

LSI

LS3321

256 dot LCD micro-controller

Features :

- * 12 Input/Output pad.
- * Direct drive buzzer output.
- * 3072x12 bit ROM.
- * 176x4 bit of RAM.
- * 32x4, x5, x6, x7 or 32x8 LCD segment.
- * 1/4 LCD bias.
- * 32768 Crystal/RC oscillator bonding option.
- * Single 1.5V operation.
- * Low cost and low price.

General Description

The LS3321 is a micro-controller for LCD application. It has an internal ROM size of 3Kx12bit. A 176x4 bit of RAM, 32x4, x5, x6, x7 or x8 LCD segment with 1/4 bias. It has 12 I/O (mask option) pad. It directly drive a buzzer output. The buzzer driver can also be used as general purpose I/O by mask option. The system oscillator can be R/C or 32kHz Crystal oscillator. It is suitable for timer/calendar/controller function.

Functional Description

1. RC Oscillator /Crystal

The LS3321 can use either a crystal oscillator or RC oscillator to provide the internal timing by bonding option.

2. Program ROM

The LS3321 has internal 3Kx12 bit ROM providing simple operation. It has six internal stacks. The program ROM is page-segmented with 1K per page. To access pages higher than 1K, use the CALL instruction. The CALL instruction jumps to the address defined by ROMPAGE.jjjjjjjjjj where jjjjjjjjjj is specified in the CALL instruction.

3. Interrupt Control

The LS3321 has 5 different sources of interrupt, namely, POWERUP, F4HZ, F16HZA, F16HZA and F1HZ. The starting address of the interrupt are as follow :

Interrupt	Address
POWERUP	0x3ff
F1HZ	0x3fe
F4HZ	0x3fc
F16HZA	0x3f8
F16HZA	0x3f1

The system generates 16 interrupts for F16HZA in one second but only 11 interrupts for F16HZA. The other 5 interrupts goes to F4HZ (4) and F1HZ (1) interrupts.

4. Program RAM

The system has 128x4bit of program RAM (00H to 7FH) with IO address as follows.

Address	Description	Initialize
0H	RptrL	undefined
1H	RptrH	undefined
2H	Rptr1L	undefined
3H	Rptr1H	undefined
4H	Beep Control	0
5H	ROM PAGE	0
6H	RAM PAGE	0
7H	No use	0
8H	IOP0	IO[0:3]
9H	IOP1	IO[4:7]
AH	IOP2	IO[8:11]
BH	IOP3	INP[0:3]
CH(read)	Timer 1 Value	-
CH(write)	Timer 1 Data	-
DH(write)	Timer 1 Control	0
FH(write)	COM/OUTPUT (XXX0/XXX1)	XXX0
10H-3FH	SYSTEM RAM	-
40H-7FH	DISPLAY RAM	-
80H-AFH	SYSTEM RAM	-

Address 1H:0H forms a 8bit address for indirect read/write operation for pointer read/write.
 Address 3H:2H forms a 8bit address for indirect read/write operation for pointer1 read/write.

Indirect address is specified, for example, as rINC #op

Indirect Operand (#op)	Resulting address
#0	RptrH.RptrL
#1	RptrH.Rptr1L
#2	Rptr1H.RptrL
#3	Rptr1H.Rptr1L

5. Buzzer Control

The system can output 4khz/2khz alarm signal by mask option. The alarm signal is enabled to the output BD[0:1] when the Beep Control Register: Bit[0] is high.

6. Timer/Counter

The 3321 has a 4 bit timer/counter. It is map to address CH and DH.

Address	Description	Timer 1 Value	Timer 1 Data	D0
CH(read)				
CH(write)				
DH(write)	D3	No. use	D1(tone)	D0
	1=START		1=FOSC	1=tone
	0=STOP		0=PHI12	0=buz
			D1(timer)	
			1=XINP0	
			0=F1HZ	

5. LCD driver

The system has 32 LCD segment pad with 2-8 common pads (by mask option) providing 32x2,3,4,5,6,7,8 LCD segment output.

The LCD segment table is shown below :

COMMON	SEG [1:32]
1	78H:D[0:3], 79H:D[0:3], 7AH:D[0:3], 7BH:D[0:3], 7CH:D[0:3], 7DH:D[0:3], 7EH:D[0:3], 7FH:D[0:3]
2	70H:D[0:3], 71H:D[0:3], 72H:D[0:3], 73H:D[0:3], 74H:D[0:3], 75H:D[0:3], 76H:D[0:3], 77H:D[0:3]
3	68H:D[0:3], 69H:D[0:3], 6AH:D[0:3], 6BH:D[0:3], 6CH:D[0:3], 6DH:D[0:3], 6EH:D[0:3], 6FH:D[0:3]
4	60H:D[0:3], 61H:D[0:3], 62H:D[0:3], 63H:D[0:3], 64H:D[0:3], 65H:D[0:3], 66H:D[0:3], 67H:D[0:3]
5	58H:D[0:3], 59H:D[0:3], 5AH:D[0:3], 5BH:D[0:3], 5CH:D[0:3], 5DH:D[0:3], 5EH:D[0:3], 5FH:D[0:3] OR (MASKING OPTION)
	28H:D[0:3], 29H:D[0:3], 2AH:D[0:3], 2BH:D[0:3], 2CH:D[0:3], 2DH:D[0:3], 2EH:D[0:3], 2FH:D[0:3]
6	50H:D[0:3], 51H:D[0:3], 52H:D[0:3], 53H:D[0:3], 54H:D[0:3], 55H:D[0:3], 56H:D[0:3], 57H:D[0:3]
7	48H:D[0:3], 49H:D[0:3], 4AH:D[0:3], 4BH:D[0:3], 4CH:D[0:3], 4DH:D[0:3], 4EH:D[0:3], 4FH:D[0:3]
8	40H:D[0:3], 41H:D[0:3], 42H:D[0:3], 43H:D[0:3], 44H:D[0:3], 45H:D[0:3], 46H:D[0:3], 47H:D[0:3]

6. Mask option

Name	description
BZ2K/4K	buzzer frequency
BZ[0], BZ[1]	buzzer control
FSYSPRB	Power Up Control

INA address	description
0	Watch dog reset
3	ROMH
5	ROMHH/OSCON
4	OFF OSC
5	ON OSC
6	OFF LCD
7	ON LCD

Address DH(write)	Description			
	D3	D2	D1(tone)	D0
	1=START	1=XINP0	1=FOSC	1=tone
	0=STOP	0=F1HZ	0=FOSC/2	0=buz
			D1(timer)	
			1=XINP0	
			0=F1HZ	

- **Pin Assignment**

DESIGNATION	TYPE	DESCRIPTION
B [0:1]	OUTPUT	Buzzer output
V1, V2, VP1, VP2	OUTPUT	LCD bias
VEE	OUTPUT	LCD power
T2, T1	INPUT (PL)	TEST pin
OO, RO	OUTPUT	RC/32KHz oscillator output
OI	INPUT	32KHz oscillator input
VDD	POWER	+1.5V power supply
GND	POWER	Ground
I[0:11]	I(PH)/O	Input/output pad
PB	RESET	Low active
C[1:8]	OUTPUT	LCD Common output
S[1:32]	OUTPUT	LCD Segment output

Note: (PL) – pull low
(PH) - pull high

Absolute Maximum Ratings

Supply voltage Vdd - Vss.....0 to 5V

Input voltage Vin.....Vss to Vdd

Operating temperature Top-10°C to 60°C

Storing temperature Tst-40°C to 70°C

***Comments**

Stress above those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress rating only. Functional operation of this device at these or any other conditions above those indicated in the operational sections of this specification is not implied and exposure to absolute maximum rating conditions for extended periods may affect device reliability.

D.C. Electrical Characteristics

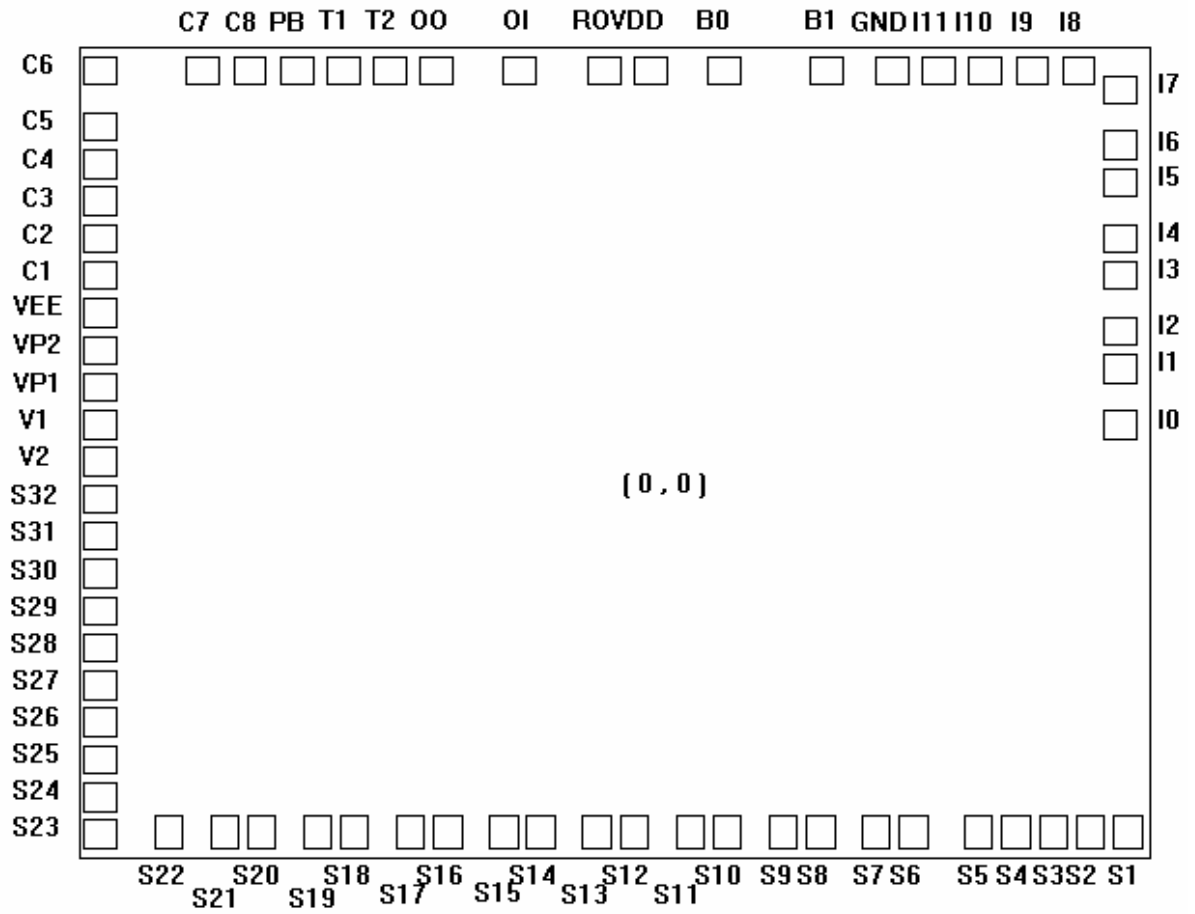
(GND = 0V, Vdd = 1.5V, Ta = 25°C unless otherwise specified)

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions
Supply Voltage	Vdd	1.2	1.5	1.8	V	
Operating current	Idd	-	2	6	μA	No load
OSC. built-in cap	Cd	-	20	-	pF	
OSC. trimmer cap	Ctrim	5	-	35	pF	
Buzzer output current	Ib	500	-	-	μA	Vbd-Vss=0.5
LCD frequency	Flcd	-	64	-	Hz	
Segment current	Is	0.15	-	-	μA	Vseg=0.2V
Common current	Ic	3.0	-	-	μA	Vcom=0.2V

Pad location

PAD	X(μ m)	Y(μ m)	PAD	X(μ m)	Y(μ m)
S1	1728.0	-1368.0	V2	-1830.0	-70.0
S2	1604.0	-1368.0	V1	-1830.0	+60.0
S3	1480.0	-1368.0	VP1	-1830.0	+190.0
S4	1356.0	-1368.0	VP2	-1830.0	+320.0
S5	1230.0	-1368.0	VEE	-1830.0	+450.0
S6	1030.0	-1368.0	C1	-1830.0	+580.0
S7	902.0	-1368.0	C2	-1830.0	+710.0
S8	702.0	-1368.0	C3	-1830.0	+840.0
S9	574.0	-1368.0	C4	-1830.0	+970.0
S10	374.0	-1368.0	C5	-1830.0	+1100.0
S11	246.0	-1368.0	C6	-1830.0	+1270.0
S12	46.0	-1368.0	C7	-1662.0	+1270.0
S13	-82.0	-1368.0	C8	-1532.0	+1270.0
S14	-282.0	-1368.0	PB	-1402.0	+1270.0
S15	-410.0	-1368.0	T1	-1272.0	+1270.0
S16	-610.0	-1368.0	T2	-1142.0	+1270.0
S17	-738.0	-1368.0	OO	-982.0	+1270.0
S18	-938.0	-1368.0	OI	-355.0	+1270.0
S19	-1066.0	-1368.0	RO	+60.0	+1270.0
S20	-1266.0	-1368.0	VDD	+194.0	+1270.0
S21	-1394.0	-1368.0	B0	+434.0	+1270.0
S22	-1594.0	-1368.0	B1	+820.0	+1270.0
S23	-1830.0	-1370.0	GND	+1058.0	+1270.0
S24	-1830.0	-1240.0	I11	+1188.0	+1270.0
S25	-1830.0	-1110.0	I10	+1318.0	+1270.0
S26	-1830.0	-980.0	I9	+1448.0	+1270.0
S27	-1830.0	-850.0	I8	+1578.0	+1270.0
S28	-1830.0	-720.0	I7	+1728.0	+1219.0
S29	-1830.0	-590.0	I6	+1728.0	+1019.0
S30	-1830.0	-460.0	I5	+1728.0	+885.0
S31	-1830.0	-330.0	I4	+1728.0	+685.0
S32	-1830.0	-200.0	I3	+1728.0	+551.0
			I2	+1728.0	+351.0
			I1	+1728.0	+217.0
			I0	+1728.0	+17.0

Pad Location



APPLICATION CIRCUIT

