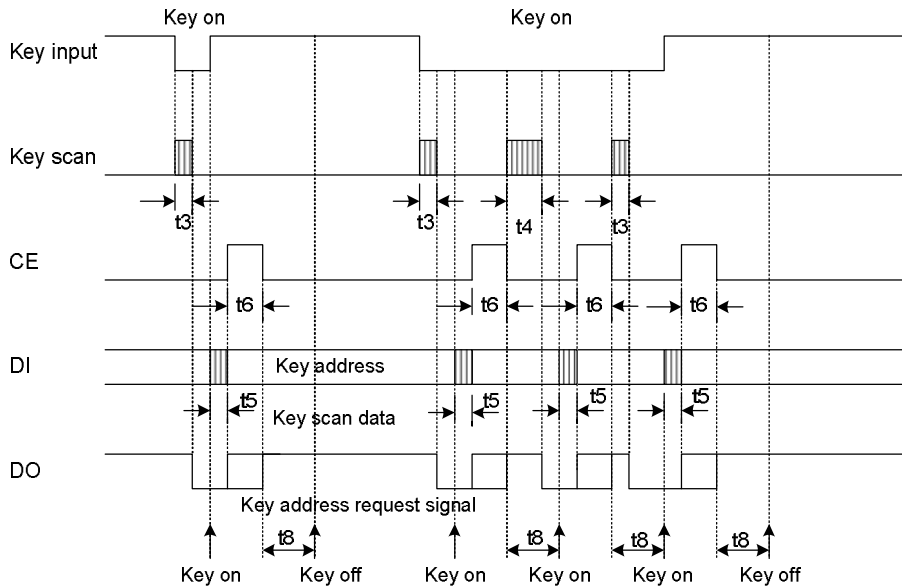
t6: Key data transmission time

$$T = 2^{13}/fx$$

t7: t7=t5+ t4+LCD transmission time

(fx = system clock)

2. Suppose that the host receives key data by interrupt



t3: Key scan time (8T).....The data of the two key scan is different(new key data and already exist data)

t4: Key scan time(16T)...The data of the two key scan is the same(new key data and already exist data)

t5: Key address(43H)transmission time

t6: Key data transmission time

$$T = 2^{13}/fx$$

t8: t8= t4+LCD transmission time

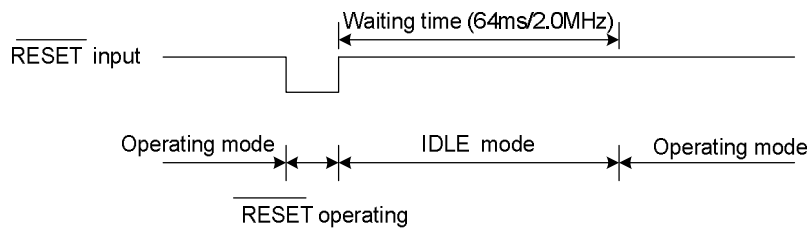
(fx = system clock)

RESET

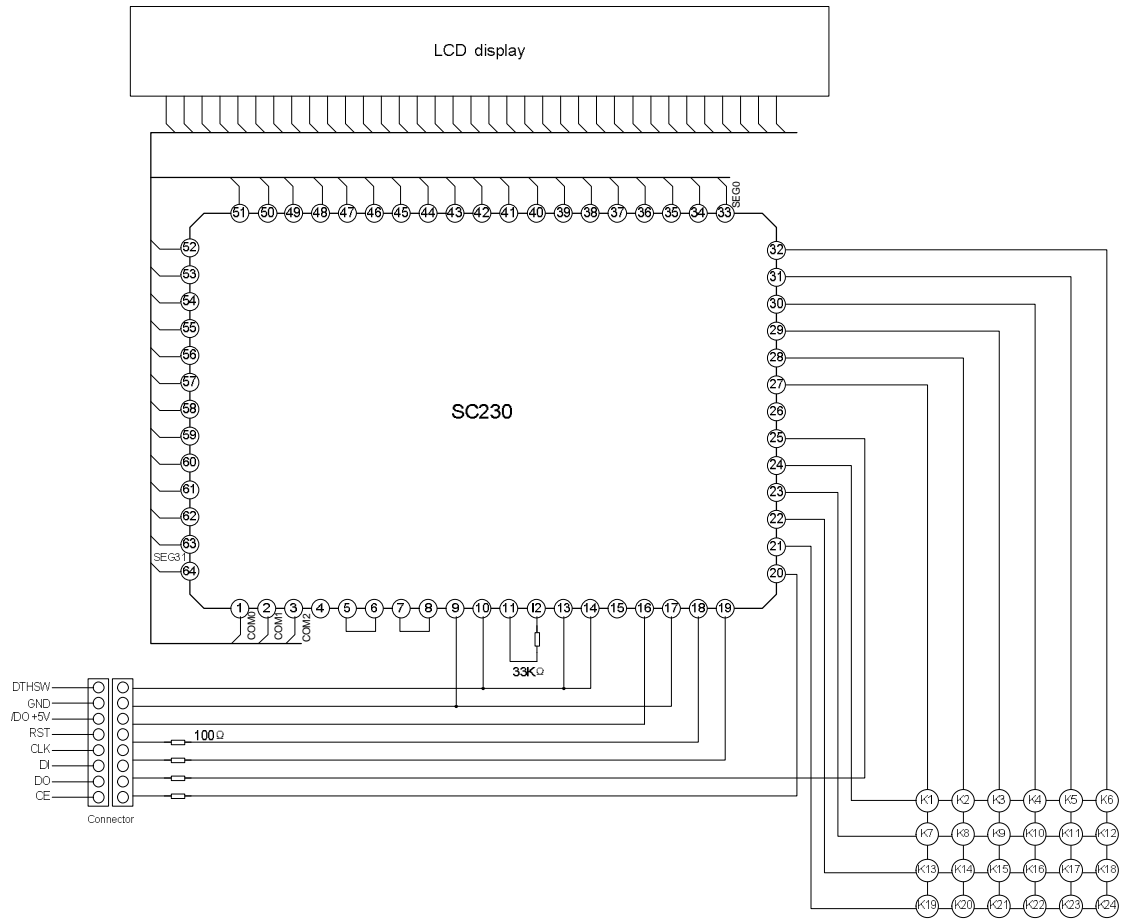
Port state when reset

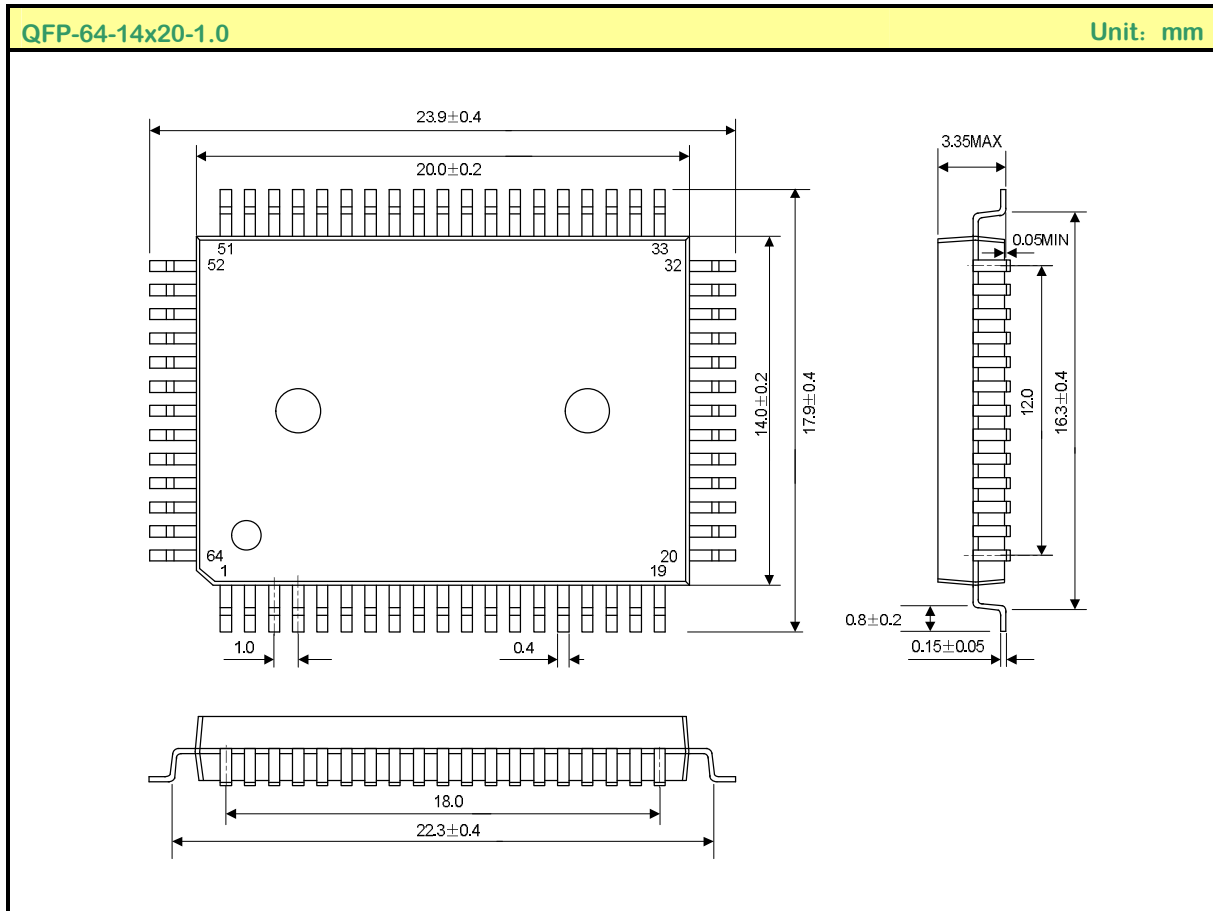
Output		State
SEG0/P1~SEG3/P4	Output buffer	Close
	Output buffer	L
SEG4~SEG31	Output buffer	Close
	Output buffer	L
COM0~COM2		L
KS1~KS4		L
DO		L

RESET Sequence



TYPICAL APPLICATION CIRCUIT



PACKAGE OUTLINE

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**HANDLING MOS DEVICES:**

Electrostatic charges can exist in many things. All of our MOS devices are internally protected against electrostatic discharge but they can be damaged if the following precautions are not taken:

- Persons at a work bench should be earthed via a wrist strap.
- Equipment cases should be earthed.
- All tools used during assembly, including soldering tools and solder baths, must be earthed.
- MOS devices should be packed for dispatch in antistatic/conductive containers.