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SAA1027

## STEPPING MOTOR DRIVE CIRCUIT

### GENERAL DESCRIPTION

The SAA1027 is a bipolar integrated circuit intended for driving a four-phase two-stator motor. The circuit consists of a bidirectional four-state counter and a code converter to drive the four outputs in the sequence required for driving a stepping motor.

### Features

- high noise immunity inputs
- clockwise and counter-clockwise operation
- reset facility
- high output current
- outputs protected against damage by overshoot.

### QUICK REFERENCE DATA

Supply voltage range	$V_{CC}$	9,5to 18 V
Supply current, unloaded	$I_{CC}$	typ. 4,5 mA
Input voltage, all inputs		
HIGH	$V_{IH}$	min. 7.5 v
LOW	$V_{IL}$	max. 4,5 v
Input current, all inputs, LOW	$I_{IL}$	typ. 30 $\mu$ A
Output current LOW	$I_{OL}$	max. 500 mA
Operating ambient temperature range	$T_{amb}$	-20 to +70 oc

### PACKAGE OUTLINE

16-lead DIL; plastic (SOT-38A).



**Mullard**

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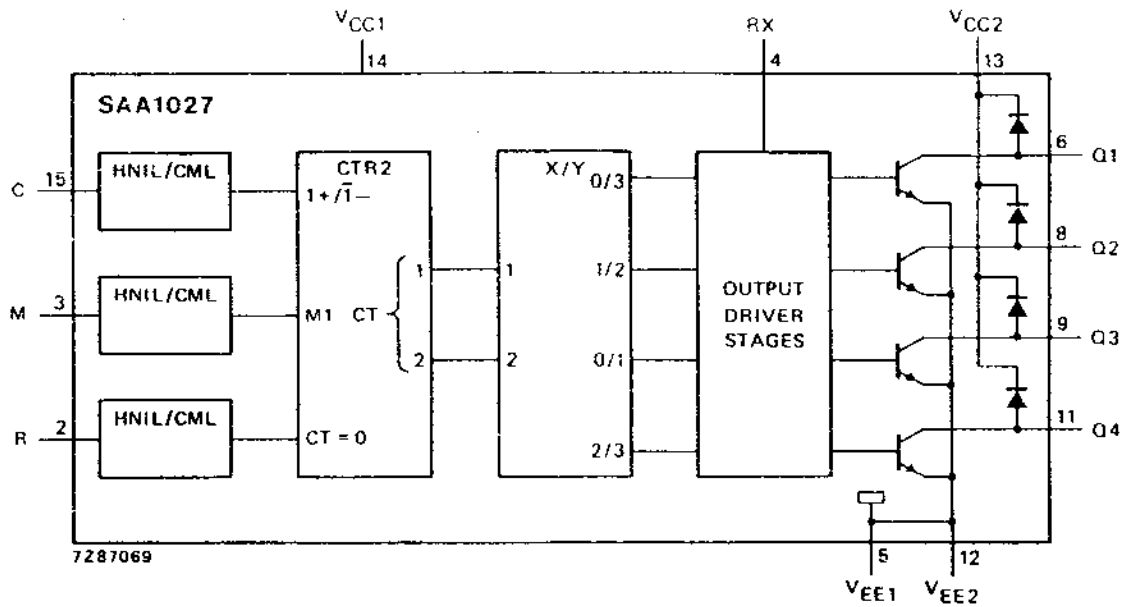


Fig. 1 Block diagram. The blocks marked HNIL/CML are high noise immunity input stages, the block marked CTR2 is a bidirectional synchronous 2-bit (4-state) counter and the block marked X/Y is a code converter. C is the count input, M the mode input to select forward or reverse counting and R is the reset input which resets the counter to content zero.

PINNING

1	n.c.	not connected
2	R	reset input
3	M	mode input
4	RX	external resistor
5	VEE1	ground
6	Q1	output 1
7	n.c.	not connected
8	Q2	output 2
9	Q3	output 3
10	n.c.	not connected
11	Q4	output 4
12	VEE2	ground
13	VCC2	positive supply
14	VCC1	positive supply
15	C	count input
16	n.c.	not connected

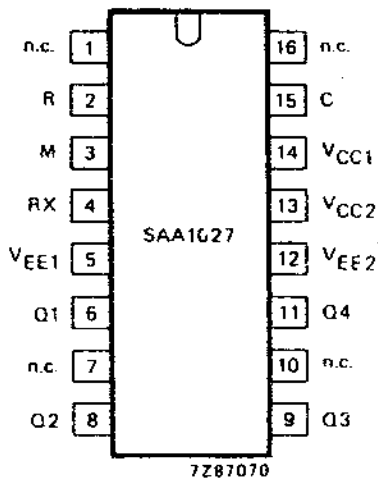


Fig. 2 Pinning diagram.



**FUNCTIONAL DESCRIPTION****Count input C (pin 15)**

The outputs change state after each L to H signal transition at the count input.

**Mode input M (pin 3)**

With the mode input the sequence of output signals, and hence the direction of rotation of the stepping motor, can be chosen, as shown in the following table.

counting sequence	M = L				M = H			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
0	L	H	L	H	L	H	L	H
1	H	L	L	H	L	H	H	L
2	H	L	H	L	H	L	H	L
3	L	H	H	L	H	L	L	H
0	L	H	L	H	L	H	L	H

**Reset input R (pin 2)**

A LOW level at the R input resets the counter to content zero. The outputs take on the levels shown in the upper and lower line of the table above.

If this facility is not used the R input should be connected to the supply.

**External resistor pin RX (pin 4)**

The external resistor R4 connected to RX sets the base current of the output transistors. Its value has to be chosen in accordance with the required output current (see Fig. 5).

**Outputs Q1 to Q4 (pins 6, 8, 9 and 11)**

The circuit has open-collector outputs. To prevent damage by an overshooting output voltage the outputs are protected by diodes connected to  $V_{CC2}$ , pin 13. High output currents mainly determine the total power dissipation, see Fig. 3.



## RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Supply voltage, d.c.	$V_{CC1}; V_{CC2}$	max.	18 V
Input voltage, all inputs	$V_I$	max.	18 V
Current into pin 4	$I_{RX}$	max.	120 mA
Output current	$I_{OL}$	max.	500 mA
Power dissipation	$P_{tot}$	see Fig. 4	
Storage temperature range	$T_{stg}$	-40 to +125 °C	
Operating ambient temperature range	$T_{amb}$	-20 to +70 °C	

## CHARACTERISTICS

 $V_{CC} = 9,5$  to 18 V;  $V_{EE} = 0$  V;  $T_{amb} = -20$  to 70 °C unless otherwise specified.

parameter	symbol	min.	typ.	max.	unit
<b>Supply <math>V_{CC1}</math> and <math>V_{CC2}</math> (pins 14 and 13)</b>					
Supply current at $V_{CC1} = 12$ V; unloaded; all inputs HIGH; pin 4 open	$I_{CC}$	2	4,5	6,5	mA
<b>Inputs C, M and R (pins 15, 3 and 2)</b>					
Input voltage					
HIGH	$V_{IH}$	7,5	—	—	V
LOW	$V_{IL}$	—	—	4,5	V
Input current					
HIGH	$I_{IH}$	—	1	—	$\mu$ A
LOW	$-I_{IL}$	—	30	—	$\mu$ A
<b>External resistor pin RX (pin 4)</b>					
Voltage at RX at $V_{CC} = 12$ V $\pm$ 15%; $R_4 = 130 \Omega \pm 5\%$	$V_{RX}$	3	—	4,5	V
<b>Outputs Q1 to Q4</b>					
Output voltage LOW					
at $I_{OL} = 350$ mA	$V_{OL}$	—	500	1000	mV
at $I_{OL} = 500$ mA	$V_{OL}$	—	700	—	mV
Output current					
LOW	$I_{OL}$	—	—	500*	mA
HIGH at $V_O = 18$ V	$-I_{OH}$	—	—	50	$\mu$ A

\* See Figs 3 and 4.



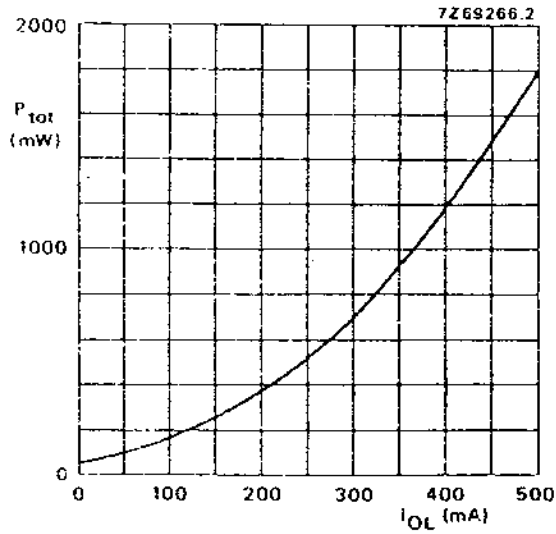


Fig. 3 Total power dissipation  $P_{tot}$  as a function of output current  $I_{OL}$ .

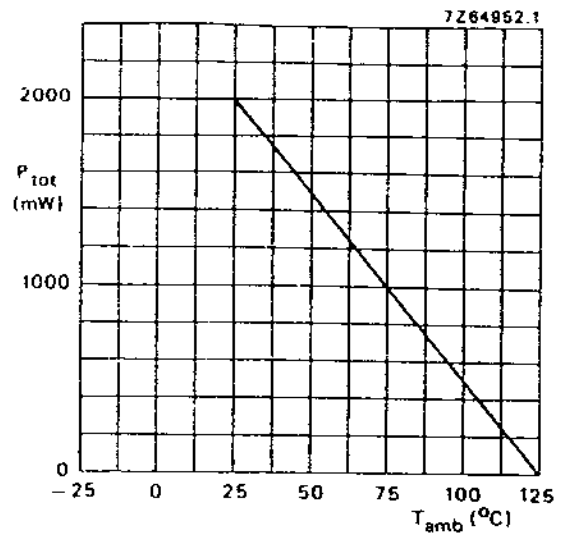


Fig. 4 Power derating curve.

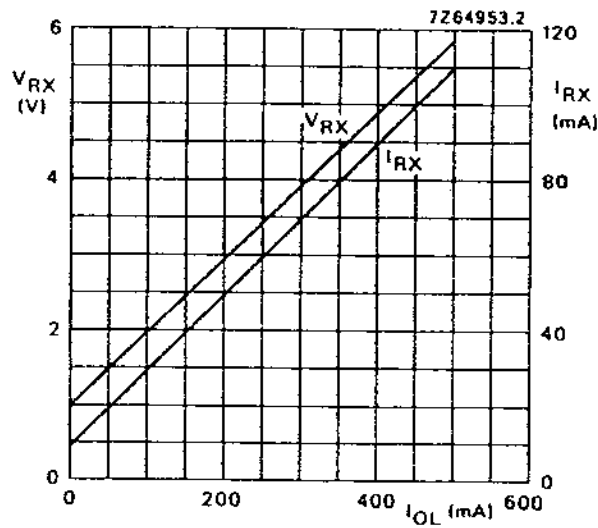


Fig. 5 Current  $I_{RX}$  into RX and voltage  $V_{RX}$  on RX as a function of required output current  $I_{OL}$ .

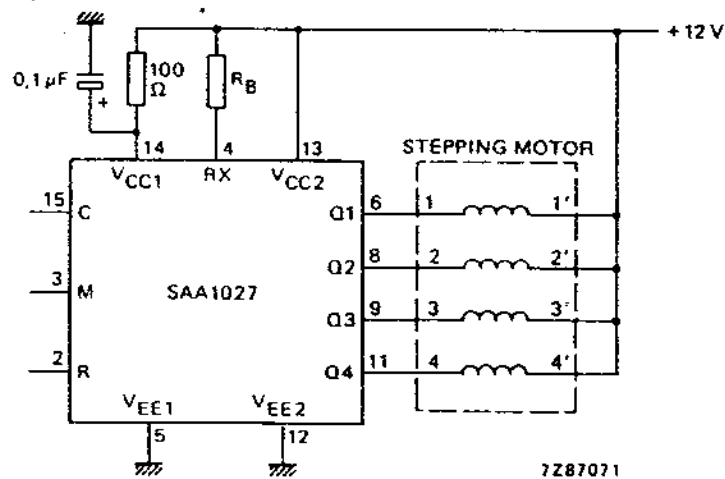
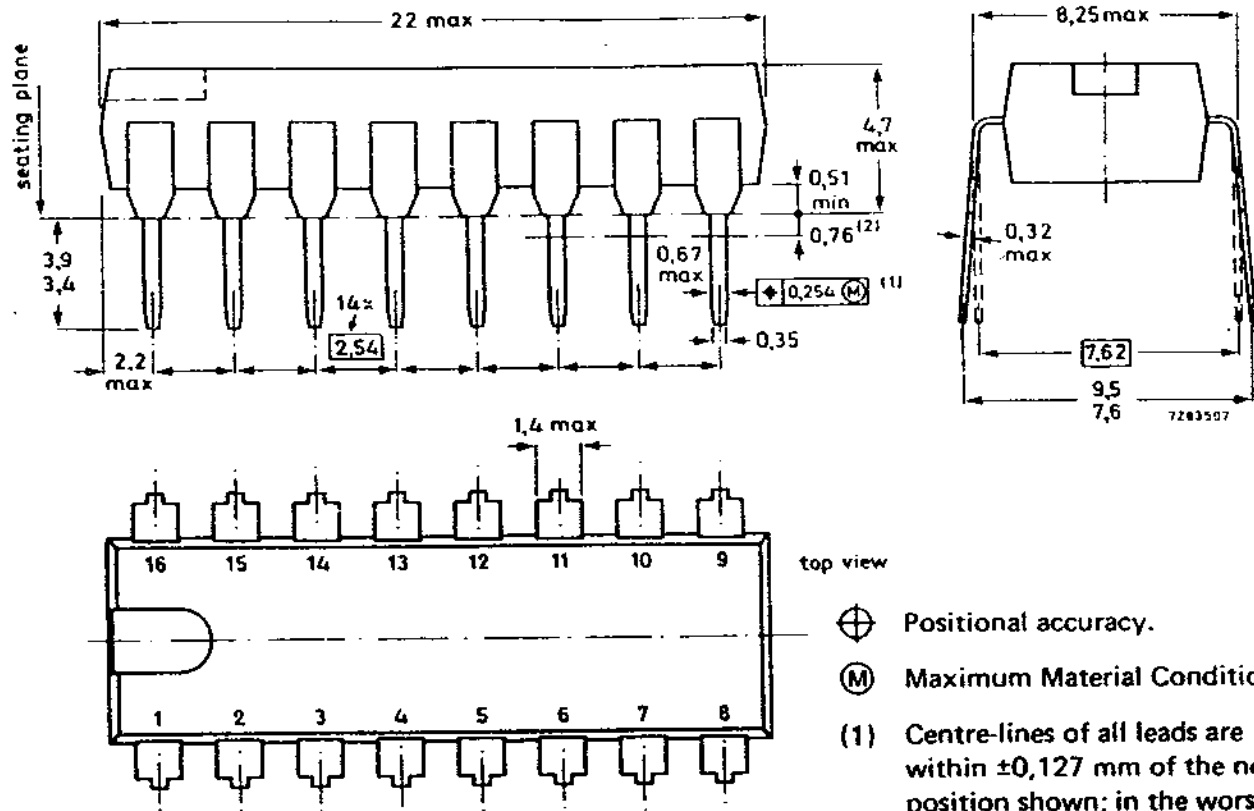


Fig. 6 Typical application of the SAA1027 as a stepping motor driver.



## 16-LEAD DUAL IN-LINE; PLASTIC (SOT-38A)



Dimensions in mm

## SOLDERING

### 1. By hand

Apply the soldering iron below the seating plane (or not more than 2 mm above it). If its temperature is below 300 °C it must not be in contact for more than 10 seconds; if between 300 °C and 400 °C, for not more than 5 seconds.

### 2. By dip or wave

The maximum permissible temperature of the solder is 260 °C; this temperature must not be in contact with the joint for more than 5 seconds. The total contact time of successive solder waves must not exceed 5 seconds.

The device may be mounted up to the seating plane, but the temperature of the plastic body must not exceed the specified storage maximum. If the printed-circuit board has been pre-heated, forced cooling may be necessary immediately after soldering to keep the temperature within the permissible limit.

### 3. Repairing soldered joints

The same precautions and limits apply as in (1) above.

