

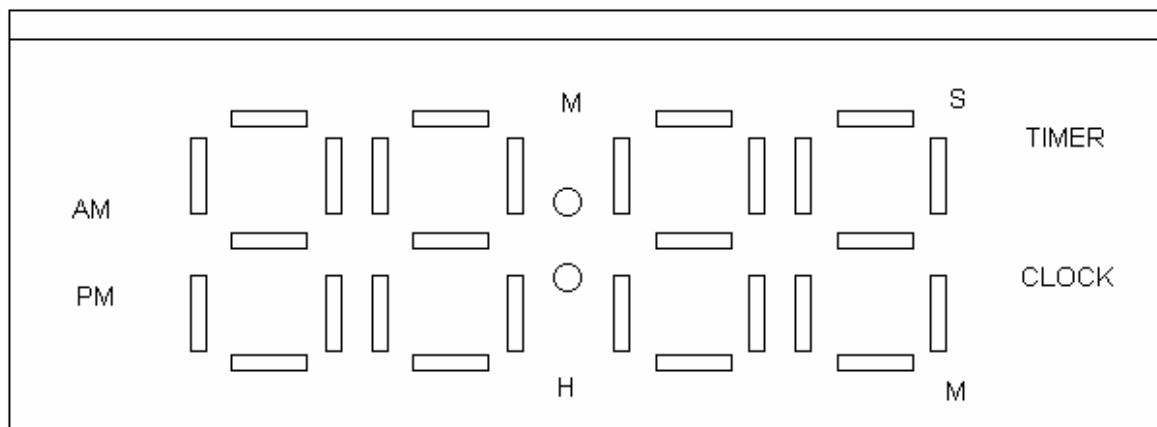
**Features**

- \* 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.<br>Press KST will count up if the timer value is 0:00.                                                                                                         |
|             | GND    | Count up disable<br>Press KST will have no function is the timer value is 0:00.                                                                                                 |
| BDN         | VDD    | Count down enable.<br>Press KL, KH sets the timer value for count down.                                                                                                         |
|             | GND    | Count down disable<br>Press KL,. KH has no function for setting (no count down).                                                                                                |
| BMS         | VDD    | Minute Second mode.<br>Press KL sets second value, KH sets minute value.                                                                                                        |
|             | GND    | Hour Minute mode.<br>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<br>OCK | VDD    | No Clock                                                                                                                                                                        |
|             | GND    | Enable clock. In timer mode, press KL,KH, KST simultaneously enters clock mode.                                                                                                 |
| BSET        | VDD    | Enable setting in PAUSE mode.<br>While the timer is counting, press KST enters PAUSE mode.                                                                                      |
|             | GND    | No setting in PAUSE mode.                                                                                                                                                       |
| BNRE<br>P   | VDD    | No repeat function.                                                                                                                                                             |
|             | GND    | Repeat function enabled.<br>The timer will restart from the setting value by the end of count automatically.<br>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.<br>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.<br>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<br>U<br>P | B<br>D<br>N | B<br>M<br>S | B<br>9<br>9 | B<br>N<br>C<br>L<br>O<br>C<br>K | B<br>S<br>E<br>T | B<br>N<br>R<br>E<br>P | B<br>O<br>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,<br>BNCLOCK, BSET,<br>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**

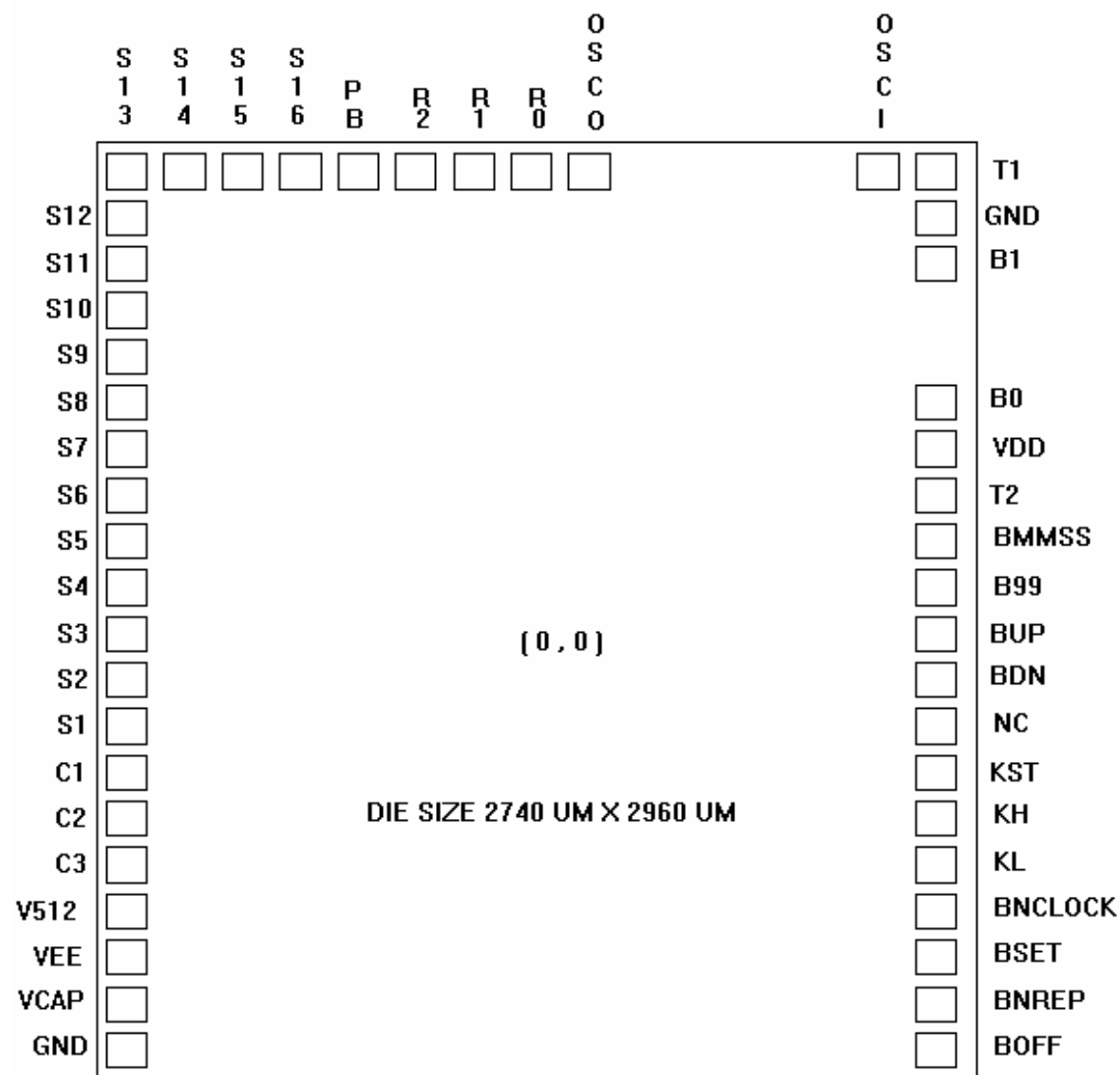
(GND = 0V, Vdd = 1.5V, Ta = 25°C unless otherwise specified)

| 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   |
|                       |              |      |      |      |      |             |

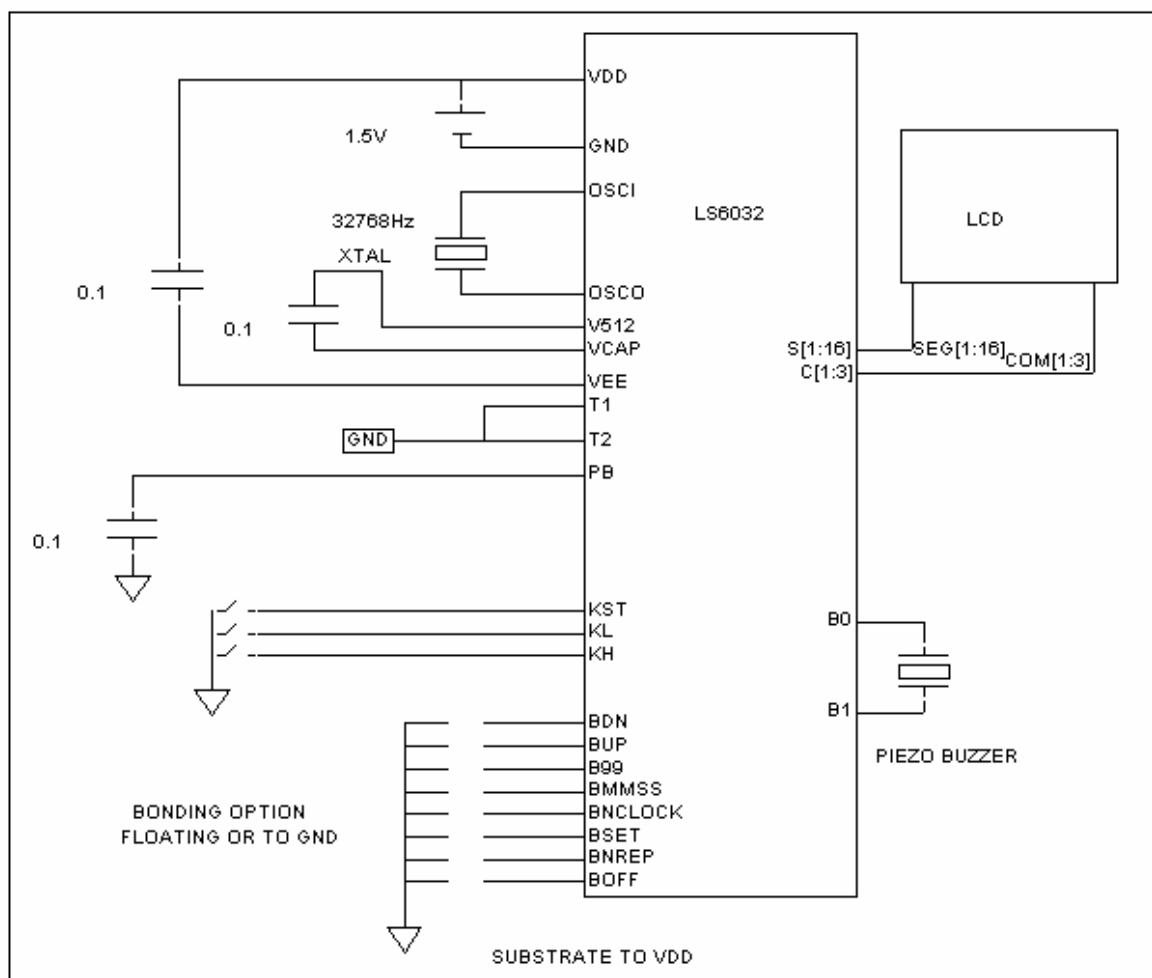
**Pad Coordinate**

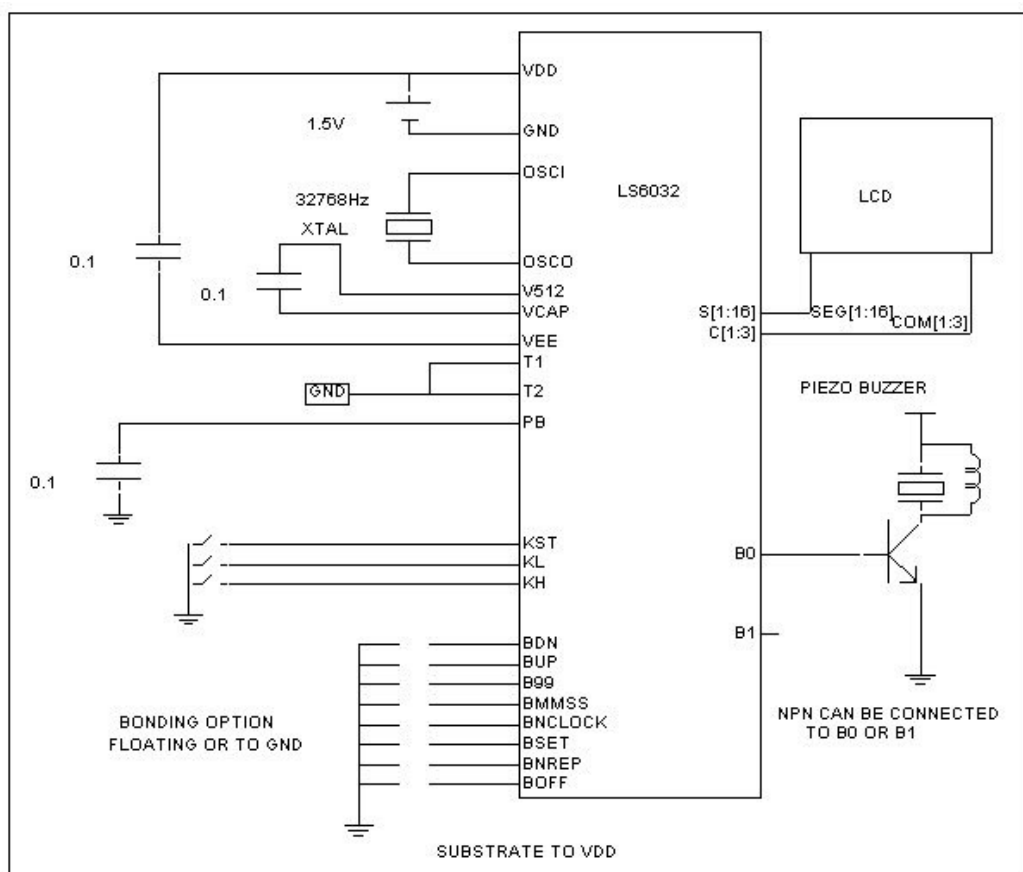
| <b>PAD</b> | <b>X(μm)</b> | <b>Y(μm)</b> | <b>PAD</b> | <b>X(μm)</b> | <b>Y(μm)</b> |
|------------|--------------|--------------|------------|--------------|--------------|
| GND        | -1295.0      | -1394.0      | PB         | -743.0       | +1350.0      |
| VCAP       | -1295.0      | -1251.0      | 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**



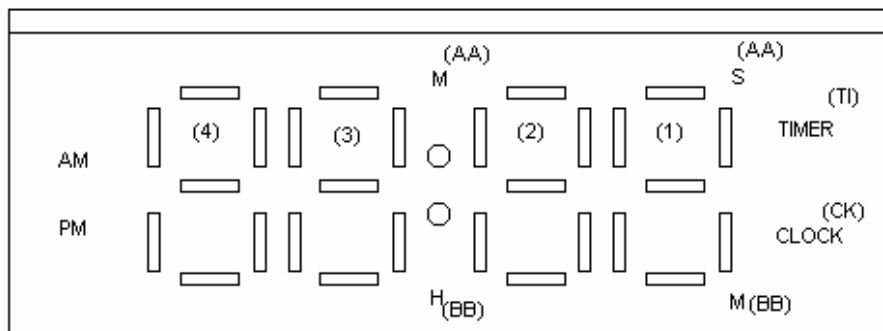
## Application Circuit





# 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.