National Semiconductor

March 1991

MM58248 High Voltage Display Driver

General Description

The MM58248 is a monolithic MOS integrated circuit utilizing CMOS metal gate low threshold P- and N-channel devices. It is available both in 40-pin molded dual-in-line packages or as dice. The MM58248 is particularly suited for driving high voltage (60V max) vacuum fluorescent (VF) displays (e.g., a 5 x 7 dot matrix display).

Applications

- COPS™ or microprocessor-driven display
- Instrumentation readouts
- Industrial control indicator
- Digital clock, thermostat, counter, voltmeter
- Word processor text displays
- Automotive dashboards

Features

- Direct interface to high voltage display
- Serial data input
- No external resistors required
- Wide display power supply operation
- LSTTL compatible inputs
- Software compatible with NS display driver family
- Compatible with alphanumeric or dot matrix displays
- No load signal required

Block Diagram

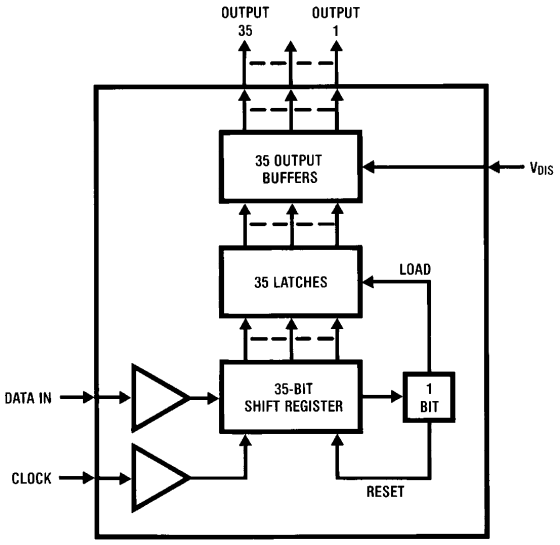

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FIGURE 1

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  RRD-B30M105/Printed in U. S. A.

Absolute Maximum Ratings

If Military/Aerospace specified devices are required, please contact the National Semiconductor Sales Office/Distributors for availability and specifications.

Voltage at Any Input Pin	$V_{DD} + 0.3V$ to $V_{SS} - 0.3V$
Voltage at Any Display Pin	V_{DD} to $V_{DD} - 62.5V$
$V_{DD} + \lvert V_{DIS} \rvert$	62.5V
Storage Temperature	−65°C to +150°C
Power Dissipation at +25°C	
Molded DIP Package, Board Mount	2.28W*
Molded DIP Package, Socket Mount	2.05W**

*Molded DIP Package, Board Mount θ_{JA} = 46°C/W, Derate 21.7 mW/°C above +25°C.

**Molded DIP Package, Socket Mount, θ_{JA} = 51°C/W, Derate 19.6 mW/°C above +25°C.

Junction Temperature	130°C
Lead Temperature (Soldering, 10 seconds)	260°C

Operating Conditions

	Min	Max	Units
Supply Voltage (V_{DD}) V_{SS} = 0V	4.5	5.5	V
Display Voltage (V_{DIS})	−55	−25	V
Temperature Range	−40	+85	°C

DC Electrical Characteristics

T_A = −40°C to +85°C, V_{DD} = 5V ±0.5V, V_{SS} = 0V unless otherwise specified

Symbol	Parameter	Conditions	Min	Typ	Max	Units
I_{DD}	Power Supply Currents	$V_{IN} = V_{SS}$ or V_{DD}, V_{SS} = 0V, V_{DIS} Disconnected			150	μA
I_{DIS}		V_{DD} = 5.5V, V_{SS} = 0V, V_{DIS} = −55V, All Outputs Low			10	mA
V_{IL}	Input Logic Levels DATA IN, CLOCK Logic '0'				0.8	V
V_{IH}	Input Logic Levels DATA IN, CLOCK Logic '1'	(Note 1)	2.4			V
I_{IN}	Input Currents, DATA IN, CLOCK	V_{IN} = 0V or V_{DD}	−10		10	μA
C_{IN}	Input Capacitance, DATA IN, CLOCK				15	pF
R_{OFF}	Display Output Impedances Output Off *(Figure 3a)*	V_{DD} = 5.5V, V_{SS} = 0V V_{DIS} = −25V V_{DIS} = −40V V_{DIS} = −55V	 60 70 80		 400 550 650	 kΩ kΩ kΩ
R_{ON}	Display Output Impedances Output on *(Figure 3b)*	V_{DD} = 5.5V, V_{SS} = 0V V_{DIS} = −25V V_{DIS} = −40V V_{DIS} = −55V		 3.0 2.6 2.3	 4.0 3.7 3.4	 kΩ kΩ kΩ
V_{DOL}	Display Output Low Voltage	V_{DD} = 5.5V, I_{OUT} = Open Circuit, $-55V \le V_{DIS} \le -25V$	V_{DIS}		$V_{DIS} + 4$	V

Note 1: 74LSTTL V_{OH} = 2.7V @ I_{OUT} = −400 μA, TTL V_{OH} = 2.4V @ I_{OUT} = −400 μA.

AC Electrical Characteristics T_A = −40°C to +85°C, V_{DD} = 5V ±0.5V

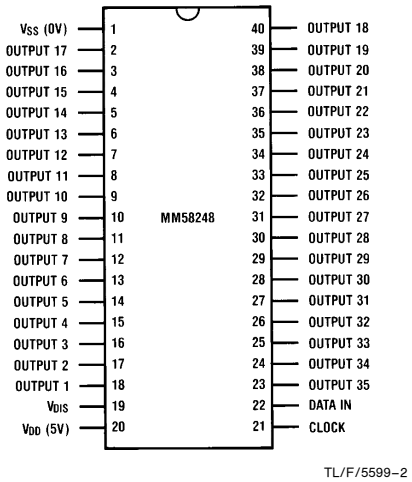
Symbol	Parameter	Conditions	Min	Typ	Max	Units
f_C	Clock Input Frequency	(Notes 2, 3)			1.0	MHz
t_H	Clock Input High Time		300			ns
t_L	Clock Input Low Time		300			ns
t_{DS}	Data Input Setup Time	C_L = 50 pF	100			ns
t_{DH}	Data Input Hold Time		100			ns

Note 2: AC input waveform specification for test purposes: t_r, $t_f \le 20$ ns, f = 1 MHz, 50% ±10% duty cycle.

Note 3: Clock input rise and fall times must not exceed 5 μs.

Connection Diagrams

Dual-In-Line Package



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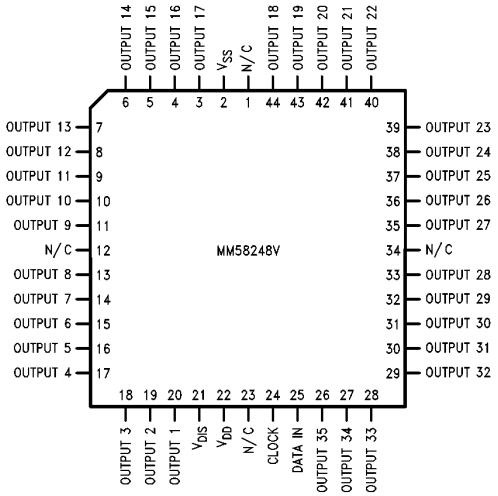
Top View

Order Number MM58248N
See NS Package Number N40A

Plastic Chip Carrier



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Top View

Order Number MM58248V
See NS Package Number V44A

FIGURE 2

Functional Description

This product is specifically designed to drive multiplexed or non-multiplexed high voltage alphanumeric or dot matrix vacuum fluorescent (VF) displays. Character generation is done externally in the microprocessor, with a serial data path to the display driver. The MM58248 uses two signals, DATA IN and CLOCK, with a format of a leading '1' followed by the 35 data bits, hence allowing data transfer without an additional signal. A block diagram of the MM58248 is shown in *Figure 1.*

Figure 2 shows the pinout of the MM58248 device, where output 1 (pin 18) is equivalent to bit 1, i.e., the first bit of data to be loaded into the shift register following the start bit. A logic '1' at the input will turn on the corresponding display digit/segment/dot output.

A significant reduction in discrete board components can be achieved by the use of the MM58248, because external pull-down resistors are not required. Due to the nature of the output stage, both its on and off impedance values vary as a function of the display voltage applied. However, *Figures 3a* and *3b* show that this output impedance will remain constant for a fixed value of display voltage.

Figure 4 demonstrates the critical timing requirements between CLOCK and DATA IN for the MM58248.

In *Figure 5,* a start bit of logic '1' precedes the 35 bits of data, each bit being accepted on the rising edge of CLOCK, i.e., a '0'–'1' transition. At the 36th clock, a LOAD signal is generated synchronously with the high state of the clock, thus loading the 35 bits of the shift register into the latches. At the low state of the clock, a RESET signal is generated, clearing all bits of the shift register for the next set of data. Hence, a complete set of 36 clock pulses is needed for the MM58248, or the shift register will not clear. To clear (reset) the display driver at 'power on' or any time, the following flushing routine may be used. Clock in 36 ''zeroes'', followed by a ''one'' (start bit), followed by 35 ''zeroes''. This procedure will completely blank the display. It is recommended to clear the driver at power on.

Figure 6 shows a schematic diagram of a microprocessor-based system where the MM58248 is used to provide the anode drive for a 32-digit 5 x 7 dot matrix vacuum fluorescent (VF) display. The grid drive in this example is provided by another member of the high voltage display driver family, namely the MM58241, which has the additional features of a BLANKING CONTROL pin, a DATA OUT pin, and an ENABLE (external load signal) pin.

Functional Description (Continued)

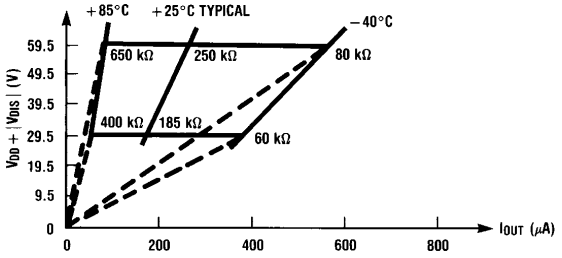

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FIGURE 3a. Output Impedance Off

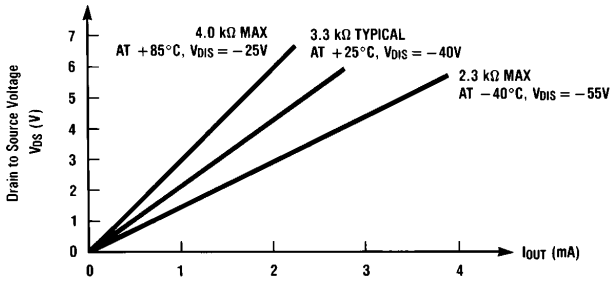

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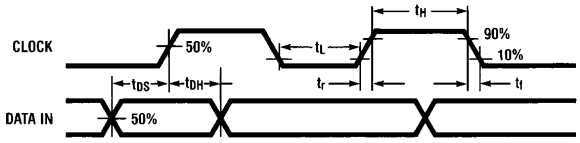
FIGURE 3b. Output Impedance On

Timing Diagrams



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For the purposes of AC measurement, V_{IH} = 2.4V, V_{IL} = 0.8V.

FIGURE 4. Clock and Data Timings

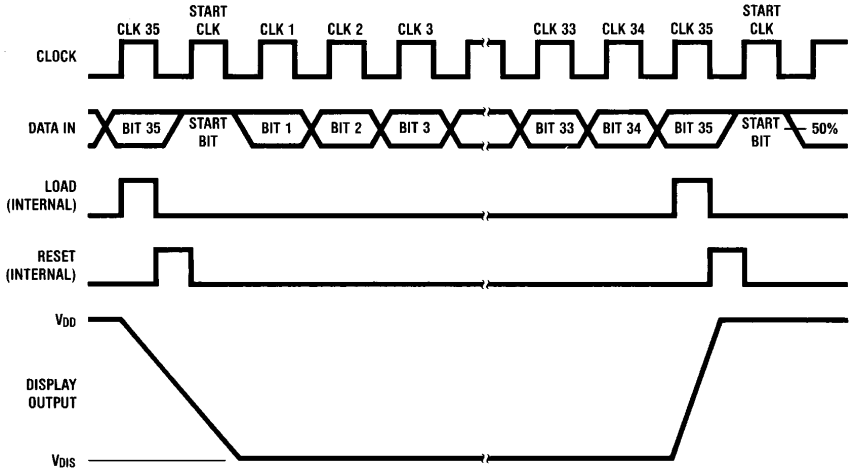

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FIGURE 5. MM58248 Timings (Data Format)

Typical Applications

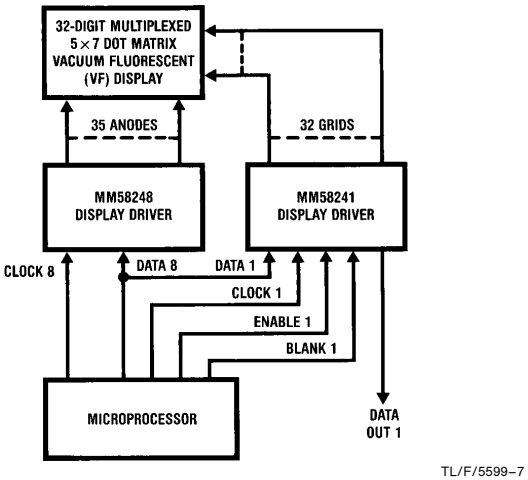
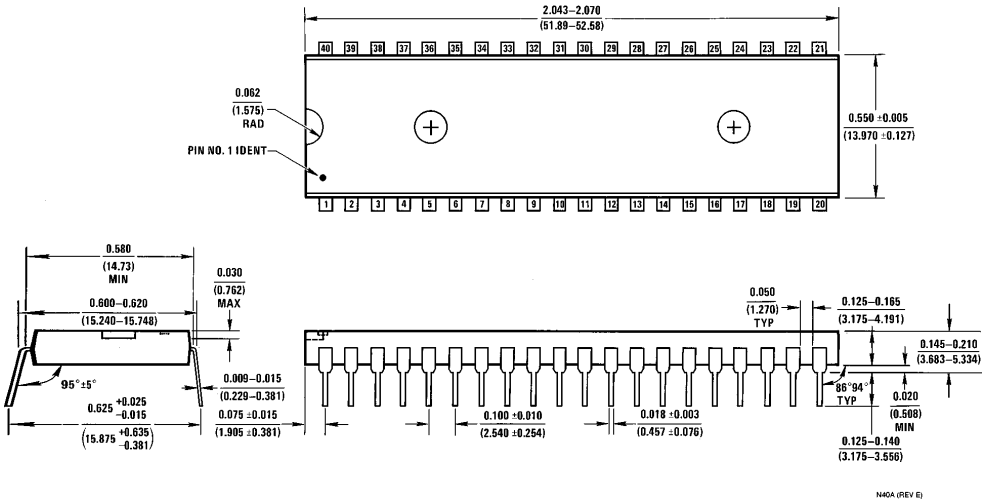


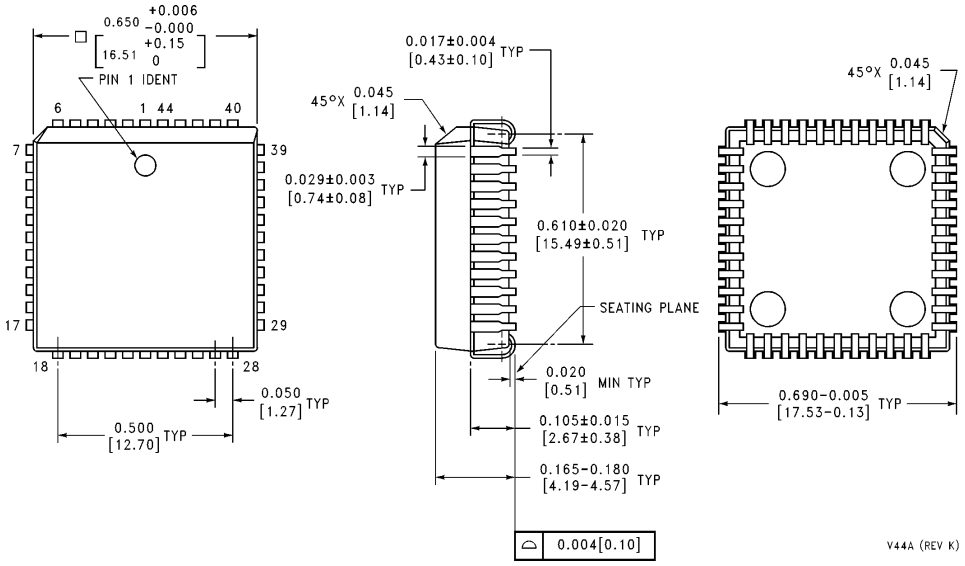
FIGURE 6. Microprocessor-Controlled Word Processor

Physical Dimensions inches (millimeters)



Molded Dual-In-Line Package (N)
Order Number MM58248N
NS Package Number N40A

Physical Dimensions inches (millimeters) (Continued)



Plastic Chip Carrier (V)
Order Number MM58248V
NS Package Number V44A

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