

# LITEON

## 0.56" 7-Segment Numeric LED Displays With MOS I.C. Driver LTM-8500 Series

### Features

- 0.56 inch (14.22mm) digit height.
- Wide supply voltage operation.
- Serial data input.
- Constant Current drivers.
- Continuous brightness control.
- Solid state reliability-long operation life.
- Wide viewing angle.
- Choices of five bright colors/bright red/green/yellow/red orange/high efficiency red.
- TTL compatible.

### Description

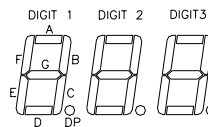
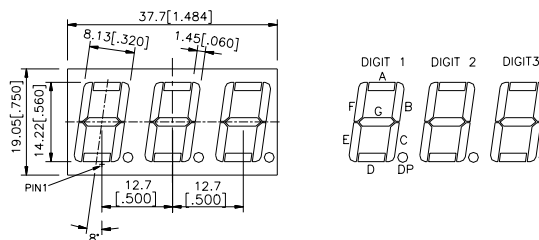
The LTM-8500 series are 0.56 inch (14.22mm) numeric display modules, and a built-in M5450 MOS integrated circuits. The integrated circuit contains serial data input, 35 bits shift register. 34 LED driver output and a brightness control.

The bright red yellow and green devices utilize LED chips which are made from GaP on a transparent GaP substrate. The red orange and high efficiency red devices utilize LED chips which are made from GaAsP on a transparent GaP substrate. The MOS integrated circuits are produced with N-channel silicon gate technology.

Bright red displays have black face and red segments. Green and yellow displays have gray face and white segments. Red orange displays have orange face and orange segments. High efficiency red displays have red face and red segments.

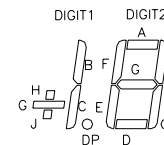
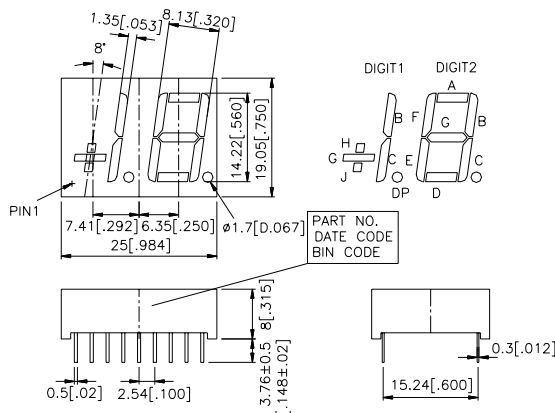
### Package Dimensions

#### A. LTM-8522

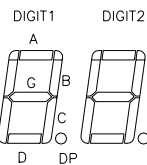
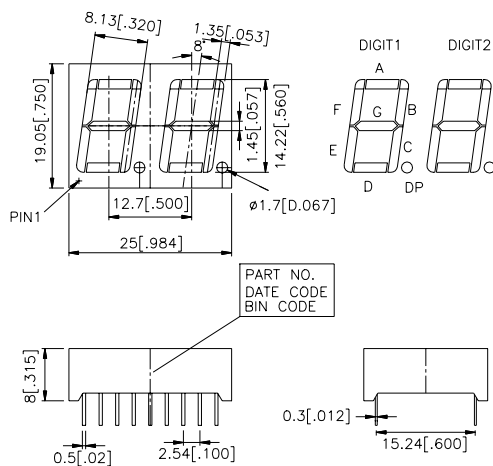


DISPLAYS

#### B. LTM-8529



#### C. LTM-8530



Notes: All dimensions are in millimeters (inches).  
Tolerance :  $\pm 0.25\text{mm}$  (0.010") unless otherwise noted.

## Devices

Part No. LTM-					Description	Package Dimension
Bright Red	Green	Yellow	Red Orange	Hi.-Eff. Red		
8522P	8522G	8522Y	8522E	8522HR	3 Digit, Rt. Hand Decimal	A
8529P	8529G	8529Y	8529E	8529HR	1 1/2 Digit, Rt. Hand Decimal	B
8530P	8530G	8530Y	8530E	8530HR	2 Digit, Rt. Hand Decimal	C

## Pin Connection

Pin No.	Connection		
	LTM-8522	LTM-8529	LTM-8530
1	Vss	Vss	Vss
2	VLED	VLED	VLED
3	VLED	No Pin	No Pin
4	Bit 25 Output	No Pin	No Pin
5	Bit 26 Output	No Pin	No Pin
6	Bit 27 Output	Bit 15 Output	Bit 17 Output
7	Bit 28 Output	Bit 16 Output	Bit 18 Output
8	Bit 29 Output	Bit 17 Output	Bit 19 Output
9	Bit 30 Output	Bit 18 Output	Bit 20 Output
10	Bit 31 Output	Bit 19 Output	Bit 21 Output
11	Bit 32 Output	Bit 20 Output	Bit 22 Output
12	Bit 33 Output	Bit 21 Output	Bit 23 Output
13	Bit 34 Output	Bit 22 Output	Bit 24 Output
14	Data Enable	Data Enable	Data Enable
15	Data Input	Data Input	Data Input
16	Clock Input	Clock Input	Clock Input
17	VDD	VDD	VDD
18	BRT. Control	BRT. Control	BRT. Control

## Absolute Maximum Ratings at Ta=25°C

Parameter	Symbol	Min.	Max.	Unit
Supply Voltage*1	V <sub>DD</sub>	-0.3	12	V
Input Voltage	V <sub>I</sub>	-0.3	12	V
Off State Output Voltage	V <sub>O(off)</sub>		12	V
LED Supply Voltage	V <sub>LED</sub>	2.8	3.5	V
Power Dissipation of IC*2	P <sub>D(IC)</sub>		335	mW
Supply Current	I <sub>DD</sub>		8.5	mA
Operating Temperature Range	T <sub>OP</sub>	-20	+60	°C
Storage Temperature Range	T <sub>stg</sub>	-20	+60	°C
Solder Temperature 1/16 Inch Below Seating Plane for 3 Seconds at 260°C				

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

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

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

## Recommended Operating Condition at Ta=25°C

Parameter	Symbol	Min.	Typ.	Max.	Unit	Test Condition
Supply Voltage	V <sub>DD</sub>	4.75		11	V	
Input Voltage						
Logical" 0" Level		-0.3		0.8	V	± 10 $\mu$ A Input Bias 4.75V<V <sub>DD</sub> <5.25V V <sub>DD</sub> >5.25V
Logical" 1" Level		2.2		V <sub>DD</sub>	V	
Logical" 1" Level	V <sub>I</sub>	V <sub>DD</sub> -2		V <sub>DD</sub>	V	
Brightness Input Current	I <sub>B</sub>	0		0.75	mA	
Brightness Input Voltage	V <sub>B</sub>	3		4.3	V	Input Current =750 $\mu$ A
Off State Voltage	V <sub>O(off)</sub>			11	V	
Output Sink Current						
Segment Off			3	10	$\mu$ A	I <sub>F</sub> =0 $\mu$ A I <sub>B</sub> =100 $\mu$ A I <sub>F</sub> =200 $\mu$ A
Segment On			6		mA	
Input Clock Frequency	F <sub>CLOCK</sub>	0		0.5	MHZ	
Output Matching	I <sub>O</sub>			± 20	%	

## Electrical/Optical Characteristics at Ta=25°C

LTM-8522P/8529P/8530P

Parameter	Symbol	Min.	Typ.	Max.	Unit	Test Condition
Average Luminous Intensity	I <sub>v</sub>	320	950		$\mu$ cd	I <sub>B</sub> =0.4mA
Peak Emission Wavelength	$\lambda$ P		697		nm	I <sub>B</sub> =0.4mA
Spectral Line Half-Width	$\Delta \lambda$		90		nm	I <sub>B</sub> =0.4mA
Dominant Wavelength	$\lambda$ d		657		nm	I <sub>F</sub> =20mA
Luminous Intensity Matching Ratio	I <sub>v-m</sub>			2:1		I <sub>B</sub> =0.4mA

LTM-8522G/8529G/8530G

Parameter	Symbol	Min.	Typ.	Max.	Unit	Test Condition
Average Luminous Intensity	I <sub>v</sub>	800	2400		$\mu$ cd	I <sub>B</sub> =0.4mA
Peak Emission Wavelength	$\lambda$ P		565		nm	I <sub>B</sub> =0.4mA
Spectral Line Half-Width	$\Delta \lambda$		30		nm	I <sub>B</sub> =0.4mA
Dominant Wavelength	$\lambda$ d		569		nm	I <sub>F</sub> =20mA
Luminous Intensity Matching Ratio	I <sub>v-m</sub>			2:1		I <sub>B</sub> =0.4mA

LTM-8522Y/8529Y/8530Y

Parameter	Symbol	Min.	Typ.	Max.	Unit	Test Condition
Average Luminous Intensity	I <sub>v</sub>	800	2400		$\mu$ cd	I <sub>B</sub> =0.4mA
Peak Emission Wavelength	$\lambda$ P		585		nm	I <sub>B</sub> =0.4mA
Spectral Line Half-Width	$\Delta \lambda$		35		nm	I <sub>B</sub> =0.4mA
Dominant Wavelength	$\lambda$ d		588		nm	I <sub>F</sub> =20mA
Luminous Intensity Matching Ratio	I <sub>v-m</sub>			2:1		I <sub>B</sub> =0.4mA

LTM-8522E/8529E/8530E

Parameter	Symbol	Min.	Typ.	Max.	Unit	Test Condition
Average Luminous Intensity	I <sub>v</sub>	800	2400		$\mu$ cd	I <sub>B</sub> =0.4mA
Peak Emission Wavelength	$\lambda$ P		630		nm	I <sub>B</sub> =0.4mA
Spectral Line Half-Width	$\Delta \lambda$		40		nm	I <sub>B</sub> =0.4mA
Dominant Wavelength	$\lambda$ d		621		nm	I <sub>F</sub> =20mA
Luminous Intensity Matching Ratio	I <sub>v-m</sub>			2:1		I <sub>B</sub> =0.4mA

Parameter	Symbol	Min.	Typ.	Max.	Unit	Test Condition
Average Luminous Intensity	$I_v$	800	2400		$\mu$ cd	$I_B=0.4mA$
Peak Emission Wavelength	$\lambda_P$		635		nm	$I_B=0.4mA$
Spectral Line Half-Width	$\Delta\lambda$		40		nm	$I_B=0.4mA$
Dominant Wavelength	$\lambda_d$		623		nm	$I_F=20mA$
Luminous Intensity Matching Ratio	$I_v-m$			2:1		$I_B=0.4mA$

Note: Luminous intensity is measured with a light sensor and filter combination that approximates the CIE (Commision Internationale De L'Eclairage) eye-response curve.

## 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 36th 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 $\Omega$  nominal value.

Figure 1 shows the input data format. A start bit of logical "1" preceed the 35 bits of data. At the 36th 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 0.5MHz is assumed.

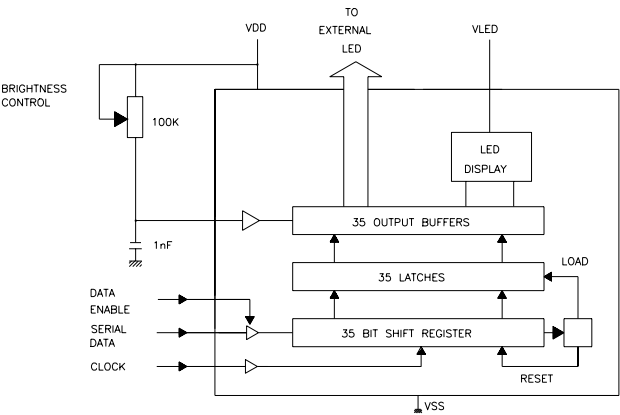


Figure 1. Internal Block Diagram

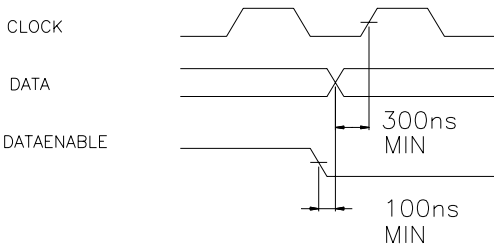


Figure 2. Input Data Format

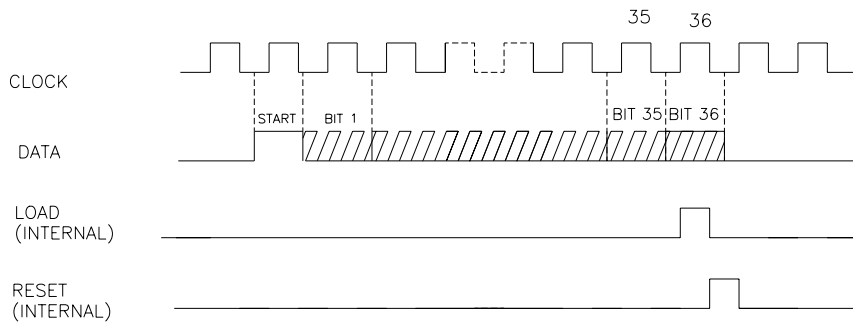
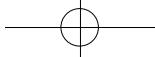


Figure 3. Timing Relationship

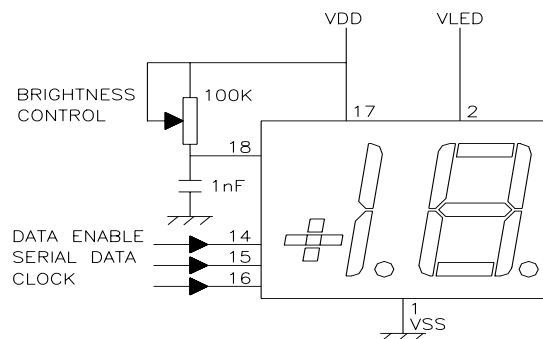
Table I Serial Data Input Sequence

Bit	LTM-8522		LTM-8529		LTM-8530	
	Digit	Segment	Digit	Segment	Digit	Segment
1	1	A	1	B	1	A
2	1	B	1	C	1	B
3	1	C	1	G	1	C
4	1	D	1	H	1	D
5	1	E	1	J	1	E
6	1	F	1	D.P.	1	F
7	1	G	2	A	1	G
8	1	D.P.	2	B	1	D.P.
9	2	A	2	C	2	A
10	2	B	2	D	2	B
11	2	C	2	E	2	C
12	2	D	2	F	2	D
13	2	E	2	G	2	E
14	2	F	2	D.P.	2	F
15	2	G		Pin 6	2	G
16	2	D.P.		Pin 7	2	D.P.
17	3	A		Pin 8		Pin 6
18	3	B		Pin 9		Pin 7
19	3	C		Pin 10		Pin 8
20	3	D		Pin 11		Pin 9
21	3	E		Pin 12		Pin 10
22	3	F		Pin 13		Pin 11
23	3	G		No Connection		Pin 12
24	3	D.P.		No Connection		Pin 13
25		Pin 4		No Connection		No Connection
26		Pin 5		No Connection		No Connection
27		Pin 6		No Connection		No Connection
28		Pin 7		No Connection		No Connection
29		Pin 8		No Connection		No Connection
30		Pin 9		No Connection		No Connection
31		Pin 10		No Connection		No Connection
32		Pin 11		No Connection		No Connection
33		Pin 12		No Connection		No Connection
34		Pin 13		No Connection		No Connection

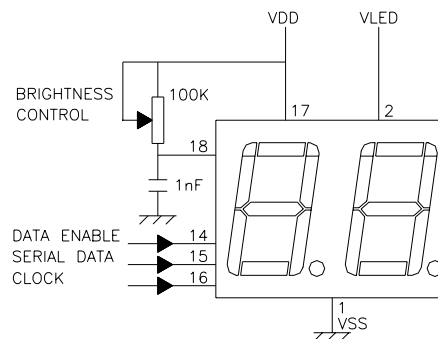


## Typical Application

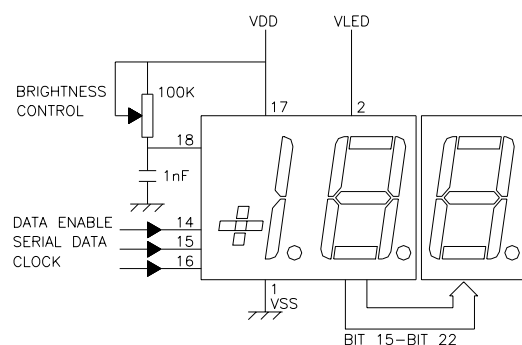
### A. 1 1/2 DIGIT DISPLAY



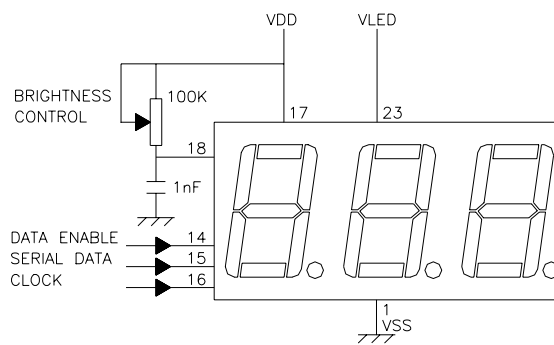
### B. 2 DIGIT DISPLAY



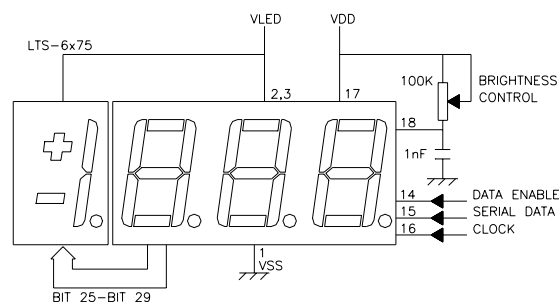
### C. 2 1/2 DIGIT DISPLAY



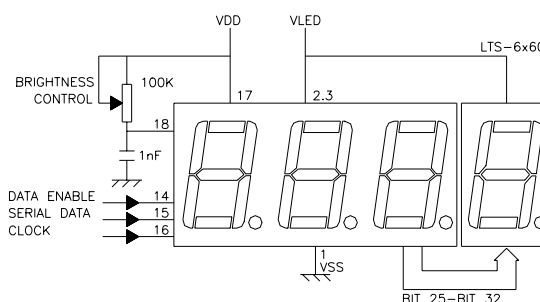
### D. 3 DIGIT DISPLAY



### E. 3 1/2 DIGIT DISPLAY



### F. 4 DIGIT DISPLAY



NOTES:1.Clean only in water,isopropanol, ethanol,freon TF(or equivalent).

2.Luminous intensity is measured with a light sensor and filter combination thar approximates the CIE (Commision Internationale De L'Eclairage)eye-response curve.

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