

Linear Products

DESCRIPTION

The NE/SA5090 addressable relay driver is a high-current latched driver, similar in function to the 9934 address decoder. The device has 8 open-collector Darlington power outputs, each capable of 150mA load current. The outputs are turned on or off by respectively loading a logic "1" or logic "0" into the device data input. The required output is defined by a 3-bit address. The device must be enabled by a \overline{CE} input line which also serves the function of further address decoding. A common clear input, \overline{CLR} , turns all outputs off when a logic "0" is applied. The device is packaged in a 16-pin plastic or Cerdip package.

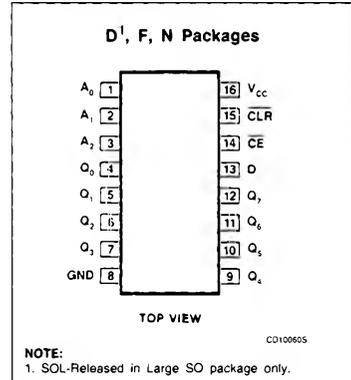
FEATURES

- 8 high-current outputs
- Low-loading bus-compatible inputs
- Power-on clear ensures safe operation
- Will operate in addressable or demultiplex mode
- Allows random (addressed) data entry
- Easily expandable
- Pin-compatible with 9334 (Siliconix or Fairchild)

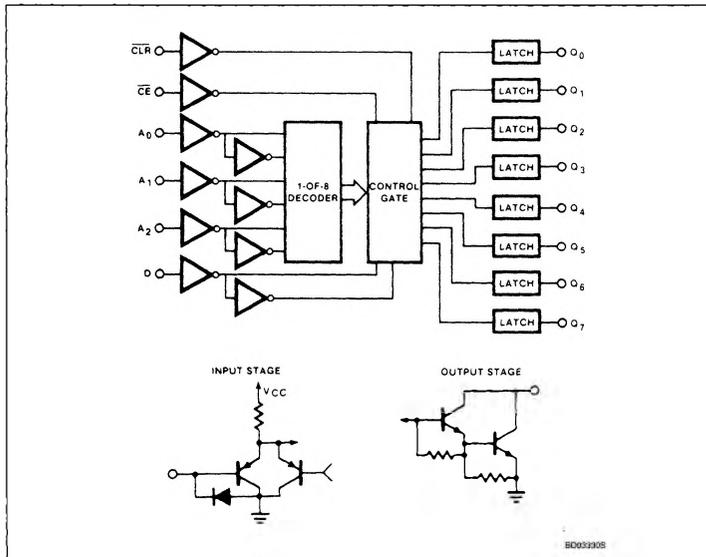
APPLICATIONS

- Relay driver
- Indicator lamp driver
- Triac trigger
- LED display digit driver
- Stepper motor driver

PIN CONFIGURATION



BLOCK DIAGRAM



Addressable Relay Driver

NE/SA5090

PIN DESIGNATION

PIN NO.	SYMBOL	NAME AND FUNCTION
1-3	A ₀ -A ₂	A 3-bit binary address on these pins defines which of the 8 output latches is to receive the data.
4-7, 9-12	Q ₀ -Q ₇	The 8 device outputs.
13	D	The data input. When the chip is enabled, this data bit is transferred to the defined output such that: "1" turns output switch "ON" "0" turns output switch "OFF"
14	CE	The chip enable. When this input is low, the output latches will accept data. When CE goes high, all outputs will retain their existing state, regardless of address of data input condition.
15	CLR	The clear input. When CLR goes low all output switches are turned "OFF". The high data input will override the clear function on the addressed latch.

ORDERING INFORMATION

DESCRIPTION	TEMPERATURE RANGE	ORDER CODE
16-Pin Plastic SOL	0 to +70°C	NE5090D
16-Pin Plastic DIP	0 to +70°C	NE5090N
16-Pin Cerdip	0 to +70°C	NE5090F
16-Pin Plastic DIP	-40 to +85°C	SA5090N

TRUTH TABLE

INPUTS						OUTPUTS								MODE
CLR	CE	D	A ₀	A ₁	A ₂	Q ₀	Q ₁	Q ₂	Q ₃	Q ₄	Q ₅	Q ₆	Q ₇	
L	H	X	X	X	X	H	H	H	H	H	H	H	H	Clear
L	L	L	L	L	L	H	H	H	H	H	H	H	H	Demultiplex
L	L	L	L	L	L	L	H	H	H	H	H	H	H	
L	L	L	L	L	L	L	L	H	H	H	H	H	H	
L	L	L	L	L	L	L	L	L	H	H	H	H	H	
L	L	L	L	L	L	L	L	L	L	H	H	H	H	
H	H	X	X	X	X	Q _{N-1} →								Memory
H	L	L	L	L	L	H Q _{N-1} →								Addressable Latch
H	L	L	L	L	L	L Q _{N-1} →								
H	L	L	L	L	L	Q _{N-1} H Q _{N-1} →								
H	L	L	L	L	L	Q _{N-1} L Q _{N-1} →								
H	L	L	L	L	L	Q _{N-1} → H								
H	L	L	L	L	L	Q _{N-1} → L								

NOTES:

- X = Don't care condition
- Q_{N-1} = Previous output state
- L = Low voltage level/"ON" output state
- H = High voltage level/"OFF" output state

Addressable Relay Driver

NE/SA5090

ABSOLUTE MAXIMUM RATINGS $T_A = 25^\circ\text{C}$, unless otherwise specified.

SYMBOL	PARAMETER	RATING	UNIT
V_{CC}	Supply voltage	-0.5 to +7	V
V_{IN}	Input voltage	-0.5 to +15	V
V_{OUT}	Output voltage	0 to +30	V
I_{GND}	Ground current	500	mA
I_{OUT}	Output current Each output	200	mA
P_D	Maximum power dissipation, $T_A = 25^\circ\text{C}$ (still-air) ¹ F package N package D package	1388 1712 1315	mW mW mW
T_A	Ambient temperature range	0 to +70	$^\circ\text{C}$
T_J	Junction temperature	150	$^\circ\text{C}$
T_{STG}	Storage temperature range	-65 to +150	$^\circ\text{C}$
T_{SOLD}	Lead soldering temperature (10sec. max)	300	$^\circ\text{C}$

NOTE:

- Derate above 25°C at the following rates:
F package at 11.1mW/ $^\circ\text{C}$.
N package at 13.7mW/ $^\circ\text{C}$.
D package at 10.5mW/ $^\circ\text{C}$.

DC ELECTRICAL CHARACTERISTICS $V_{CC} = 4.75\text{V}$ to 5.25V , $0^\circ\text{C} \leq T_A \leq +70^\circ\text{C}$, unless otherwise specified.¹

SYMBOL	PARAMETER	TEST CONDITIONS	LIMITS			UNIT
			Min	Typ	Max	
V_{IH} V_{IL}	Input voltage High Low		2.0		0.8	V
V_{OL}	Output voltage Low	$I_{OL} = 150\text{mA}$, $T_A = 25^\circ\text{C}$ Over temperature		1.05	1.30 1.50	V
I_{IH} I_{IL}	Input current High Low	$V_{IN} = V_{CC}$ $V_{IN} = 0\text{V}$		< 1.0 -3.0	10 -250	μA
I_{OH}	Leakage current	$V_{OUT} = 28\text{V}$,		5	250	μA
I_{CCL} I_{CCH}	Supply current All outputs low All outputs high	$V_{CC} = 5.25\text{V}$		35 22	60 50	mA
P_D	Power dissipation	No output load			315	mW

NOTE:

- All typical values are at $V_{CC} = 5\text{V}$ and $T_A = 25^\circ\text{C}$.

Addressable Relay Driver

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SWITCHING CHARACTERISTICS $V_{CC} = 5V, T_A = 25^\circ C, V_{OUT} = 5V, I_{OUT} = 100mA, V_{IL} = 0.8V, V_{IH} = 2.0V.$

SYMBOL	PARAMETER	TO	FROM	MIN	TYP	MAX	UNIT
t_{PLH} t_{PHL}	Propagation delay time Low-to-high ¹ High-to-low ¹	Output	\overline{CE}		900 130	1800 260	ns
t_{PLH} t_{PHL}	Low-to-high ² High-to-low ²	Output	Data		920 130	1850 260	ns
t_{PLH} t_{PHL}	Low-to-high ³ High-to-low ³	Output	Address		900 130	1800 260	ns
t_{PLH} t_{PHL}	Low-to-high ⁴ High-to-low ⁴	Output	\overline{CLR}		920	1850	ns
Switching setup requirements							
$t_{S(H)}^5$ $t_{S(L)}^5$	Setup time high Setup time low	Chip enable Chip enable	High data Low data	40 50			ns
$t_{S(A)}^6$	Address setup time	Chip enable	Address	40			ns
$t_{H(H)}^5$ $t_{H(L)}^5$	Hold time high Hold time low	Chip enable Chip enable	High data Low data	10 10			ns
$t_{PW(E)}^1$	Chip enable pulse width ¹			40			ns

NOTES:

1. See Turn-On and Turn-Off Delays, Enable-to-Output and Enable Pulse Width timing diagram.
2. See Turn-On and Turn-Off Delays, Data-to-Output timing diagram.
3. See Turn-On and Turn-Off Delays, Address-to-Output timing diagram.
4. See Turn-Off Delay, Clear-to-Output timing diagram.
5. See Setup and Hold Time, Data-to-Enable timing diagram.
6. See Setup Time, Address-to-Enable timing diagram.

FUNCTIONAL DESCRIPTION

This peripheral driver has latched outputs which hold the input data until cleared. The NE5090 has active-Low, open-collector outputs, all of which are cleared when power is first applied. This device is identical to the NE590, except the outputs can withstand 28V.

Addressable Latch Function

Any given output can be turned on or off by presenting the address of the output to be set or cleared to the three address pins, by holding the "D" input High to turn on the selected output, or by holding it Low to turn off, holding the \overline{CLR} input High, and bringing the \overline{CE} input Low. Once an output is turned on or off, it will remain so until addressed again, or until all outputs are cleared by bringing the \overline{CLR} input Low while holding the \overline{CE} input High.

Demultiplexer Operation

By holding the \overline{CLR} and \overline{CE} inputs Low and the "D" input High, the addressed output will remain on and all other outputs will be off.

High Current Outputs

The obvious advantage of this device over other drivers such as the 9334 and

N74LS259 is the fact that the outputs of the NE5090 are each capable of 250mA and 28V. It must be noted, however, that the total power dissipation would be over 2.5W if all 8 outputs were on together and carrying 250mA each. Since the total power dissipation is limited by the package to 1W, and since power dissipation due to supply current is 0.25W, the total load power dissipation by the device is limited to 0.75W at room temperature, and decreases as ambient temperature rises.

The maximum die junction temperature must be limited to 165°C, and the temperature rise above ambient and the junction temperature are defined as:

$$T_R = \theta_{JA} \times P_D$$

$$T_J = T_A + t_R$$

where

- θ_{JA} is die junction to ambient thermal resistance
- P_D is total power dissipation
- T_R is junction temperature rise above ambient
- T_J is die junction temperature
- T_A is ambient (surrounding medium) temperature

For example, if we are using the NE5090 in a plastic package in an application where the ambient temperature is never expected to rise above 50°C, and the output current at the 8 outputs, when on, are 100, 40, 50, 200, 15, 30, 80, and 10mA, we find from the graph of output voltage vs load current that the output voltages are expected to be about 0.92, 0.75, 0.78, 1.04, 0.5, 0.7, 0.9, and 0.4V, respectively. Total device power due to these loads is found to be 473.5mW. Adding the 250mW due to the power supply brings total device power dissipation to 723.5mW. The thermal resistances are 83°C per W for plastic packages and 100°C per W for Cerdips. Using the equations above we find:

$$\text{Plastic } T_R = 83 \times 0.7235 = 60^\circ C$$

$$\text{Plastic } T_J = 50 + 60 = 100^\circ C$$

$$\text{Cerdip } T_R = 100 \times 0.7235 = 72.4^\circ C$$

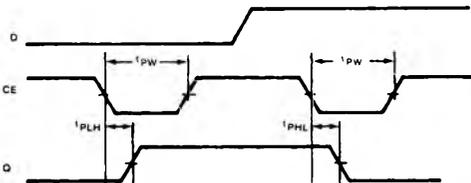
$$\text{Cerdip } T_J = 50 + 72.4 = 122.4^\circ C$$

Thus we find that T_J for either package is below the 165°C maximum and either package could be used in this application. The graphs of total load power vs ambient temperature would also give us this same information, although interpreting the graphs would not yield the same accuracy.

Addressable Relay Driver

NE/SA5090

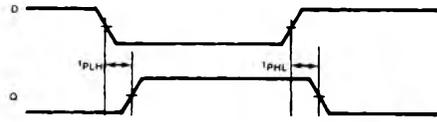
TIMING DIAGRAMS



WF157505

NOTE:
Other Inputs: CLR = H, A = Stable

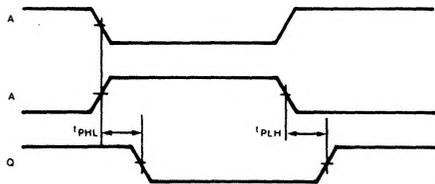
Turn-On and Turn-Off Delays, Enable-to-Output and Enable Pulse Width



WF157605

NOTE:
Other Inputs: CE = L, CLR = H, A = Stable

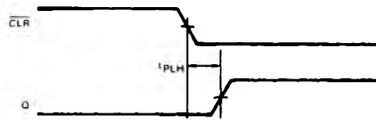
Turn-On and Turn-Off Delays, Data-to-Output



WF157705

NOTE:
Other Inputs: CE = L, CLR = L, D = H

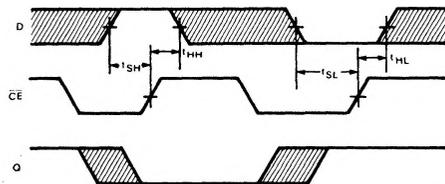
Turn-On and Turn-Off Delays, Address-to-Output



WF157805

NOTE:
Other Inputs: CE = H

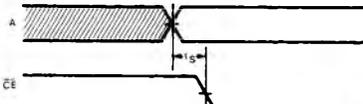
Turn-Off Delay, Clear-to-Output



WF157905

NOTE:
Other Inputs: CLR = H, A = Stable

Setup and Hold Time, Data-to-Enable



WF158005

NOTE:
Other Inputs: CLR = H

Setup Time, Address-to-Enable

Addressable Relay Driver

NE/SA5090

TYPICAL APPLICATIONS

LD06040S

TC10871S

Driving Simple Loads

TC10860S

Operating in Demultiplex Mode

NOTE:
A₀, A₁, A₂ may be connected to the address bus if permitted by system design.

Interfacing With a Microprocessor System

TYPICAL PERFORMANCE CHARACTERISTICS

