

**FEATURES**

- \* 0.56 INCH (14.22 mm) DIGIT HEIGHT.
- \* WIDE SUPPLY VOLTAGE OPERATION.
- \* SERIAL DATA INPUT.
- \* CONSTANT CURRENT DRIVERS.
- \* CONTINUOUS BRIGHTNESS CONTROL.
- \* SOLID STATE RELIABILITY-LONG OPERATION LIFE.
- \* WIDE VIEWING ANGLE.
- \* TTL COMPATIBLE.

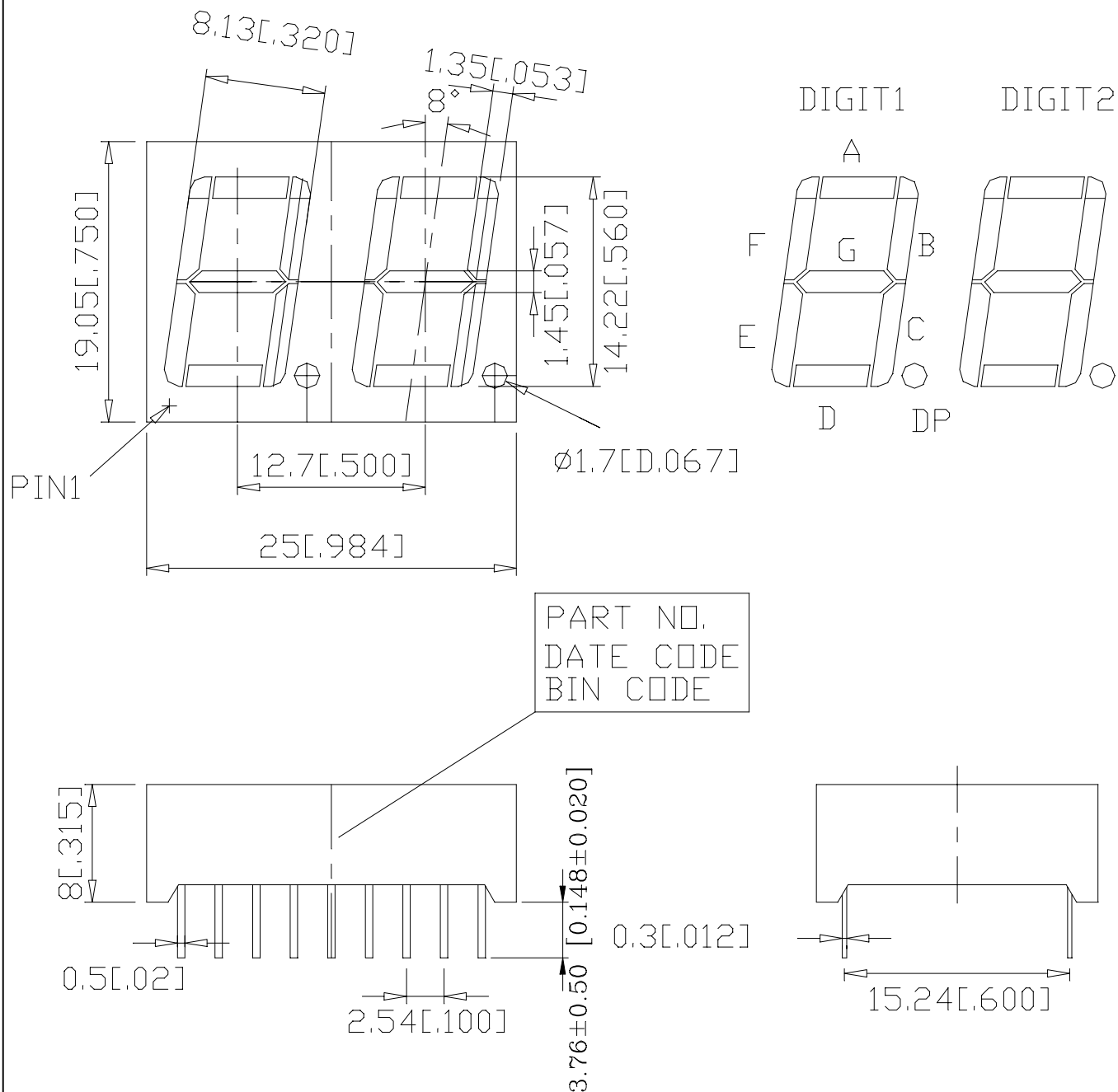
**DESCRIPTION**

The LTM-8530HR is a 0.56 inch (14.22 mm) numeric display modules, and a built-in M5450 MOS integrated circuits. The integrated circuit contains serial data input, 35 bits shift register. 34 LED driver output and a brightness control. This device utilizes high efficiency red LED chips, which are made from GaAsP on a transparent GaP substrate, and has a red face and red segments. The MOS integrated circuits are produced with N-channel silicon gate technology.

**DEVICE**

| PART NO.    | DESCRIPTION      |
|-------------|------------------|
| HL-EFF. RED | 2 Digit          |
| LTM-8530HR  | Rt. Hand Decimal |

## PACKAGE DIMENSIONS



NOTES: All dimensions are in millimeters. Tolerances are  $\pm 0.25$  mm (0.01") unless otherwise noted.

**PIN CONNECTION**

| <b>No.</b> | <b>CONNECTION</b> |
|------------|-------------------|
| 1          | VSS               |
| 2          | VLED              |
| 3          | NO PIN            |
| 4          | NO PIN            |
| 5          | NO PIN            |
| 6          | BIT 17 OUTPUT     |
| 7          | BIT 18 OUTPUT     |
| 8          | BIT 19 OUTPUT     |
| 9          | BIT 20 OUTPUT     |
| 10         | BIT 21 OUTPUT     |
| 11         | BIT 22 OUTPUT     |
| 12         | BIT 23 OUTPUT     |
| 13         | BIT 24 OUTPUT     |
| 14         | DATA ENABLE       |
| 15         | DATA INPUT        |
| 16         | CLOCK INPUT       |
| 17         | VDD               |
| 18         | BRT. CONTROL      |

## ABSOLUTE MAXIMUM RATING AT T<sub>A</sub>=25°C

| PARAMETER                                                                | Symbol  | Min. | Max. | UNIT |
|--------------------------------------------------------------------------|---------|------|------|------|
| Supply Voltage *1                                                        | VDD     | -0.3 | 12   | V    |
| Input Voltage                                                            | VI      | -0.3 | 12   | V    |
| Off State Output Voltage                                                 | VO(off) |      | 12   | V    |
| LED Supply Voltage                                                       | VLED    | 2.8  | 3.5  | V    |
| Power Dissipation of IC *2                                               | PD(IC)  |      | 335  | mW   |
| Supply Current                                                           | IDD     |      | 8.5  | mA   |
| Operating Temperature Range                                              | Top     | -20  | +60  | °C   |
| Storage Temperature Range                                                | Tstg    | -20  | +60  | °C   |
| Solder Temperature: max 260°C for max 3sec at 1.6mm below seating plane. |         |      |      |      |

Note: 1. All voltage are with respect to Vss(GND)

2. Power dissipation of IC is given by  $PD=(V_{LED}-V_F) \cdot (I_F) \cdot (\text{No. of Segments})+(8.5\text{mA}) \cdot (V_{DD})$

\*V<sub>F</sub> is LED forward voltage.

## RECOMMENDED OPERATING CONDITION AT T<sub>A</sub>=25°C

| Parameter                | Symbol  | Min.   | Typ. | Max. | Unit | Test Condition       |
|--------------------------|---------|--------|------|------|------|----------------------|
| Supply Voltage           | VDD     | 4.75   |      | 11   | V    |                      |
| Input Voltage            |         |        |      |      |      |                      |
| Logical "0" Level        |         | -0.3   |      | 0.8  | V    | ±10μA Input Bias     |
| Logical "1" Level        | VI      | 2.2    |      | VDD  | V    | 4.75V < VDD < 5.25V  |
| Logical "1" Level        |         | VDD -2 |      | VDD  | V    | VDD > 5.25V          |
| Brightness Input Current | IB      | 0      |      | 0.75 | mA   |                      |
| Brightness Input Voltage | VB      | 3      |      | 4.3  | V    | Input Current=750 μA |
| Off State Voltage        | VO(off) |        |      | 11   | V    |                      |
| Output Sink Current      |         |        |      |      |      |                      |
| Segment Off              |         |        |      | 10   | μA   | IB=0 μA              |
| Segment On               |         |        | 3    |      | mA   | IB=100 μA            |
|                          |         |        | 6    |      | mA   | IB=200 μA            |
| Input Clock Frequency    | FCLOCK  | 0      |      | 0.5  | MHZ  |                      |
| Output Matching          | IO      |        |      | ±20  | %    |                      |

**ELECTRICAL/OPTICAL CHARACTERISTICS AT Ta=25°C**

| PARAMETER                         | SYMBOL            | MIN. | TYP. | MAX. | UNIT | TEST CONDITION        |
|-----------------------------------|-------------------|------|------|------|------|-----------------------|
| Average Luminous Intensity        | I <sub>v</sub>    | 800  | 2400 |      | μcd  | I <sub>B</sub> =0.4mA |
| Peak Emission Wavelength          | λ <sub>p</sub>    |      | 635  |      | nm   | I <sub>B</sub> =0.4mA |
| Spectral Line Half-Width          | Δλ                |      | 40   |      | nm   | I <sub>B</sub> =0.4mA |
| Dominant Wavelength               | λ <sub>d</sub>    |      | 623  |      | nm   | I <sub>F</sub> =20mA  |
| Luminous Intensity Matching Ratio | I <sub>v</sub> -m |      |      | 2:1  |      | I <sub>B</sub> =0.4mA |

**FUNCTIONAL DESCRIPTION**

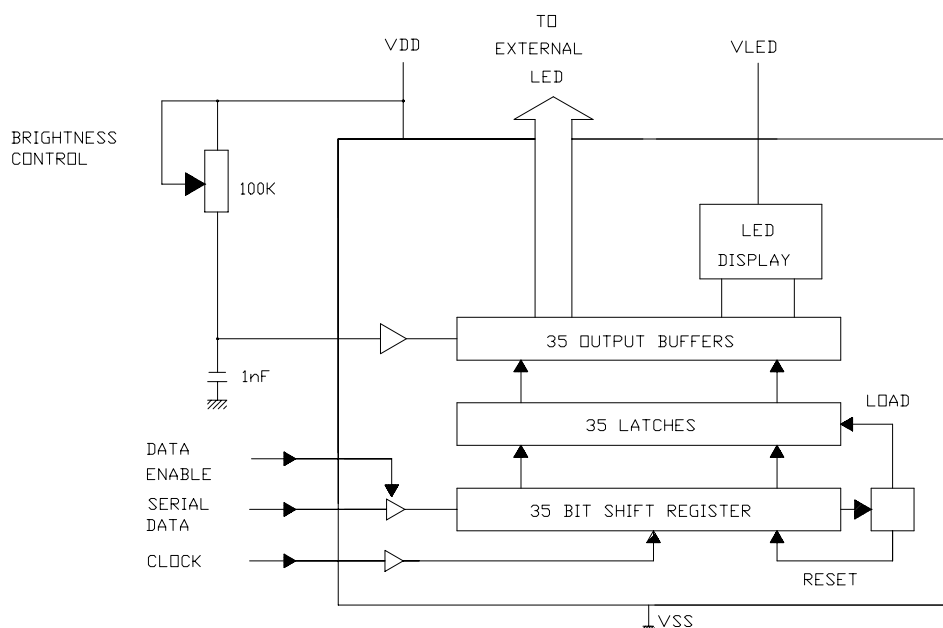
Serial data transfer from the data source to the display driver is accomplished with 2 signals serial data and clock. Using a format of a leading “1” followed by the 35 data bits allow data transfer without an additional load signal. The 35 data bits are latched after the 36<sup>th</sup> bit is completed, thus providing non multiplexed, direct drive to the display. Outputs change only if the serial data bits differ from the previous time.

Brightness of display is determined by control the output current of LED display. A 1nF capacitor should be connected to brightness control, Pin 7 to prevent possible oscillations. The output current is typically 25 times greater than the current into Pin 7 which is set by an external variable resistor. There is an internal limiting resistor of 400 Ω nominal value.

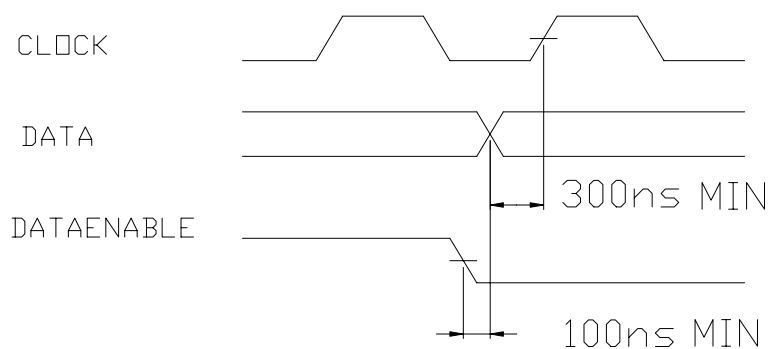
Figure 1 shows the input data format. A start bit of logical “1” proceed the 35 bits of data. At the 36<sup>th</sup> clock, a LOAD signal is generated synchronously with the high state of the clock, which loads the 35 bits of the shift registers into the latches. At the low state of the clock a RESET signal is generated which clears all the shift registers for the next set of data. The shift registers are static master-slave configuration. There is no clear for master portion of the first register, thus allowing continuous operation.

There must be a complete set of 36 clocks or the shift registers won't clear. When power is first applied to the chip, an internal power ON, a reset signal is generated which reset all registers and all latches. The START bit and first clock return the chip on its normal operation. Bit 1 is the first following the start bit and it will appear on the segment A of the digit 1. A logical “1” at the input will turn on the appropriate LED. Figure 2 shows the timing relationship between data, clock, and DATA ENABLE. A max. clock frequency of 0.5 MHz is assumed.

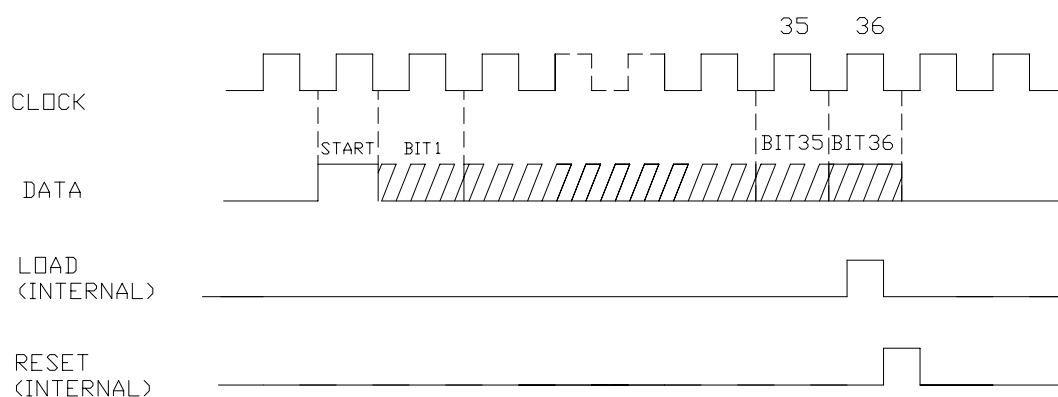
**FIGURE 1. INTERNAL BLOCK DIAGRAM**



**FIGURE 2. INPUT DATA FORMAT**



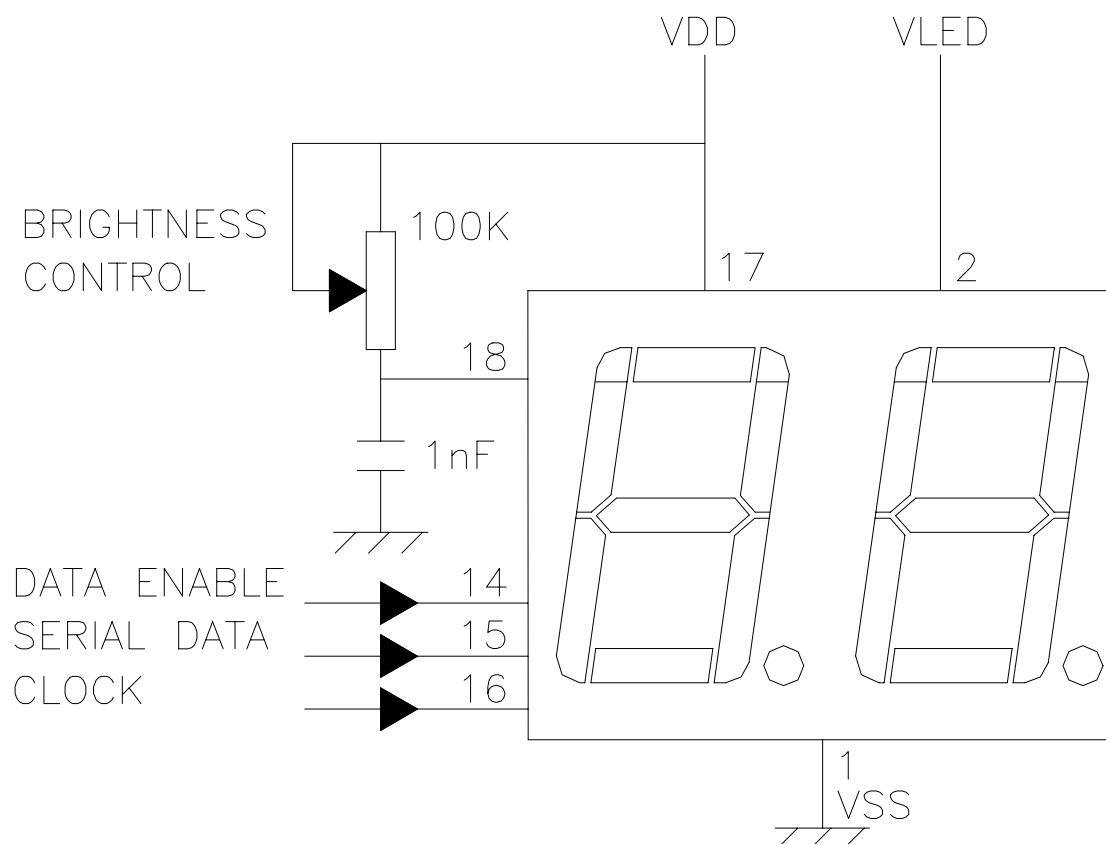
**FIGURE 3. TIMING RELATIONSHIP**



**TABLE 1 SERIAL DATA INPUT SEQUENCE**

| BIT | LTM-8530 |               |
|-----|----------|---------------|
|     | DIGIT    | SEGMENT       |
| 1   | 1        | A             |
| 2   | 1        | B             |
| 3   | 1        | C             |
| 4   | 1        | D             |
| 5   | 1        | E             |
| 6   | 1        | F             |
| 7   | 1        | G             |
| 8   | 1        | D.P.          |
| 9   | 2        | A             |
| 10  | 2        | B             |
| 11  | 2        | C             |
| 12  | 2        | D             |
| 13  | 2        | E             |
| 14  | 2        | F             |
| 15  | 2        | G             |
| 16  | 2        | D.P.          |
| 17  |          | PIN 6         |
| 18  |          | PIN 7         |
| 19  |          | PIN 8         |
| 20  |          | PIN 9         |
| 21  |          | PIN 10        |
| 22  |          | PIN 11        |
| 23  |          | PIN 12        |
| 24  |          | PIN 13        |
| 25  |          | NO CONNECTION |
| 26  |          | NO CONNECTION |
| 27  |          | NO CONNECTION |
| 28  |          | NO CONNECTION |
| 29  |          | NO CONNECTION |
| 30  |          | NO CONNECTION |
| 31  |          | NO CONNECTION |
| 32  |          | NO CONNECTION |
| 33  |          | NO CONNECTION |
| 34  |          | NO CONNECTION |

## TYPICAL APPLICATION



- NOTES: 1. Clean only in water, isopropanol, ethanol, freon TF(or equivalent).
2. Luminous intensity is measured with a light sensor and filter combination that approximates the CIE (Commision Internationale De L'Eclairage)eye-response curve.