

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

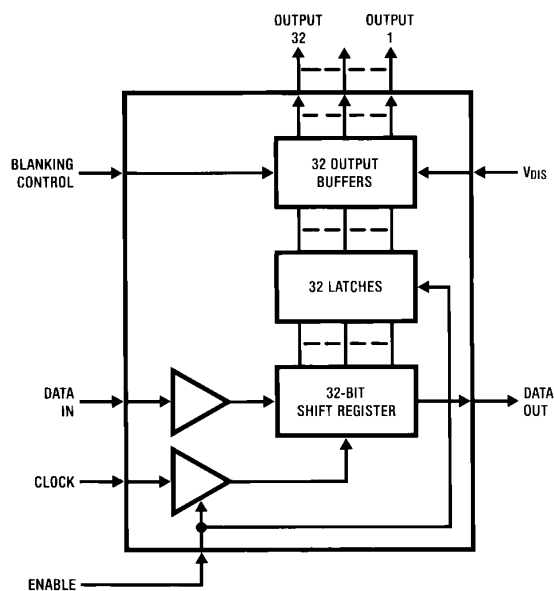


FIGURE 1

TL/F/5600-1

COPS™ is a trademark of National Semiconductor Corporation.

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} + V_{DIS} $	62.5V
Storage Temperature	$-65^{\circ}C$ to $+150^{\circ}C$
Power Dissipation at $+25^{\circ}C$	
Molded DIP Package, Board Mount	2.28W*
Molded DIP Package, Socket Mount	2.05W**
Junction Temperature	$130^{\circ}C$
Lead Temperature (Soldering, 10 sec.)	$260^{\circ}C$

*Molded DIP Package, Board Mount, $\theta_{JA} = 46^{\circ}C/W$,
Derate 21.7 mW/ $^{\circ}C$ above $+25^{\circ}C$.

**Molded DIP Package, Socket Mount, $\theta_{JA} = 51^{\circ}C/W$,
Derate 19.6 mW/ $^{\circ}C$ above $+25^{\circ}C$.

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	$^{\circ}C$

DC Electrical Characteristics

$T_A = -40^{\circ}C$ to $+85^{\circ}C$, $V_{DD} = 5V \pm 0.5V$, $V_{SS} = 0V$ unless otherwise specified

Symbol	Parameter	Conditions	Min	Typ	Max	Units
I_{DD} I_{DIS}	Power Supply Currents	$V_{IN} = V_{SS}$ or V_{DD} , $V_{SS} = 0V$, V_{DIS} Disconnected $V_{DD} = 5.5V$, $V_{SS} = 0V$, $V_{DIS} = -55V$ All Outputs Low			150 10	μA mA
V_{IL} V_{IH}	Input Logic Levels DATA IN, CLOCK ENABLE, BLANK Logic '0' Logic '1'	(Note 1)	2.4		0.8	V V
V_{OL} V_{OH} V_{OH}	Data Output Logic Levels Logic '0' Logic '1' Logic '1'	$I_{OUT} = 400 \mu A$ $I_{OUT} = -10 \mu A$ $I_{OUT} = -500 \mu A$	$V_{DD} - 0.5$ 2.8		0.4	V V 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
R_{OFF} R_{ON}	Display Output Impedances Output Off (Figure 3a) Output On (Figure 3b)	$V_{DD} = 5.5V$, $V_{SS} = 0V$ $V_{DIS} = -25V$ $V_{DIS} = -40V$ $V_{DIS} = -55V$ $V_{DIS} = -25V$ $V_{DIS} = -40V$ $V_{DIS} = -55V$	60 70 80	3.0 2.6 2.3	400 550 650 4.0 3.7 3.4	k Ω k Ω k Ω k Ω k Ω k Ω k Ω
V_{DOL}	Display Output Low Voltage	$V_{DD} = 5.5V$, $I_{OUT} = \text{Open Circuit}$, $-55V \leq V_{DIS} \leq -25V$	V_{DIS}		$V_{DIS} + 4$	V

Note 1: 74LSTTL $V_{OH} = 2.7V$ @ $I_{OUT} = -400 \mu A$, TTL $V_{OH} = 2.4V$ @ $I_{OUT} = -400 \mu A$.

AC Electrical Characteristics $T_A = -40^{\circ}\text{C}$ to $+85^{\circ}\text{C}$, $V_{DD} = 5\text{V} \pm 0.5\text{V}$

Symbol	Parameter	Conditions	Min	Typ	Max	Units
f_C	Clock Input Frequency	(Notes 3 and 4)			800	kHz
t_H	High Time		300			ns
t_L	Low Time		300			ns
t_{DS}	Data Input Set-Up Time		100			ns
t_{DH}	Hold Time		100			ns
t_{ES}	Enable Input Set-Up Time		100			ns
t_{EH}	Hold Time		100			ns
t_{CDO}	Data Output CLOCK Low to Data Out Time	$C_L = 50\text{ pF}$			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: $t_r, t_f \leq 20\text{ ns}$, $f = 800\text{ kHz}$, 50% $\pm 10\%$ duty cycle.

Note 4: Clock input rise and fall times must not exceed $5\text{ }\mu\text{s}$.

Connection Diagrams

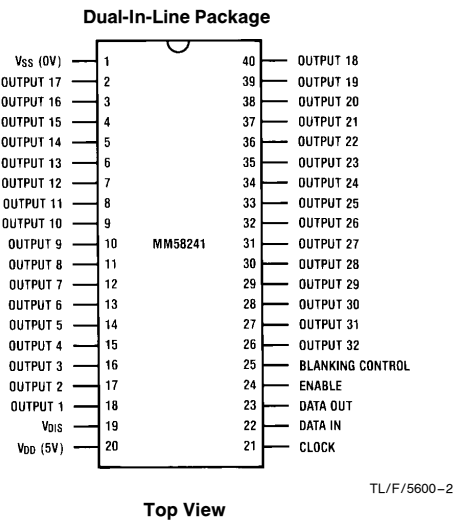
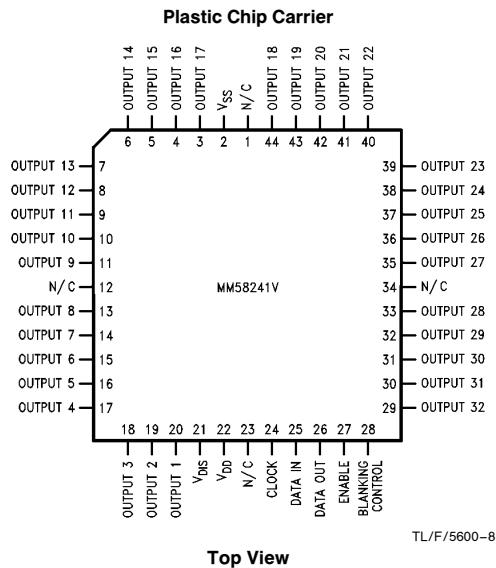


FIGURE 2

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



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 MM58241 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 vacuum 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.

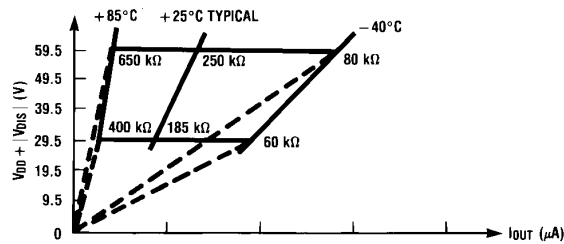


FIGURE 3a. Output Impedance Off

TL/F/5600-3

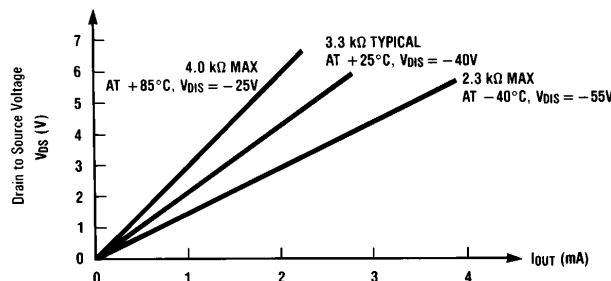
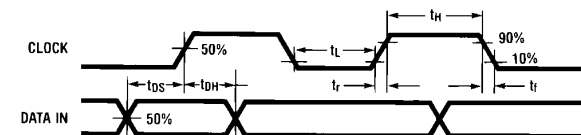


FIGURE 3b. Output Impedance On

TL/F/5600-4

Timing Diagrams



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

FIGURE 4. Clock and Data Timings

TL/F/5600-5

Timing Diagrams (Continued)

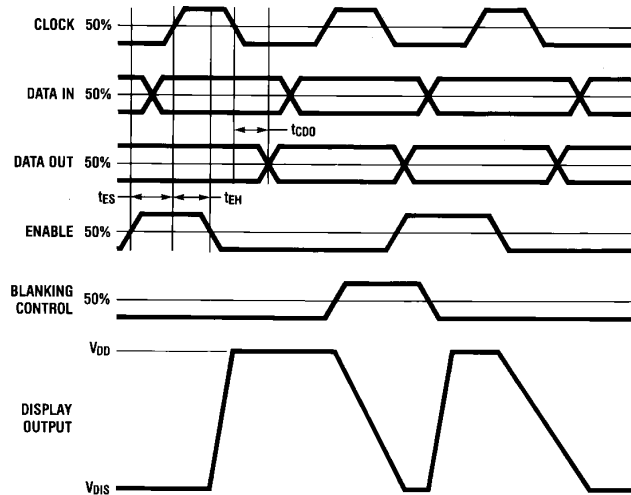


FIGURE 5. MM58241 Timings (Data Format)

TL/F/5600-6

Typical Application

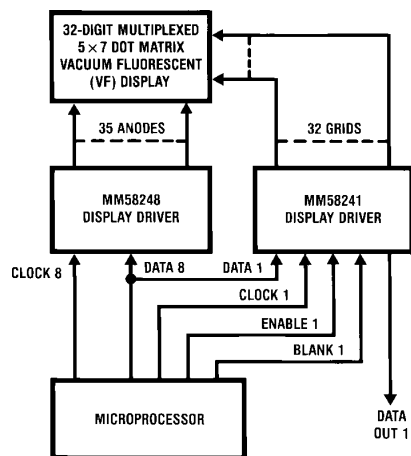
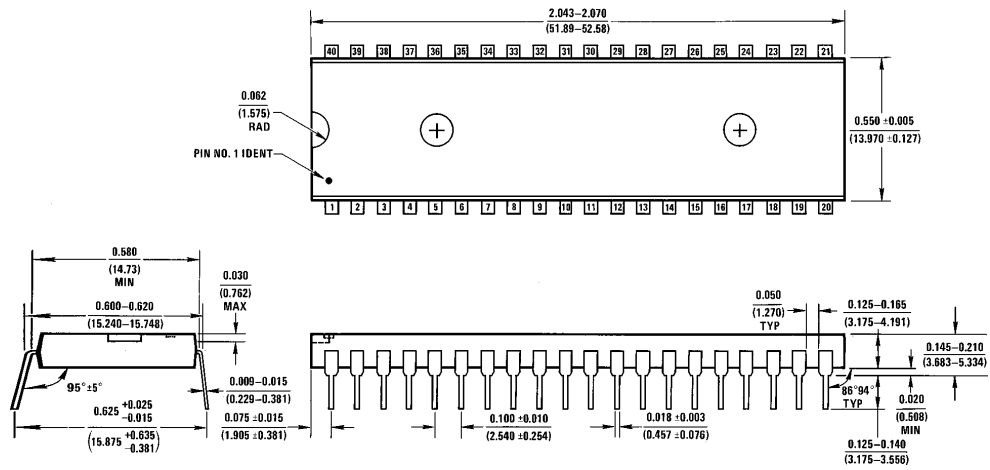


FIGURE 6. Microprocessor-Controlled Word Processor

TL/F/5600-7

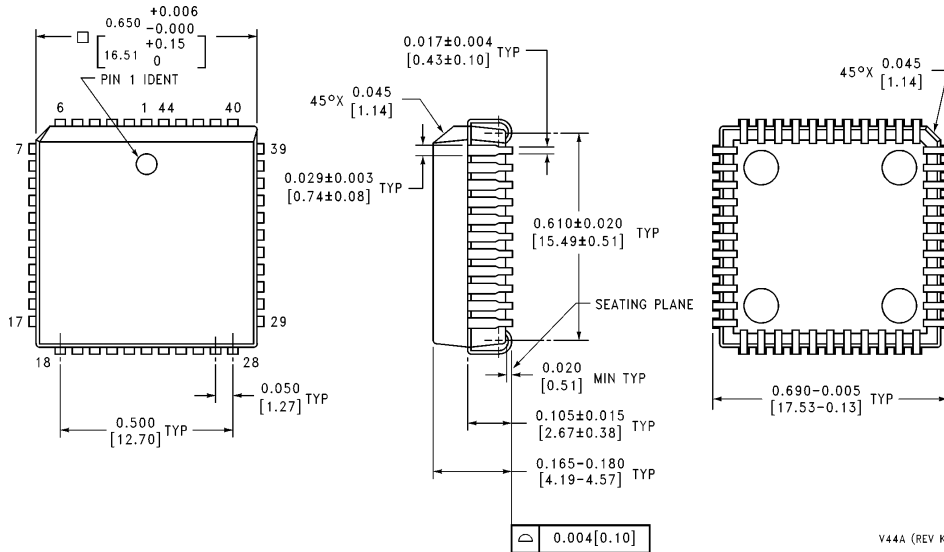
Physical Dimensions inches (millimeters)



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

N40A (REV E)

Physical Dimensions inches (millimeters) (Continued)



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

LIFE SUPPORT POLICY

NATIONAL'S PRODUCTS ARE NOT AUTHORIZED FOR USE AS CRITICAL COMPONENTS IN LIFE SUPPORT DEVICES OR SYSTEMS WITHOUT THE EXPRESS WRITTEN APPROVAL OF THE PRESIDENT OF NATIONAL SEMICONDUCTOR CORPORATION. As used herein:

1. Life support devices or systems are devices or systems which, (a) are intended for surgical implant into the body, or (b) support or sustain life, and whose failure to perform, when properly used in accordance with instructions for use provided in the labeling, can be reasonably expected to result in a significant injury to the user.
2. A critical component is any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.



National Semiconductor Corporation
1111 West Bardin Road
Arlington, TX 76017
Tel: (800) 272-9959
Fax: (800) 737-7018

National Semiconductor Europe
Fax: (+49) 0-180-530 85 86
Email: cnjwge@tevm2.nsc.com
Deutsch Tel: (+49) 0-180-530 85 85
English Tel: (+49) 0-180-532 78 32
Français Tel: (+49) 0-180-532 93 58
Italiano Tel: (+49) 0-180-534 16 80

National Semiconductor Hong Kong Ltd.
19th Floor, Straight Block,
Ocean Centre, 5 Canton Rd.
Tsimshatsui, Kowloon
Hong Kong
Tel: (852) 2737-1600
Fax: (852) 2736-9960

National Semiconductor Japan Ltd.
Tel: 81-043-299-2309
Fax: 81-043-299-2408