

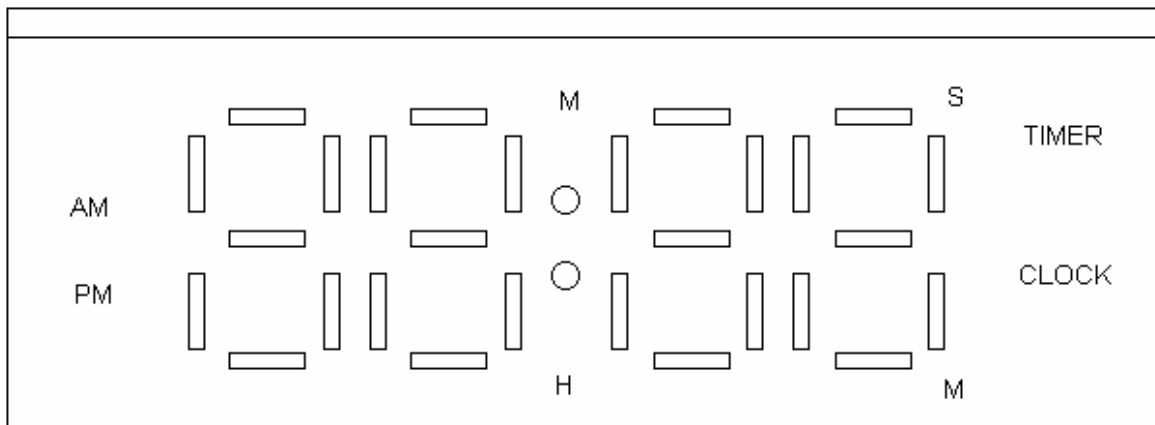
**Features**

- \* 4 digit LCD display.
- \* HH:MM or MM:SS Display.
- \* Real time Clock.
- \* 3 keys operation.
- \* 8 bonding option.
- \* Direct drive 1/2 bias 1/3 duty LCD.
- \* Very low power consumption
- \* 32768 Crystal oscillator
- \* Single 1.5V operation.

**General Description**

The LS6032 is a 4 digit timer with a real time clock. It is three keys operation : KH, KL and KST. It is very universal such that the user can tailor to the specific application as needed by bonding option. There are 8 bonding options :

1. BUP : enable/disable count up function.
2. BDN : enable/disable count down function.
3. BMMSS : Hour/Minute or Minute/Second timer.
4. B99 : Maximum is 99Hour/Minute or 19Hour/Minute.
5. BNCLOCK : enable/disable clock function.
6. BSET : enable/disable timer setting in PAUSE mode.
7. BNREP : enable/disable count down repeat function.
8. BOFF : enable/disable LCD off function.

**LCD Drawing**

## Functional Description

### Power up

At power up, the LS6032 turns on all LCD for 1 second.  
 If BNCLOCK == VDD, the LS6032 display timer.  
 If BNCLOCK == GND, the LS6032 display clock "am 1:00".

### Clock Mode

In Clock Mode, press KH enters clock setting mode.  
 The setting sequence is : Clock Mode → Set Clock Hour → Set Clock Minute → Clock Mode.  
 Press KL to set the corresponding value.  
 Press KST enters Timer Mode.

### Timer Mode Operation

The operation of the LS6032 depends on the 8 bonding option .  
 (Note : All bonding option input has a pull high resistor, therefore, floating == VDD).

	BONDED	Description
BUP	VDD	Count up enable. Press KST will count up if the timer value is 0:00.
	GND	Count up disable Press KST will have no function is the timer value is 0:00.
BDN	VDD	Count down enable. Press KL, KH sets the timer value for count down.
	GND	Count down disable Press KL, KH has no function for setting (no count down).
BMS	VDD	Minute Second mode. Press KL sets second value, KH sets minute value.
	GND	Hour Minute mode. Press KL sets minute value, KH sets hour value.
B99	VDD	Maximum range for hour setting is 99Hours.
	GND	Maximum range for hour setting is 19Hours.
BNCL	VDD	No Clock
OCK	GND	Enable clock. In timer mode, press KL, KH, KST simultaneously enters clock mode.
BSET	VDD	Enable setting in PAUSE mode. While the timer is counting, press KST enters PAUSE mode.
	GND	No setting in PAUSE mode.
BNRE P	VDD	No repeat function.
	GND	Repeat function enabled. The timer will restart from the setting value by the end of count automatically. The alarm will last for 1 minute
BOFF	VDD	If clock is selected (BNCLOCK==GND), the timer return to clock mode after 1 minute of idle state. If clock is not selected (BNCLOCK==VDD), the timer will be off.
	GND	If clock is selected (BNCLOCK==GND), the timer return to clock mode after 1 minute of idle state. If clock is not selected (BNCLOCK==VDD), the timer will be permanently on.

**Mode Demonstration**

The maximum combination of LS6032 is  $2^8 = 256$  different options selected by the 8 bonding options.

Here are some demonstrations of the mode of operation of LS6032:

B U P	B D N	B M S	B 9 9	B N C L O C K	B S E T	B N R E P	B O F	DESCRIPTION
F	F	F	X	G	F	F	F	99 Minute 59 Second Up/Down Timer with Clock
F	F	G	F	G	F	F	F	99 Hour 59 Minute Up/Down Timer with Clock
F	F	G	G	G	F	F	F	19 Hour 59 Minute Up/Down Timer with Clock
F	F	F	X	G	F	G	F	Repeatable 99 Minute 59 Second Up/Down Timer with Clock
F	F	G	F	G	F	G	F	Repeatable 99 Hour 59 Minute Up/Down Timer with Clock
F	F	G	G	G	F	G	F	Repeatable 19 Hour 59 Minute Up/Down Timer with Clock
F	G	F	X	G	F	G	F	99 Minute 59 Second Up Timer with Clock
F	G	G	F	G	F	G	F	99 Hour 59 Minute Up Timer with Clock
F	G	G	G	G	F	G	F	19 Hour 59 Minute Up Timer with Clock
G	F	F	X	G	F	G	F	Repeatable 99 Minute 59 Second Down Timer with Clock
G	F	G	F	G	F	G	F	Repeatable 99 Hour 59 Minute Down Timer with Clock
G	F	G	G	G	F	G	F	Repeatable 19 Hour 59 Minute Down Timer with Clock

F : FLOATING (==VDD).

G: GND

X: Don't Care

**Pin Assignment**

DESIGNATION	TYPE	DESCRIPTION
BD [0:1]	OUTPUT	Buzzer output
F512, VCAP	OUTPUT	Doubler output
VEE	OUTPUT	-1.5V
T1, T2	INPUT	TEST pin
COSCO	OUTPUT	32KHz oscillator output
COSCI	INPUT	32KHz oscillator input
VDD	POWER	+1.5V power supply
GND	POWER	Ground
KL, KH, KST	INPUT(PH)	Input key
BUP, BDN, B99, BMMSS, BNCLOCK, BSET, BNREP, BOFF	INPUT(PH)	Bonding option
C[1:3]	OUTPUT	LCD Common output
S[1:16]	OUTPUT	LCD Segment output

Note: (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**

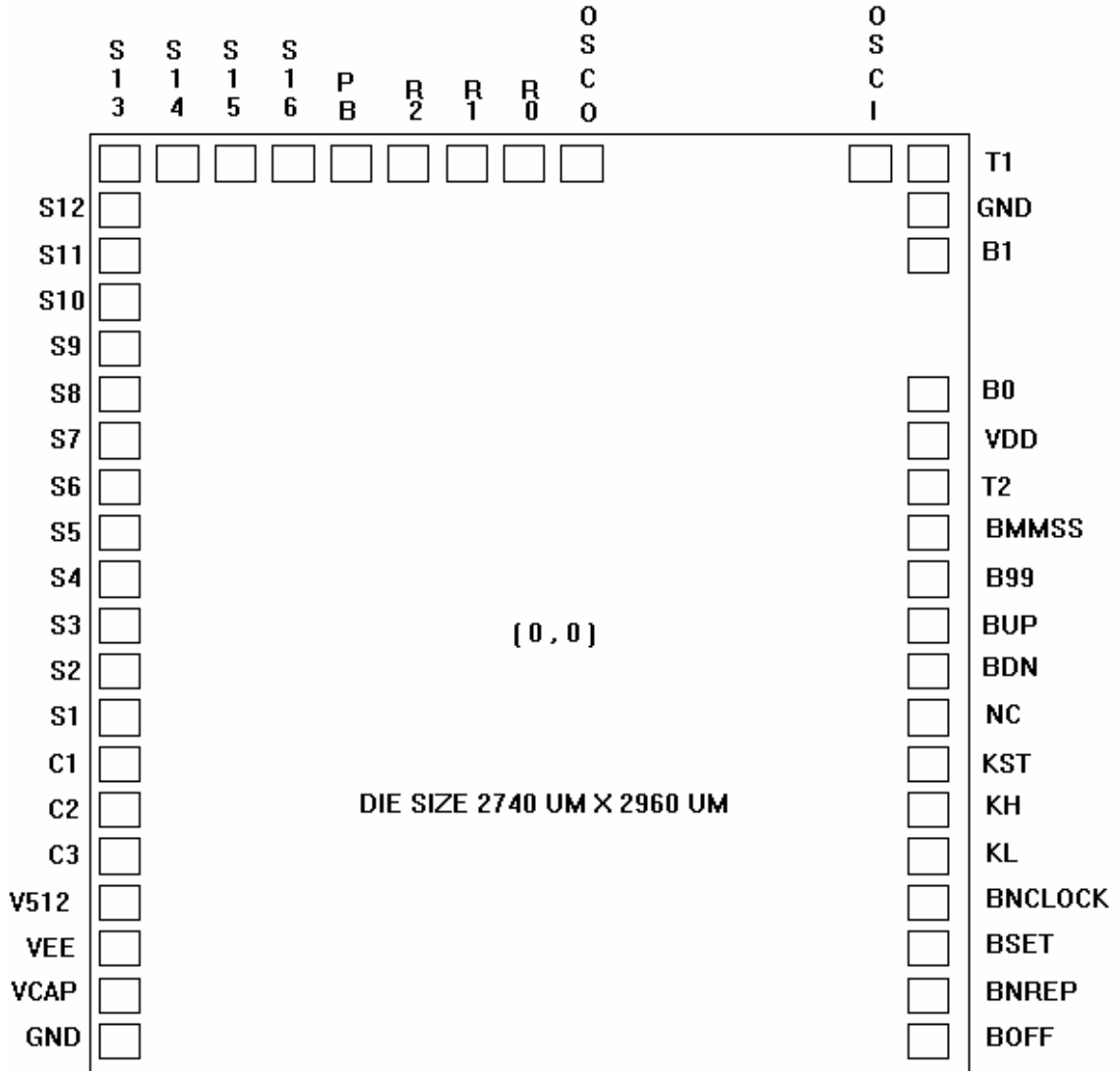
(GND = 0V, Vdd = 1.5V, Ta = 25°C unless otherwise specified)

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	
Frequency stability	$\Delta f/f$	-	-	10	ppM	Vdd=1.6-1.4
Buzzer output current	Ibd	500	-	-	μA	Vbd-Vss=0.5
LCD frequency	Flcd	-	64	-	Hz	
Segment current	Ilcd	0.15	-	-	μA	Vseg=0.2V
Common current	Icom	3.0	-	-	μA	Vcom=0.2V

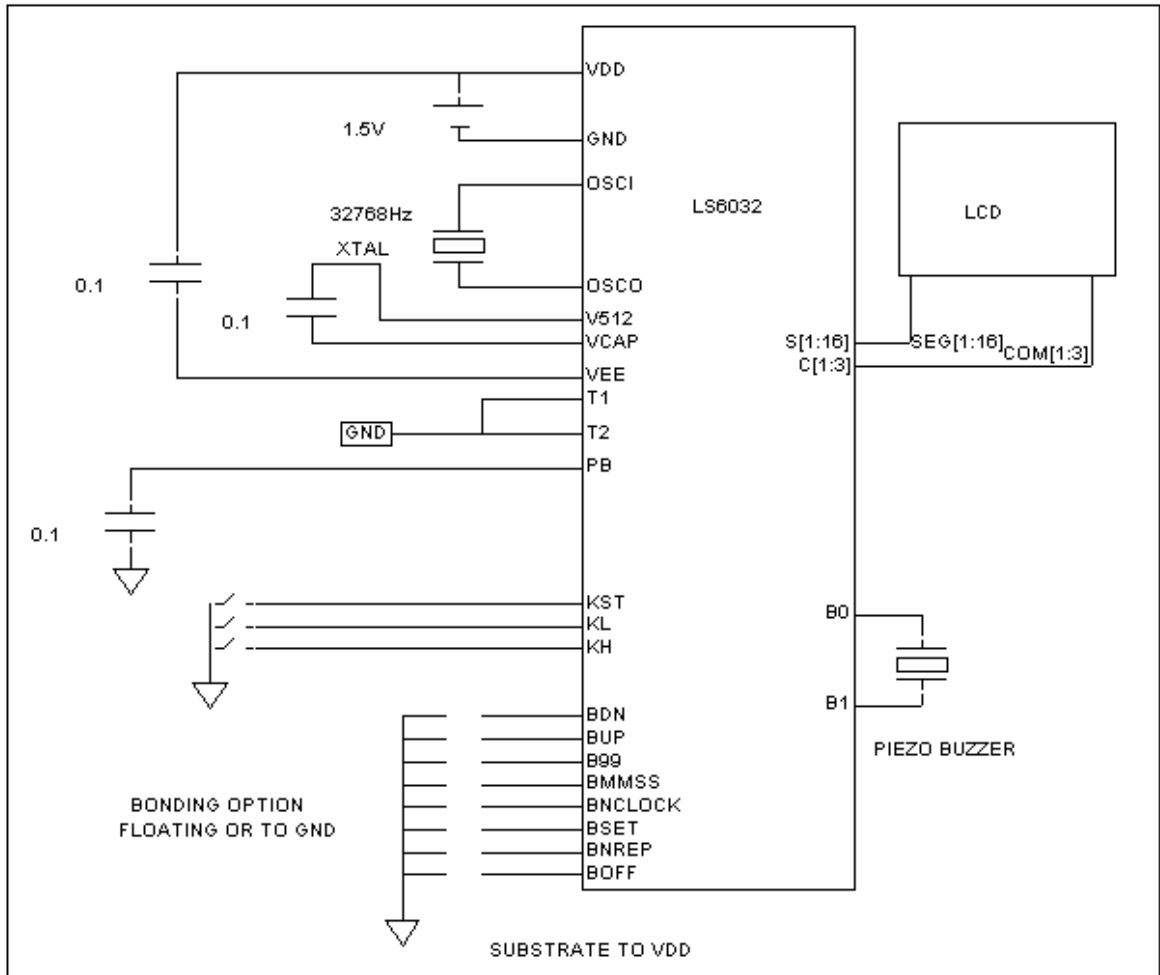
## Pad Coordinate

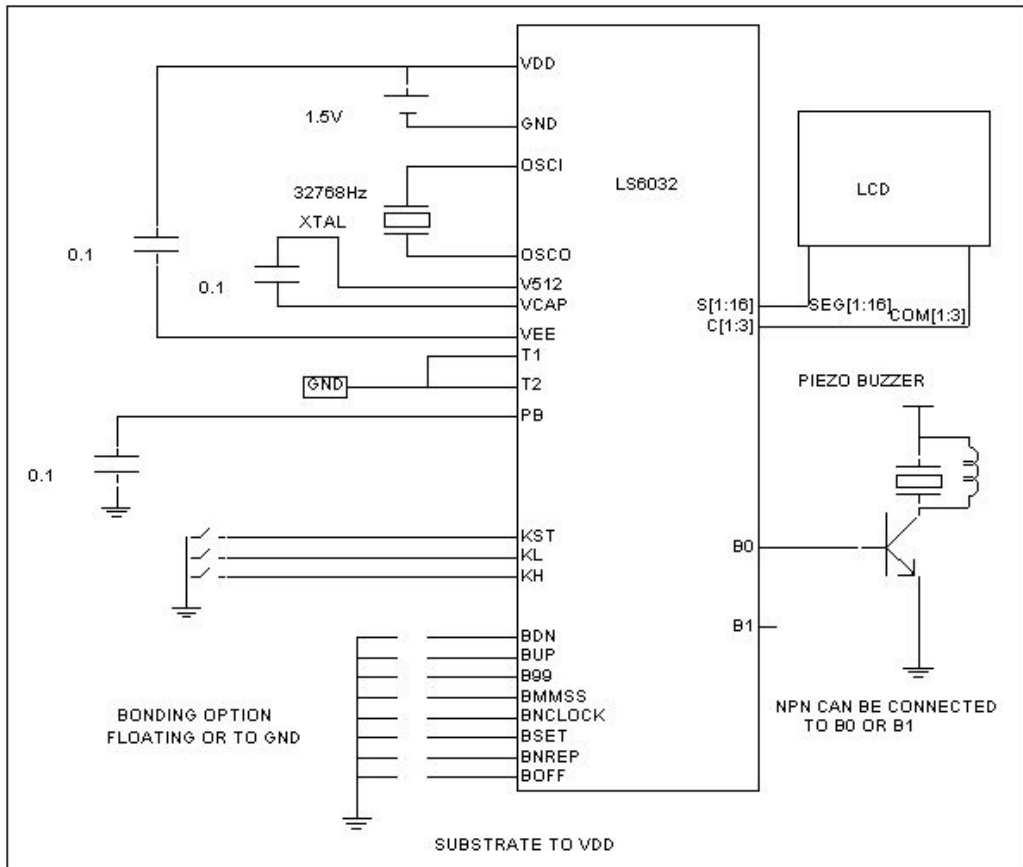
PAD	X( $\mu$ m)	Y( $\mu$ m)	PAD	X( $\mu$ m)	Y( $\mu$ m)
GND	-1295.0	-1394.0	PB	-743.0	+1350.0
VCAP	-1295.0	-1251.0	R2	-593.0	+1350.0
VEE	-1295.0	-1110.0	R1	-449.0	+1350.0
V512	-1295.0	-965.0	R0	-225.0	+1350.0
C3	-1295.0	-825.0	OSCO	-75.0	+1350.0
C2	-1295.0	-685.0	OSCI	+1105.0	+1340.0
C1	-1295.0	-545.0	T1	+1246.0	+1340.0
S1	-1295.0	-400.0	GND	+1246.0	+1140.0
S2	-1295.0	-260.0	B1	+1246.0	+988.0
S3	-1295.0	-120.0	B0	+1246.0	+678.0
S4	-1295.0	+20.0	VDD	+1246.0	+543.0
S5	-1295.0	+160.0	T2	+1246.0	+395.0
S6	-1295.0	+300.0	BMMSS	+1246.0	+226.0
S7	-1295.0	+440.0	B99	+1246.0	+78.0
S8	-1295.0	+580.0	BUP	+1246.0	-70.0
S9	-1295.0	+720.0	BDN	+1246.0	-216.0
S10	-1295.0	+860.0	NC	+1246.0	-365.0
S11	-1295.0	+1000.0	KST	+1246.0	-513.0
S12	-1295.0	+1140.0	KH	+1246.0	-661.0
S13	-1303.0	+1350.0	KL	+1246.0	-809.0
S14	-1163.0	+1350.0	BNCLOCK	+1246.0	-957.0
S15	-1023.0	+1350.0	BSET	+1246.0	-1105.0
S16	-883.0	+1350.0	BNREP	+1246.0	-1253.0
			BOFF	+1246.0	-1400.0

**Pad Location**



**Application Circuit**

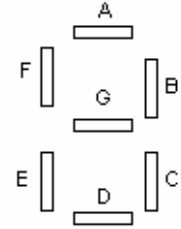
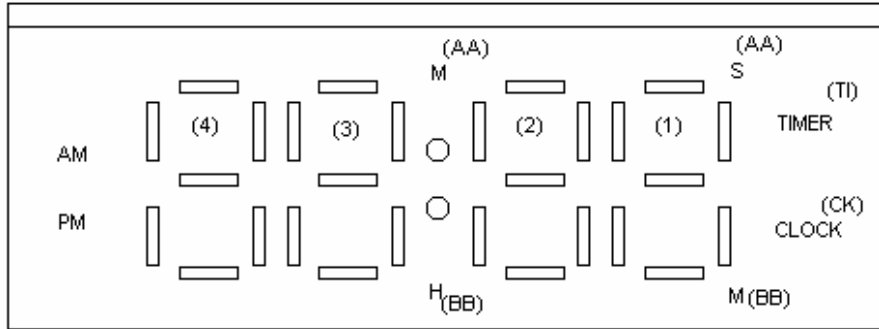






**LCD DRAWING**

PIN 1.....



PIN	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
SIGNAL	C3	C2	C1	S1	S2	S3	S5	S6	S7	S8	S9	S10	S11	S13	S14	S15
COM1	/	/	C1	4F	4A	4B	3F	3A	3B	AA	2F	2A	2B	1F	1A	1B
COM2	/	C2	/	4E	4G	4C	3E	3G	3C	:	2E	2G	2C	1E	1G	1C
COM3	C3	/	/	AM	4D	PM	/	3D	/	BB	/	2D	/	CK	1D	TI

**Revision History**

- 5.11.00 - Addition of Application for driving transistor + coil.
- 29.12.00 - Addition of Mode Demonstration Table.