National Semiconductor

September 1992

MM58241 High Voltage Display Driver

General Description

The MM58241 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 MM58241 is particularly suited for driving high voltage (60V max) vacuum fluorescent (VF) displays (e.g., a 32-digit alphanumeric or dot matrix display).

Applications

- COPS™ or microprocessor-driven displays
- 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
- Display blanking control input
- Simple to cascade

Block Diagram

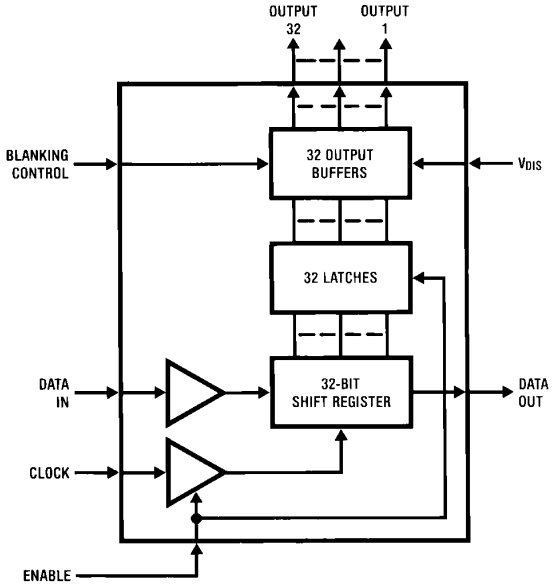

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FIGURE 1

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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**
Junction Temperature	130°C
Lead Temperature (Soldering, 10 sec.)	260°C

*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.

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
	Input Logic Levels DATA IN, CLOCK ENABLE, BLANK					
V_{IL}	Logic '0'				0.8	V
V_{IH}	Logic '1'	(Note 1)	2.4			V
	Data Output Logic Levels					
V_{OL}	Logic '0'	I_{OUT} = 400 μA			0.4	V
V_{OH}	Logic '1'	I_{OUT} = −10 μA	V_{DD} − 0.5			V
V_{OH}	Logic '1'	I_{OUT} = −500 μA	2.8			V
I_{IN}	Input Currents DATA IN, CLOCK ENABLE, BLANK	V_{IN} = 0V or V_{DD}	−10		10	μA
C_{IN}	Input Capacitance DATA IN, CLOCK ENABLE, BLANK				15	pF
	Display Output Impedances	V_{DD} = 5.5V, V_{SS} = 0V				
R_{OFF}	Output Off *(Figure 3a)*	V_{DIS} = −25V	60		400	kΩ
		V_{DIS} = −40V	70		550	kΩ
		V_{DIS} = −55V	80		650	kΩ
R_{ON}	Output On *(Figure 3b)*	V_{DIS} = −25V		3.0	4.0	kΩ
		V_{DIS} = −40V		2.6	3.7	kΩ
		V_{DIS} = −55V		2.3	3.4	kΩ
V_{DOL}	Display Output Low Voltage	V_{DD} = 5.5V, I_{OUT} = Open Circuit, −55V ≤ V_{DIS} ≤ −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 $+85°C$, $V_{DD} = 5V \pm 0.5V$

Symbol	Parameter	Conditions	Min	Typ	Max	Units
	Clock Input	(Notes 3 and 4)				
f_C	Frequency				800	kHz
t_H	High Time		300			ns
t_L	Low Time		300			ns
	Data Input					
t_{DS}	Set-Up Time		100			ns
t_{DH}	Hold Time		100			ns
	Enable Input					
t_{ES}	Set-Up Time		100			ns
t_{EH}	Hold Time		100			ns
	Data Output	$C_L = 50$ pF				
t_{CDO}	CLOCK Low to Data Out Time				500	ns

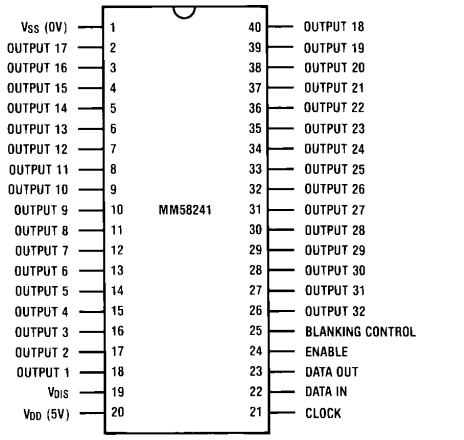
Note 2: For timing purposes, the signals ENABLE and BLANK can be considered to be totally independent of each other.

Note 3: AC input waveform specification for test purposes: t_r, $t_f \leq 20$ ns, f = 800 kHz, 50% ±10% duty cycle.

Note 4: Clock input rise and fall times must not exceed 5 μs.

Connection Diagrams

Dual-In-Line Package



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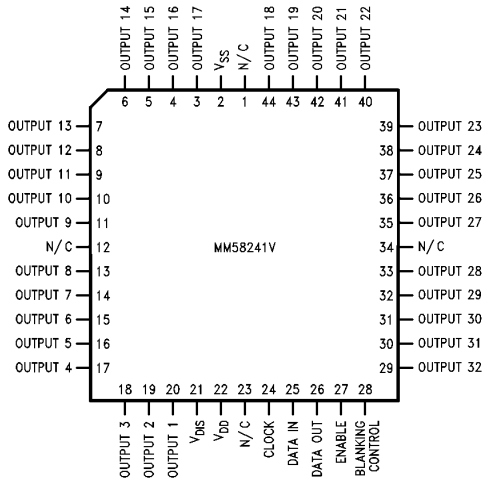
Top View

FIGURE 2

Order Number MM58241N or MM58241V
See NS Package Number N40A or V44A

Plastic Chip Carrier



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Top View

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 MM58421 uses three signals, DATA IN, CLOCK and ENABLE, where ENABLE acts as an external load signal. Display blanking can be achieved by means of the BLANKING CONTROL input, and a logic '1' will turn off all sections of the display. A block diagram of the MM58241 is shown in *Figure 1.*

Figure 2 shows the pinout of the MM58241 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 ENABLE high. 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 use of the MM58241, 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.

Functional Description (Continued)

Figure 4 demonstrates the critical timing requirements between CLOCK and DATA IN for the MM58241.

To clear (reset) the display driver at power on or any time, the following flushing routine may be used. With the enable signal high, clock in 32 zeroes. Drive the enable signal low and the display will be blank. It is recommended to clear the driver at power on.

In *Figure 5,* the ENABLE signal acts as an envelope, and only while this signal is at a logic '1' does the circuit accept CLOCK input signals. Data is transferred and shifted in the internal shift register on the rising clock edge, i.e., '0'–'1' transition. When the ENABLE signal goes low, the contents of the shift registers are latched, and the display will show new data. During data transfer, the display will show old data. DATA OUT is also provided on the MM58241, being output on the falling edge. At any time, the display may be blanked under processor control, using the BLANKING CONTROL input.

Figure 6 shows a schematic diagram of a microprocessor-based system where the MM58241 is used to provide the grid drive for a 32-digit 5 x 7 dot matrix vaccum fluorescent (VF) display. The anode drive in this example is provided by another member of the high voltage display driver family, namely the MM58248, which does not require an externally generated load signal.

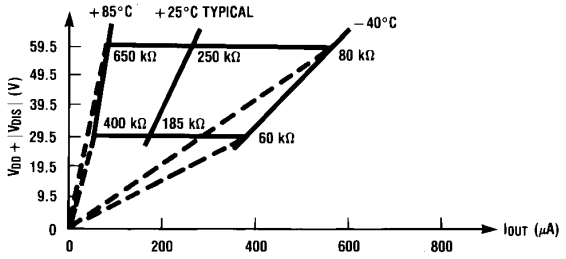

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FIGURE 3a. Output Impedance Off

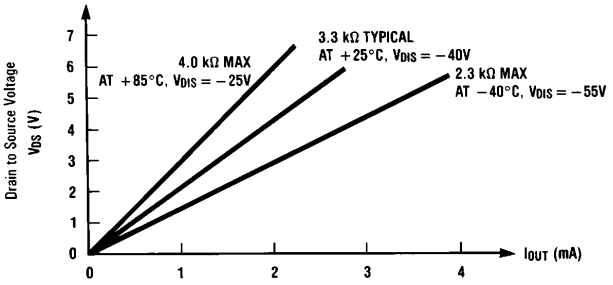

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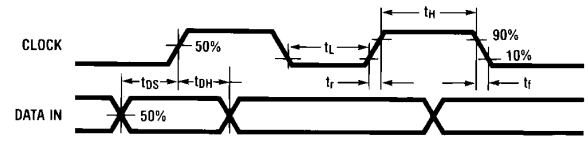
FIGURE 3b. Output Impedance On

Timing Diagrams



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

FIGURE 4. Clock and Data Timings

Timing Diagrams (Continued)

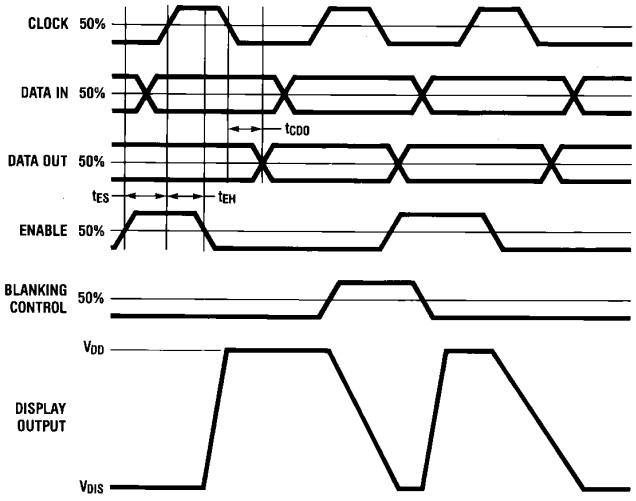

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FIGURE 5. MM58241 Timings (Data Format)

Typical Application

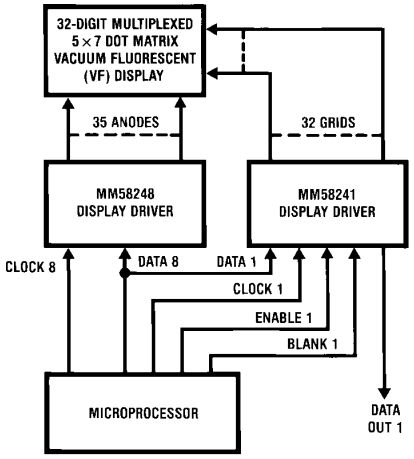

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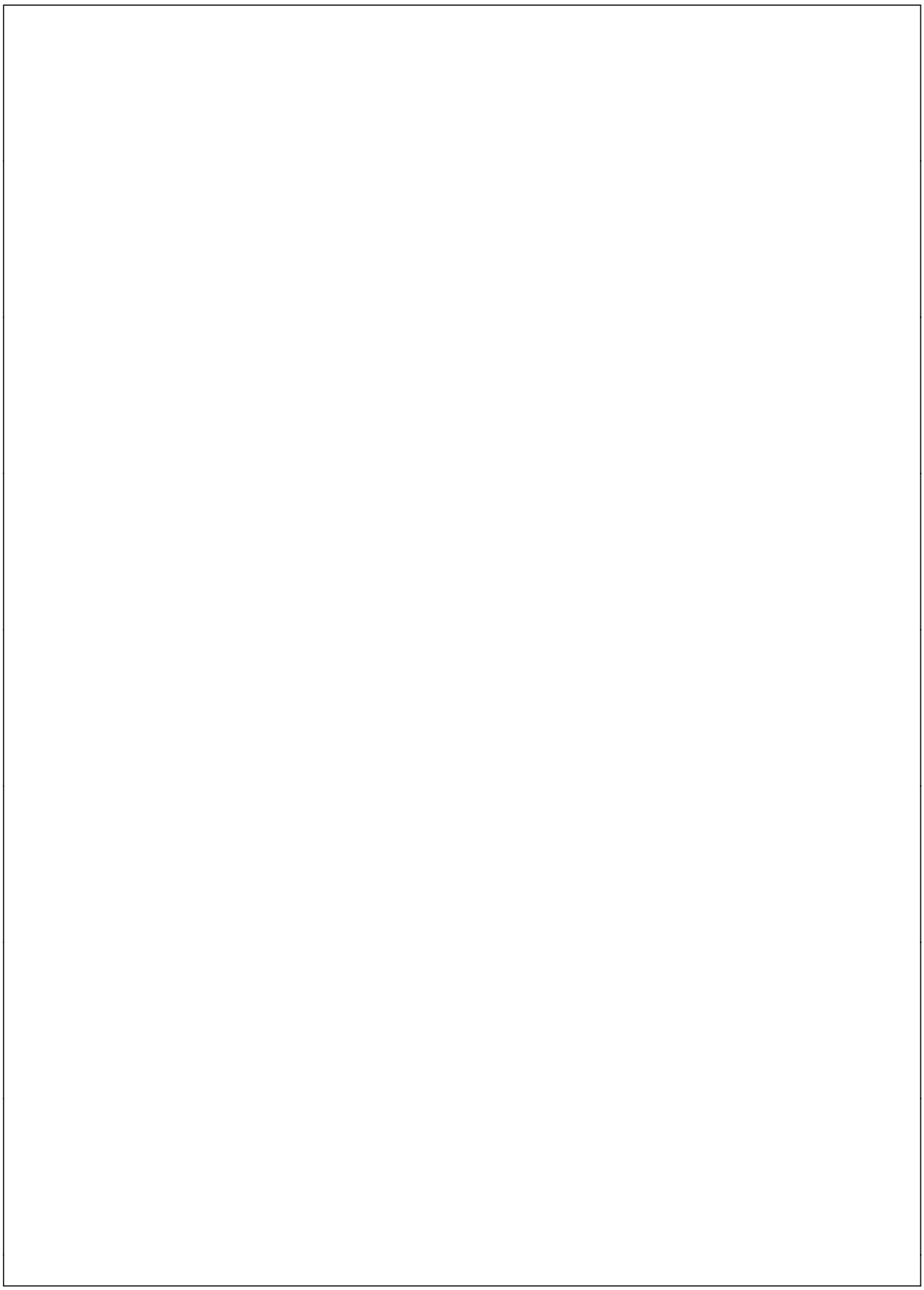
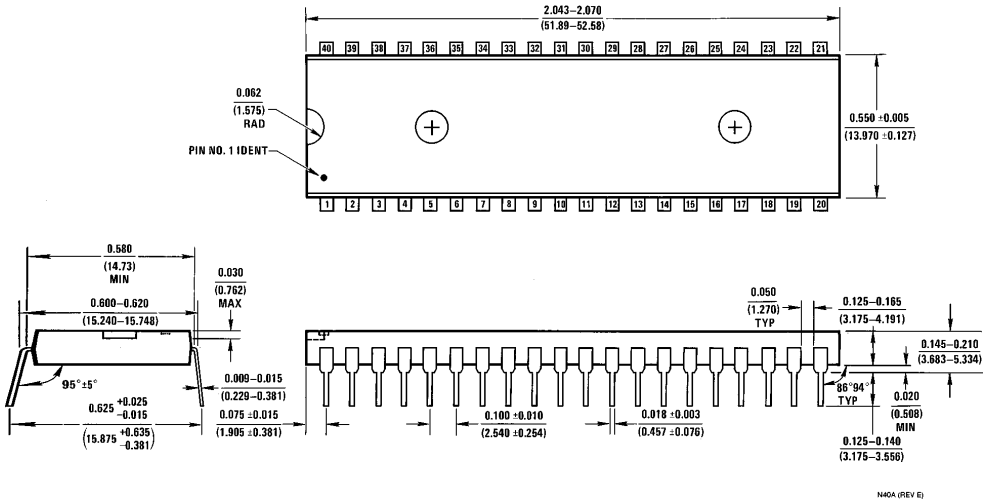
FIGURE 6. Microprocessor-Controlled Word Processor

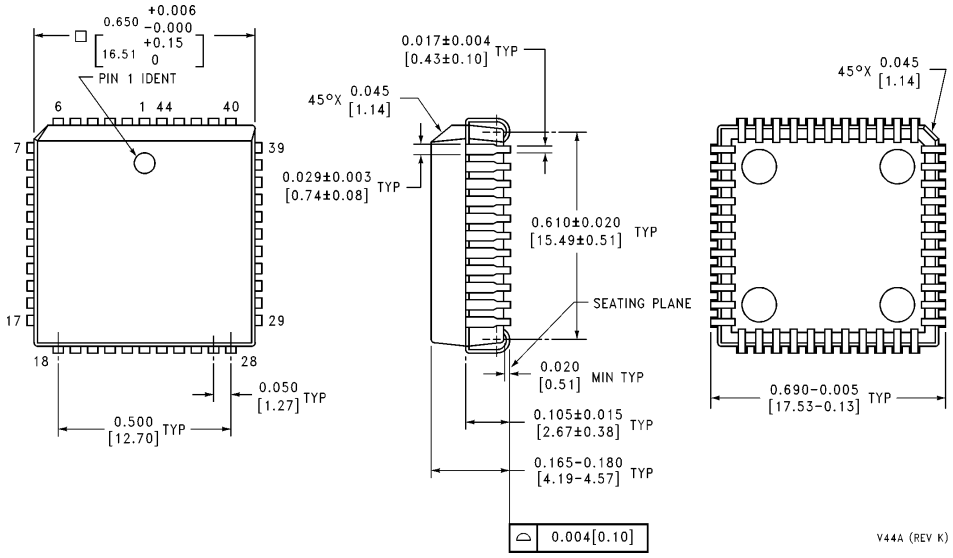


Physical Dimensions inches (millimeters)



Molded Dual-In-Line Package
Order Number MM58241N
NS Package Number N40A

Physical Dimensions inches (millimeters) (Continued)



Plastic Chip Carrier (V)
Order Number MM58241V
NS Package Number V44A

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