DATA SHEET

NE/SA5090

Addressable relay driver

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Addressable relay driver   NE/SA5090

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 150 mA 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 DIP or SO 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
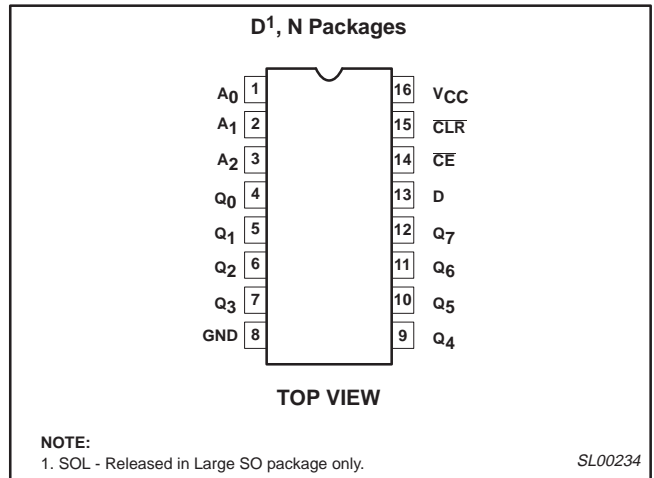- Pin-compatible with 9334 (Philips or Fairchild)

PIN CONFIGURATION

D[1], N Packages

A_0	1	16	V_{CC}
A_1	2	15	$\overline{CLR}$
A_2	3	14	$\overline{CE}$
Q_0	4	13	D
Q_1	5	12	Q_7
Q_2	6	11	Q_6
Q_3	7	10	Q_5
GND	8	9	Q_4

TOP VIEW

NOTE:
1. SOL - Released in Large SO package only.   SL00234

Figure 1. Pin Configuration

APPLICATIONS

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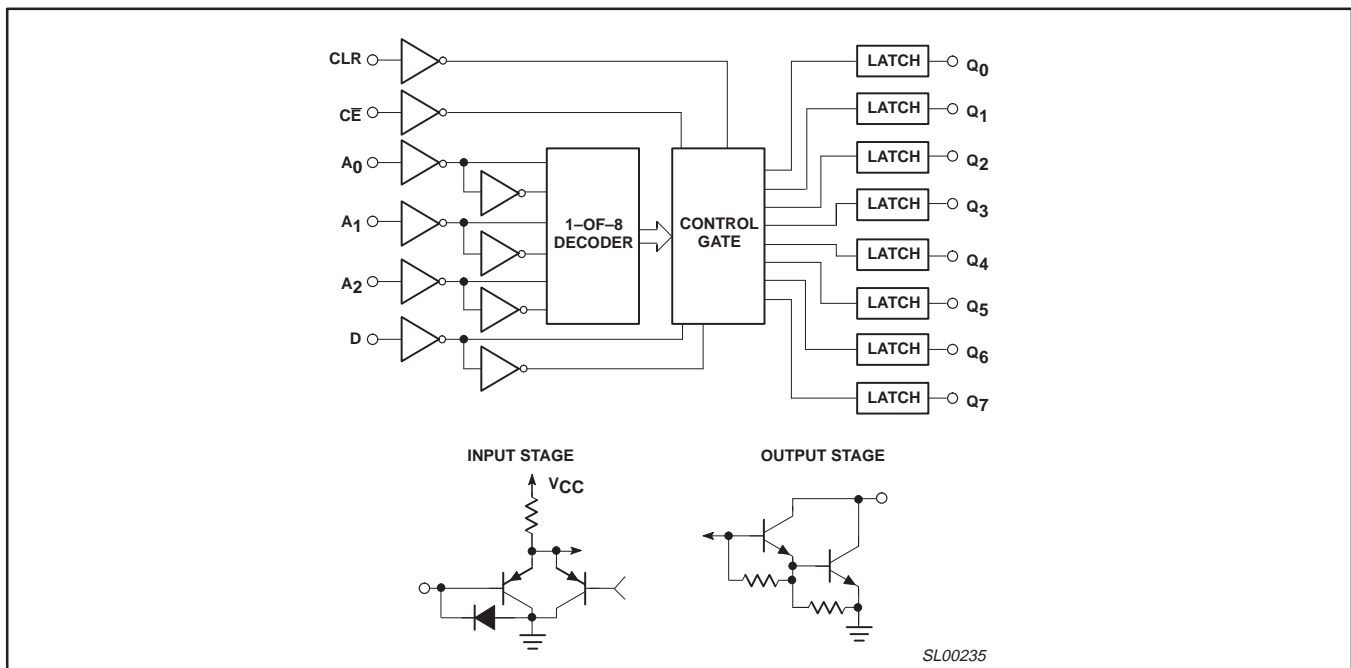- Stepper motor driver

BLOCK DIAGRAM

Figure 2. Block Diagram

Addressable relay driver

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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	$\overline{CE}$	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	$\overline{CLR}$	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	DWG #
16-Pin Plastic Small Outline Large (SOL) Package	0 °C to +70 °C	NE5090D	SOT162–1
16-Pin Plastic Dual In-Line Package (DIP)	0 °C to +70 °C	NE5090N	SOT38–4
16-Pin Plastic Small Outline Large (SOL) Package	−40 °C to +85 °C	SA5090D	SOT162–1
16-Pin Plastic Dual In-Line Package (DIP)	−40 °C to +85 °C	SA5090N	SOT38–4

TRUTH TABLE

INPUTS						OUTPUTS								MODE
$\overline{CLR}$	$\overline{CE}$	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	H	L	L	L	L	H	H	H	H	H	H	H	
L	L	L	H	L	L	H	H	H	H	H	H	H	H	
L	L	H	H	L	L	H	L	H	H	H	H	H	H	
L	L	L	H	H	H	H	H	H	H	H	H	H	H	
L	L	H	H	H	H	H	H	H	H	H	H	H	L	
H	H	X	X	X	X	Q_{N-1}								Memory
H	L	L	L	L	L	H	Q_{N-1}							Addressable Latch
H	L	H	L	L	L	L	Q_{N-1}							
H	L	L	H	L	L	Q_{N-1}	H	Q_{N-1}						
H	L	H	H	L	L	Q_{N-1}	L	Q_{N-1}						
H	L	L	H	H	H	Q_{N-1}							H	
H	L	H	H	H	H	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

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ABSOLUTE MAXIMUM RATINGS

T_{amb} = 25 °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_{amb} = 25 °C (still-air)[1]
	    N package
	    D package
		
		1712
		1315
			
			mW
			mW

T_{amb}	Ambient temperature range	0 to +70	°C
T_j	Junction temperature	150	°C
T_{stg}	Storage temperature range	−65 to +150	°C
T_{sld}	Lead soldering temperature (10 sec. max)	230	°C

NOTE:
1. Derate above 25 °C at the following rates:
    N package at 13.7 mW/°C
    D package at 10.5 mW/°C

DC ELECTRICAL CHARACTERISTICS

V_{CC} = 4.75 V to 5.25 V; 0 °C ≤ T_{amb} ≤ +70 °C, unless otherwise specified.[1]

SYMBOL	PARAMETER	TEST CONDITIONS	LIMITS Min	Typ	Max	UNIT

V_{IH}
V_{IL}
	Input voltage
	    High
	    Low
			2.0		
					
					0.8
						V

V_{OL}	Output voltage Low	I_{OL} = 150 mA, T_{amb} = 25 °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 V
				<1.0
				−3.0
					10
					−250
						µA

I_{OH}	Leakage current	V_{OUT} = 28 V		5	250	µA

I_{CCL}
I_{CCH}
	Supply current
	    All outputs low
	    All outputs high
		V_{CC} = 5.25 V		35
				22
					60
					50
						mA

P_D	Power dissipation	No output load			315	mW

NOTE:
1. All typical values are at V_{CC} = 5 V and T_{amb} = 25 °C.

SWITCHING CHARACTERISTICS

V_{CC} = 5 V; T_{amb} = 25 °C; V_{OUT} = 5 V; I_{OUT} = 100 mA; V_{IL} = 0.8 V; V_{IH} = 2.0 V.

SYMBOL	PARAMETER	TO	FROM	MIN	TYP	MAX	UNIT
Propagation delay time							
t_{PLH}	Low-to-high[1]	Output	$\overline{CE}$		900	1800	ns
t_{PHL}	High-to-low[1]				130	260	
t_{PLH}	Low-to-high[2]	Output	Data		920	1850	ns
t_{PHL}	High-to-low[2]				130	260	
t_{PLH}	Low-to-high[3]	Output	Address		900	1800	ns
t_{PHL}	High-to-low[3]				130	260	
t_{PLH}	Low-to-high[4]	Output	$\overline{CLR}$		920	1850	ns
t_{PHL}	High-to-low[4]						
Switching setup requirements							
$t_{S(H)}$	Set-up time HIGH	Chip enable	High data	40			ns
	Set-up time LOW	Chip enable	Low data	50			
$t_{S(A)}$	Address set-up time	Chip enable	Address	40			ns
$t_{H(H)}$	Hold time HIGH	Chip enable	High data	10			ns
	Hold time LOW	Chip enable	Low data	10			
$t_{PW(E)}$	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 Set-up and Hold Time, Data-to-Enable timing diagram.
6. See Set-up Time, Address-to-Enable timing diagram.

FUNCTIONAL DESCRIPTION

This peripheral driver has latched outputs which hold the input date 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 28 V.

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 200 mA and 28 V. It must be noted, however, that the total power dissipation would be over 2.5 W if all 8 outputs were on together and carrying 200 mA each. Since the total power dissipation is limited by the package to 1 W, and since power dissipation due to supply current is 0.25 W, the total load power

dissipation by the device is limited to 0.75 W 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:

$$T_R = \theta_{JA} \times P_D$$
$$T_j = T_{amb} + t_R$$

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 10 mA, 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 0.4 V, respectively. Total device power due to these loads is found to be 473.5 mW. Adding the 200 mW due to the power supply brings total device power dissipation to 723.5 mW. The thermal resistances are 83 °C per W for plastic packages. Using the equations above we find:
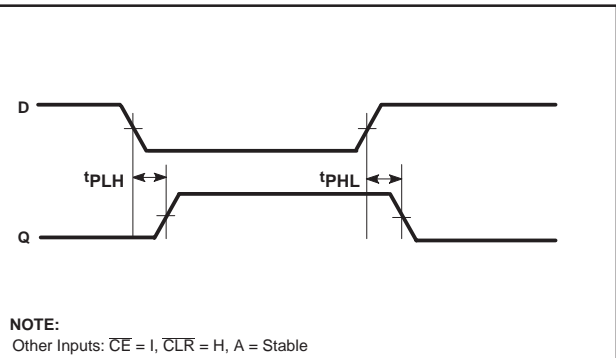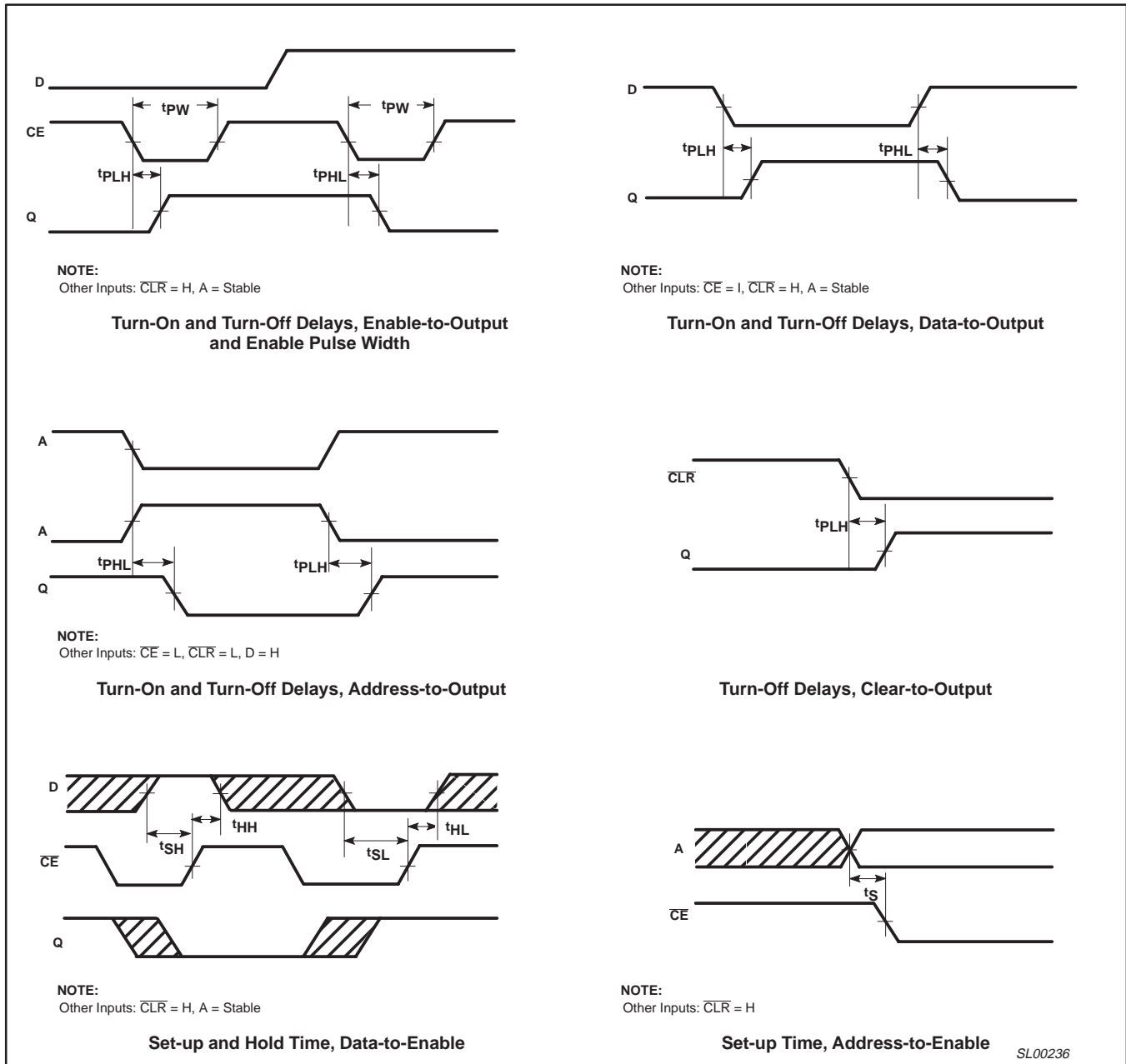
Plastic T_R=83×0.7235=60°C
Plastic T_J =50+60=100°C

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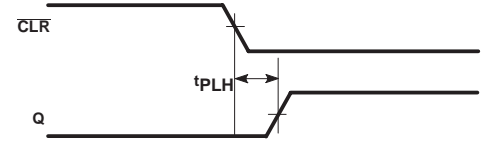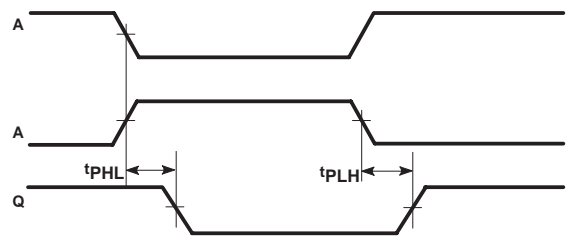
TIMING DIAGRAMS

NOTE:
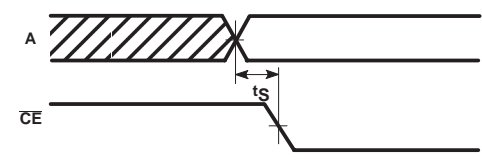Other Inputs: $\overline{CLR}$ = H, A = Stable

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

NOTE:
Other Inputs: $\overline{CE}$ = I, $\overline{CLR}$ = H, A = Stable

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

NOTE:
Other Inputs: $\overline{CE}$ = L, $\overline{CLR}$ = L, D = H

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

Turn-Off Delays, Clear-to-Output

NOTE:
Other Inputs: $\overline{CLR}$ = H, A = Stable

Set-up and Hold Time, Data-to-Enable

NOTE:
Other Inputs: $\overline{CLR}$ = H
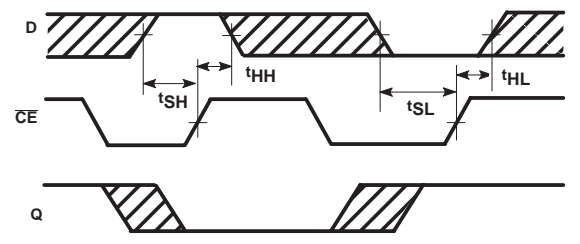
Set-up Time, Address-to-Enable

SL00236

Figure 3. Timing Diagrams

Addressable relay driver   NE/SA5090
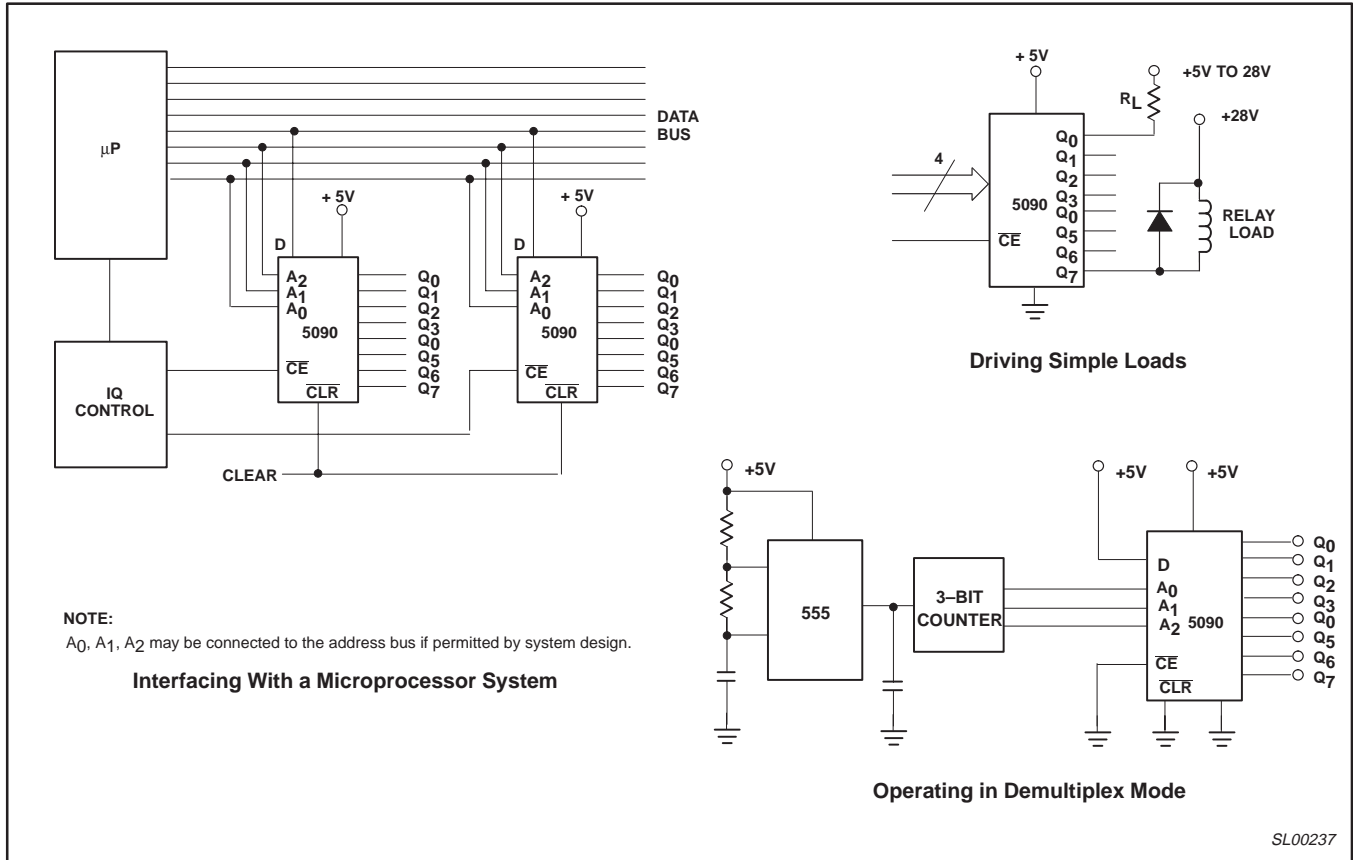
TYPICAL APPLICATIONS

Figure 4. Typical Applications
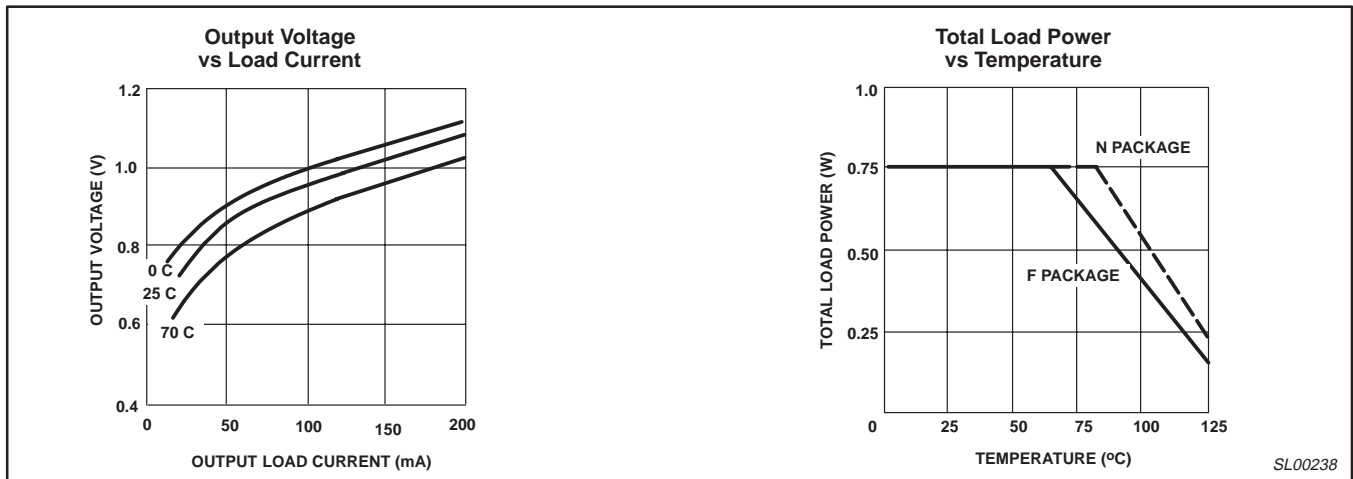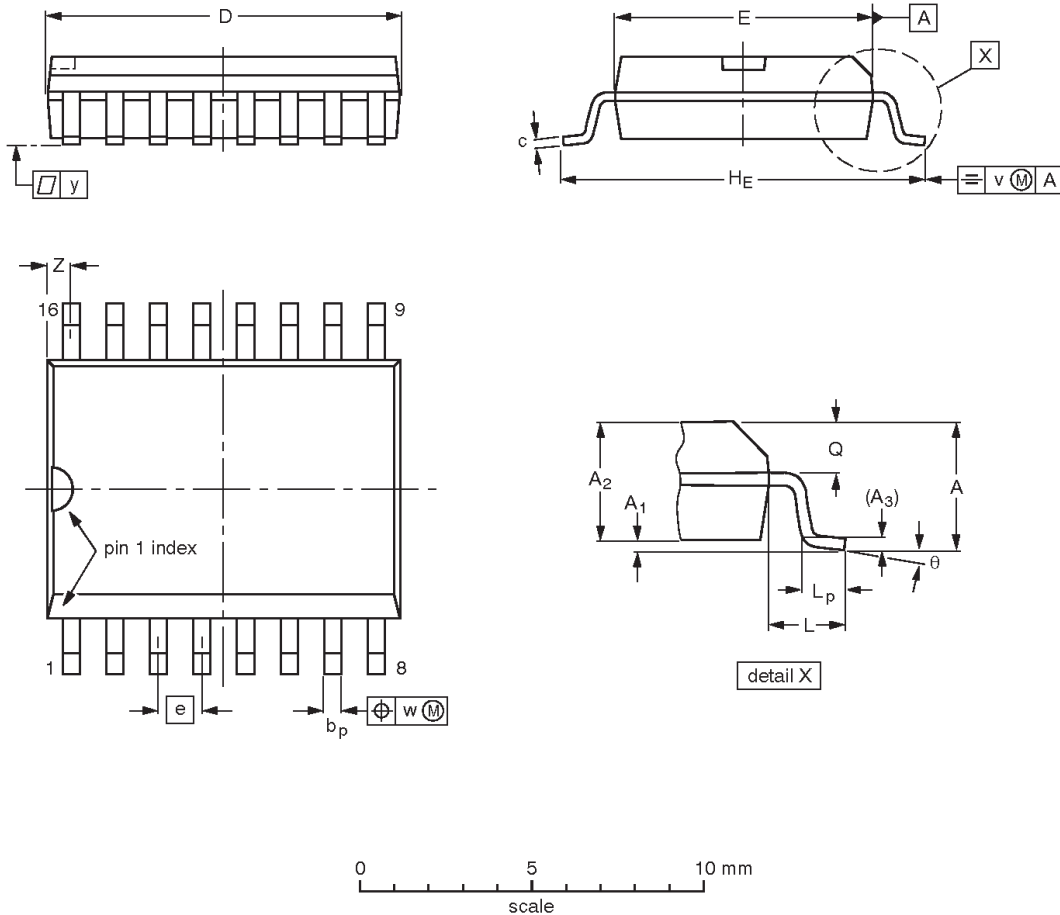
TYPICAL PERFORMANCE CHARACTERISTICS

Figure 5. Typical Performance Characteristics

Addressable relay driver

NE/SA5090

SO16:   plastic small outline package; 16 leads; body width 7.5 mm   SOT162-1

detail X

```
0        5        10 mm
|--|--|--|--|--|--|--|--|
           scale
```

DIMENSIONS (inch dimensions are derived from the original mm dimensions)

UNIT	A max.	A₁	A₂	A₃	b_p	c	D [1]	E [1]	e	H_E	L	L_p	Q	v	w	y	Z [1]	θ
mm	2.65	0.30 0.10	2.45 2.25	0.25	0.49 0.36	0.32 0.23	10.5 10.1	7.6 7.4	1.27	10.65 10.00	1.4	1.1 0.4	1.1 1.0	0.25	0.25	0.1	0.9 0.4	8° 0°
inches	0.10	0.012 0.004	0.096 0.089	0.01	0.019 0.014	0.013 0.009	0.41 0.40	0.30 0.29	0.050	0.419 0.394	0.055	0.043 0.016	0.043 0.039	0.01	0.01	0.004	0.035 0.016	

Note

1. Plastic or metal protrusions of 0.15 mm maximum per side are not included.

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ			
SOT162-1	075E03	MS-013				~~97-05-22~~ 99-12-27

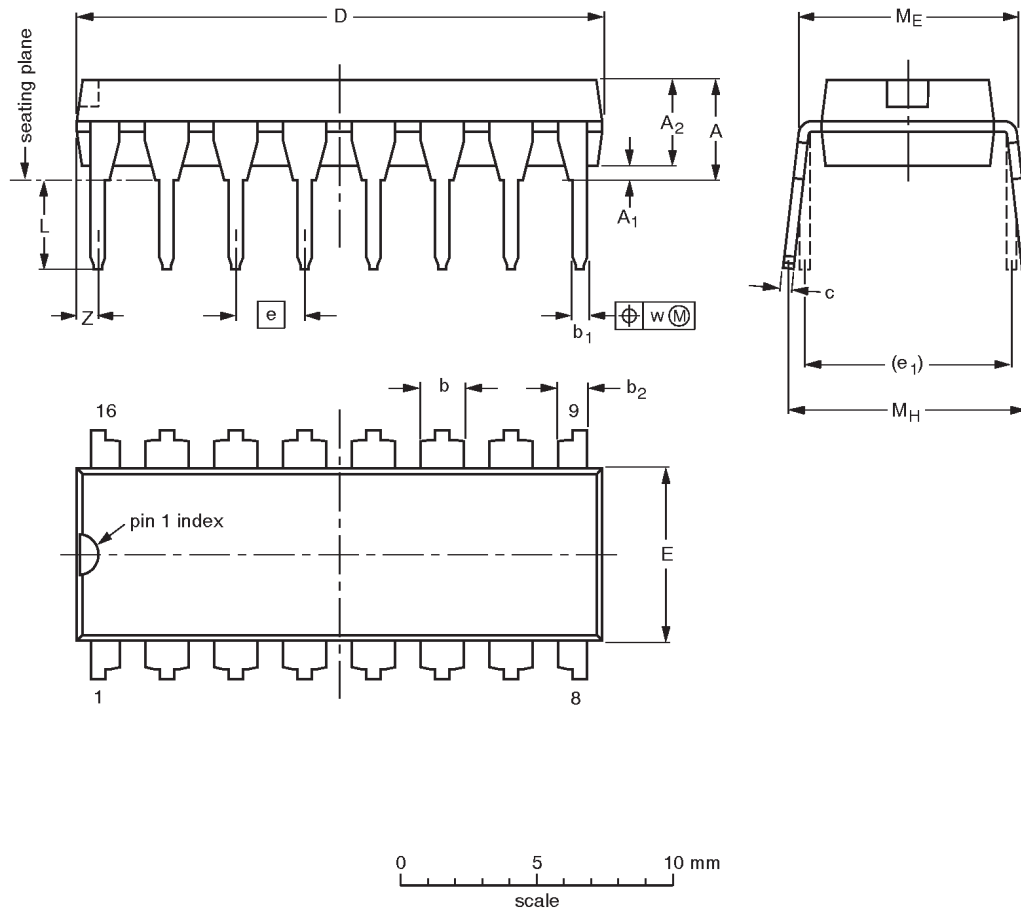## Addressable relay driver

NE/SA5090

DIP16: plastic dual in-line package; 16 leads (300 mil)

SOT38-4

pin 1 index

0 5 10 mm
scale

DIMENSIONS (inch dimensions are derived from the original mm dimensions)

UNIT	A max.	A₁ min.	A₂ max.	b	b₁	b₂	c	D (1)	E (1)	e	e₁	L	M_E	M_H	w	Z (1) max.
mm	4.2	0.51	3.2	1.73 1.30	0.53 0.38	1.25 0.85	0.36 0.23	19.50 18.55	6.48 6.20	2.54	7.62	3.60 3.05	8.25 7.80	10.0 8.3	0.254	0.76
inches	0.17	0.020	0.13	0.068 0.051	0.021 0.015	0.049 0.033	0.014 0.009	0.77 0.73	0.26 0.24	0.10	0.30	0.14 0.12	0.32 0.31	0.39 0.33	0.01	0.030

Note

1. Plastic or metal protrusions of 0.25 mm maximum per side are not included.

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ			
SOT38-4						~~92-11-17~~ 95-01-14

Data sheet status

Data sheet status[1]	Product status[2]	Definitions
Objective data	Development	This data sheet contains data from the objective specification for product development. Philips Semiconductors reserves the right to change the specification in any manner without notice.
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