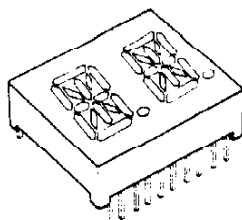




THREE-FIVE SYSTEMS, INC.

14 SEGMENT ALPHANUMERIC INTEGRATED DISPLAYS

TSM7052 (Red), TSM7252 (Green)
& TSM7752 (High Efficiency Red)



ABSOLUTE MAXIMUM RATINGS

VDD: 12V
VLED: Figure 2
Voltage at Any Other Pin: -0.3V to 12V
Driver Chip
Power Dissipation: 600mW Max.
Operating Temperature: -20°C to +70°C
Storage Temperature: -20°C to +70°C
Lead Soldering Time
@ 230°C: 5 seconds

FEATURES

- Two 0.54" 14-Segment Alphanumeric Characters with Decimal Points
- LED Current is Programmable
- Serial Data Input
- Chip Enable
- TTL Compatible
- Direct Current Drive (Non-multiplexed)
- Parts can be Marked with Appropriate Brightness Resistor Values
- Capable of Driving 4 External LEDs or Other Loads
- Epoxy Filled
- End-Stackable

BLOCK DIAGRAM

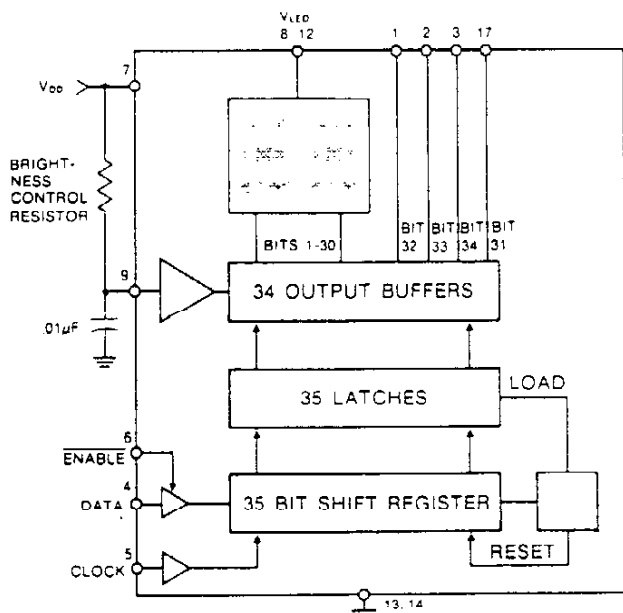


FIGURE 1—Block Diagram

APPLICATIONS

- Microprocessor Controlled Display
- Medical Equipment
- Commercial and Industrial Instrumentation

DESCRIPTION

The TSM7X52 Series features two 0.54" 14-segment alphanumeric characters with on-board serial data input/parallel data-out LED drivers designed to operate with minimal interface to the data source. Current drive to the LEDs is selected with an external resistor. The required resistor value can be indicated on the part.

Serial data transfer from the data source to the display driver is accomplished with three signals: data input, data enable, and clock. The data format consists of a leading "1" followed by 35 data bits. The 35 data bits are latched after the 36th bit is complete, thus providing non-multiplexed direct drive to the display. Outputs change only if the serial data bits differ from the previous time.



THREE-FIVE SYSTEMS, INC.

Phoenix, Arizona

TEL: 602-496-0035; FAX: 602-496-0168

THREE-FIVE SYSTEMS, LTD.

Swindon, U.K.

TEL: (0793) 618635; FAX: (0793) 614127

14 SEGMENT ALPHANUMERIC INTEGRATED DISPLAYS

TSM7X52B SERIES

BIT MAP

Bit #	Digit #	Segment	Bit #	Digit #	Segment
1	2	A	18	1	D
2	2	B	19	1	E
3	2	C	20	1	F
4	2	D	21	1	G
5	2	E	22	1	H
6	2	F	23	1	K
7	2	G	24	1	M
8	2	H	25	1	N
9	2	K	26	1	R
10	2	M	27	1	S
11	2	N	28	1	T
12	2	R	29	1	DP
13	2	S	30	2	DP
14	2	T	31		PIN 17
15	1	A	32		PIN 1
16	1	B	33		PIN 2
17	1	C	34		PIN 3

TABLE 1—Serial Input Sequence

Resistor Values			
2.7K	4.7K	7.5K	13.0K
3.0K	5.1K	8.2K	15.0K
3.3K	5.6K	9.1K	16.0K
3.6K	6.2K	10.0K	18.0K
3.9K	6.8K	11.0K	20.0K
4.3K			

TABLE 2—Part Marking

Brightness Resistor Values—To use the resistor binning feature, it is necessary to supply a current to the brightness current input. This is done by connecting an appropriate resistor between the brightness input and the V_{DD} (5.0V) pin. This resistor is located on the customer's mother board. Three-Five Systems, Inc. tests each part and marks it with the appropriate resistor value to be used.

ADDITIONAL ELECTRICAL CHARACTERISTICS (When the Specified Brightness Resistor is used)

Symbol	Parameter	Conditions (T _A = 25°C)	Min.	Typ.	Max.	Units
I _{LED}	V _{LED} Supply Current for Green, and High Eff. Red displays	V _{DD} = 5.25V, V _{LED} = 3.5V, all segs ON per the circuit of Fig.1, Note 4	240		320	mA
I _{LED}	V _{LED} Supply Current for Standard Red displays	V _{DD} = 5.25V, V _{LED} = 3.0V, all segs ON per the circuit of Fig. 1, Note 4	240		320	mA
I _{LED}	V _{LED} Supply Current for AlGaAs (645nm) Red displays	V _{DD} = 5.25V, V _{LED} = 3.0V, all segs ON per the circuit of Fig. 1	60		80	mA

Note 4: Operation above 65°C will exceed max power dissipation. For operation above 65°C, the LED drive current must be reduced. See Note 1 and Figure 7.

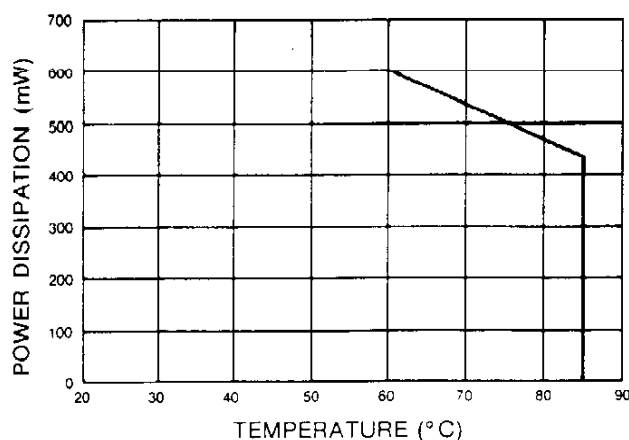


FIGURE 7—Maximum Power Dissipation vs Temperature

The TSM7X52B Series are MOS devices and normal precautions should be taken to avoid static damage.



THREE-FIVE SYSTEMS, INC.

Phoenix, Arizona

TEL: 602-496-0035; FAX: 602-496-0168

THREE-FIVE SYSTEMS, LTD.

Swindon, U.K.

TEL: (0793) 618635; FAX: (0793) 614127

14 SEGMENT ALPHANUMERIC INTEGRATED DISPLAYS

TSM7052, TSM7252 & TSM7752

ELECTRICAL CHARACTERISTICS

Symbol	Parameter	Conditions (T _A = 25°C)	Min.	Typ.	Max.	Units
I _{DD}	V _{DD} Supply Current	V _{DD} = 11V			7.0	mA
I _{LED}	V _{LED} Supply Current/Segment	I _{BR} = 400μA		10		mA
V _{IL}	Input Voltage "0" Level		-0.3		0.8	V
V _{IH}	Input Voltage "1" Level		2.2		12	V
I _{BR}	Brightness Input Current		0		600	μA
V _{IN}	Brightness Input Voltage	I _{BR CONT} = 600μA	3.0		4.3	V
C _F	Input Clock Frequency				0.5	MHz
	Duty Cycle		40	50	60	%

OPTICAL CHARACTERISTICS

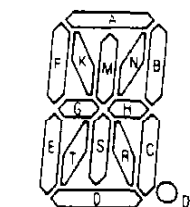
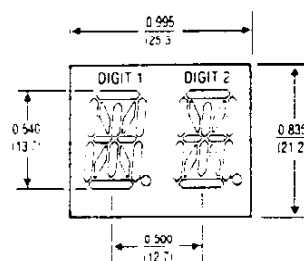
Symbol	Parameter	Conditions (T _A = 25°C)	Min.	Typ.	Max.	Units
I _L	LED Segment Intensity	I _{BR CONT} = 400μA, V _{LED} = 3.5V				
	Red		0.1	0.2		mcd
	High Efficiency Red		0.5	0.8		mcd
	Green		0.6	1.3		mcd
	Intensity Matching	I _{BR CONT} = 400μA, V _{LED} = 3.5V			±33	%
λ _P	Peak Wavelength	V _{DD} = 5.0V, V _{LED} = 3.5V				
	Red			655		nm
	High Efficiency Red			635		nm
	Green			565		nm

Note 1: Driver dissipation is given by $P_{DD} = (V_{LED} - 1.7V) I_{LED} \text{ (Total)} + (V_{DD} - 7.0\text{mA})$ where V_{LED} is the LED supply Voltage, 1.7V is the minimum LED voltage drop and 7.0mA is the maximum current of the V_{DD} supply.

Note 2: Unless otherwise stated, all specifications apply with the following conditions: V_{DD} (supply) 4.75 to 11V, V_{LED} (supply) 3.5V.

PHYSICAL DIMENSIONS

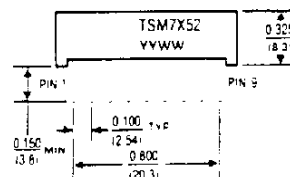
PIN	FUNCTION
1	BIT 32
2	BIT 33
3	BIT 34
4	DATA
5	CLOCK
6	ENABLE
7	V _{DD}
8	V _{LED}
9	BRIGHTNESS
10	NO PIN
11	NO PIN
12	V _{LED}
13	GROUND
14	GROUND
15	NO PIN
16	NO PIN
17	BIT 31
18	NO PIN



Segment Designation

DIMENSIONS INCHES
(Millimeters)

TOLERANCES: 0.XXX ±0.015
(X.XX ±0.38)



THREE-FIVE SYSTEMS, INC.

Phoenix, Arizona

TEL: 602-496-0035; FAX: 602-496-0168

THREE-FIVE SYSTEMS, LTD.

Swindon, U.K.

TEL: (0793) 618835; FAX: (0793) 614127

14 SEGMENT ALPHANUMERIC INTEGRATED DISPLAYS

TSM7052, TSM7252 & TSM7752

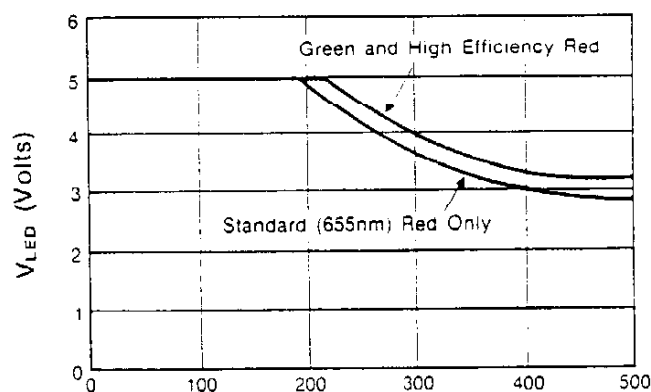


FIGURE 2—Max VLED vs ILED Circuit Per Figure 1

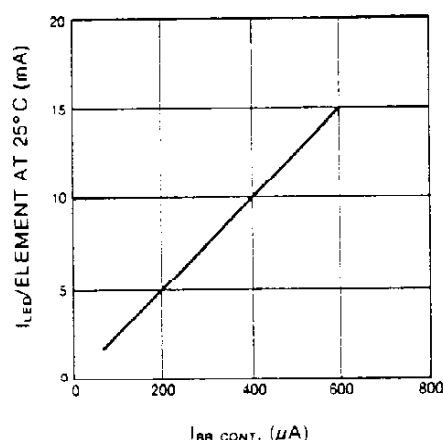


FIGURE 4—Typical LED Element Current vs Applied Brightness Control Element

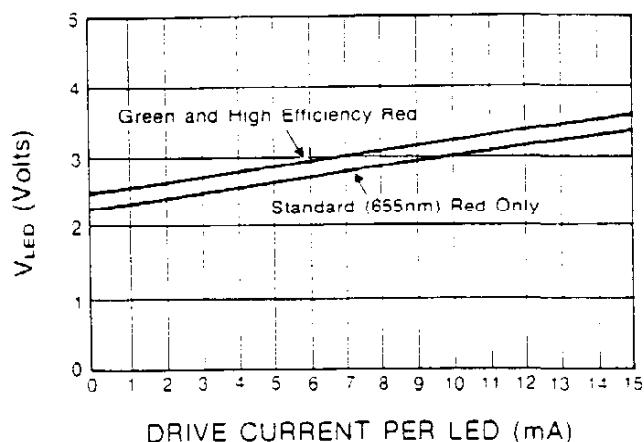


FIGURE 3—Min VLED vs Drive Current Per LED

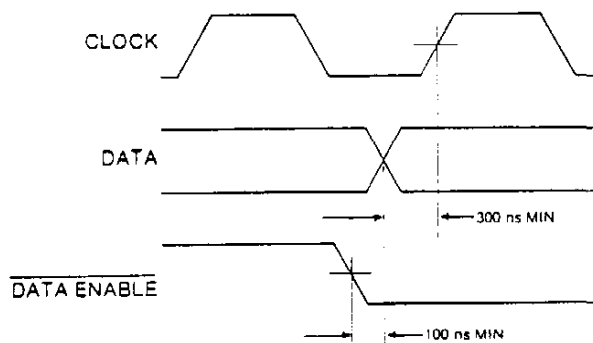


FIGURE 5—Timing Relationships

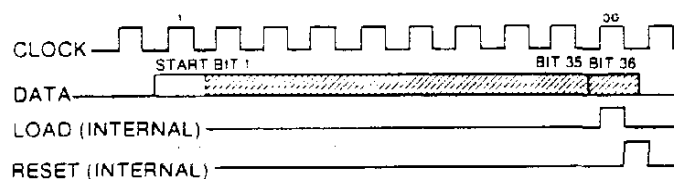


FIGURE 6—Input Data Format

FUNCTION DESCRIPTION

A block diagram is shown in Figure 1, and Figures 5 and 6 show the timing relationships and input data format. The start bit precedes the 35 data bits. At the 36th clock, a LOAD signal is generated synchronously with the high state of the clock, which loads the 35 bits in 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 configurations. There is no clear for the master portion of the first register, thus allowing continuous operation.

If the clock is not continuous, there must be a complete set of 36 clocks, otherwise the shift registers will not clear.

When the chips first powers ON, an internal power On reset signal is generated which resets all registers

and all latches. The START bit and the first clock return the chip to its normal operation. To clear the display, load a "1" followed by 35 "0". This blanks the LED and resets the driver IC.

Bit 1 is the first bit following the start bit and determines the drive current state of segment A of digit 2 (note: segment and digit designations are given in the Physical Dimensions illustration. The bit sequence for all segments is shown in Table 1.

The LED element current is typically 25 times greater than the current into the brightness control pin as shown in Figure 4. Relationship of the LED current to LED supply voltage is shown in Figure 2.

A .01μF capacitor must be connected from the brightness control pin to the ground pin to prevent oscillations.



THREE-FIVE SYSTEMS, INC.
Phoenix, Arizona
TEL: 602-496-0035; FAX: 602-496-0168

THREE-FIVE SYSTEMS, LTD.
Swindon, U.K.

TEL: (0793) 618835; FAX: (0793) 614127

14 SEGMENT ALPHANUMERIC INTEGRATED DISPLAYS

TSM7052, TSM7252 & TSM7752

BIT MAP

Bit #	Digit #	Segment	Bit #	Digit #	Segment
1	2	A	18	1	D
2	2	B	19	1	E
3	2	C	20	1	F
4	2	D	21	1	G
5	2	E	22	1	H
6	2	F	23	1	K
7	2	G	24	1	M
8	2	H	25	1	N
9	2	K	26	1	R
10	2	M	27	1	S
11	2	N	28	1	T
12	2	R	29	1	DP
13	2	S	30	2	DP
14	2	T	31		PIN 17
15	1	A	32		PIN 1
16	1	B	33		PIN 2
17	1	C	34		PIN 3

TABLE 1—Serial Input Sequence

OPTIONAL RESISTOR SELECTION

Resistor Values			
2.7K	4.3K	6.2K	9.1K
3.0K	4.7K	6.8K	10.0K
3.3K	5.1K	7.5K	11.0K
3.6K	5.6K	8.2K	13.0K
3.9K			

TABLE 2—Part Marking

Brightness Resistor Values—To use the resistor binning option, it is necessary to supply a current to the brightness current input. This is done by connecting an appropriate resistor between the brightness input and the V_{DD} (5.0V) pin. This resistor is located on the customer's mother board. Three-Five Systems, Inc. can test each part and mark it with the appropriate resistor value to be used.

ADDITIONAL ELECTRICAL CHARACTERISTICS (When the Specified Brightness Resistor is used)

Symbol	Parameter	Conditions (T _A = 25°C)	Min.	Typ.	Max.	Units
I _{LED}	V _{LED} Supply Current for Green and High Eff. Red displays	V _{DD} = 5.25V, V _{LED} = 3.5V, all segs ON per the circuit of Figure 1.	240		320	mA
I _{LCD}	V _{LCD} Supply Current for standard (655nm) Red displays	V _{DD} = 5.25V, V _{LCD} = 3.0V, all segs ON per the circuit of Figure 1.	240		320	mA

RECOMMENDED DISPLAY PROCESSING

The TSM7X52 Series are constructed on a standard printed circuit board substrate and covered with a plastic reflector. The pins will withstand 230°C for 5 seconds. Permanent damage to the display will result if reflector temperature exceeds 70°C. Since the display is not hermetic, immersion of the entire package during flux and clean operation may cause condensation of flux or cleaner on the underside of the reflector. Only the pins

should be immersed.

Rosin core solder, solid core solder, and low activity organic fluxes are recommended. Freon TF, Isopropanol, Methanol or Ethanol solvents are recommended only at room temperature and for short periods. The use of other solvents or elevated temperature use of the recommended solvents may cause permanent damage to the reflector or display.

ORDERING INFORMATION EXAMPLE:

TSM7052—Standard part (no resistor binning). TSM7052B—Standard part, with resistor binning.

The TSM7X52 Series are CMOS devices and normal precautions should be taken to avoid static damage.



THREE-FIVE SYSTEMS, INC.

Phoenix, Arizona

TEL: 602-496-0035; FAX: 602-496-0168

THREE-FIVE SYSTEMS, LTD.

Swindon, U.K.

TEL: (0793) 618835; FAX: (0793) 614127