SAA1027

Made by Philips Semiconductors.

(Information taken from Data Sheet dated October 1982)

Stepper 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 stepper 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}	9.5 to 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 µA
Output current LOW	I_{OL}	max.	500 mA
Operating ambient temperature range	Tamb	-20 to +70 °C	

Package outline - 16-lead DIL; plastic (SOT-38A)

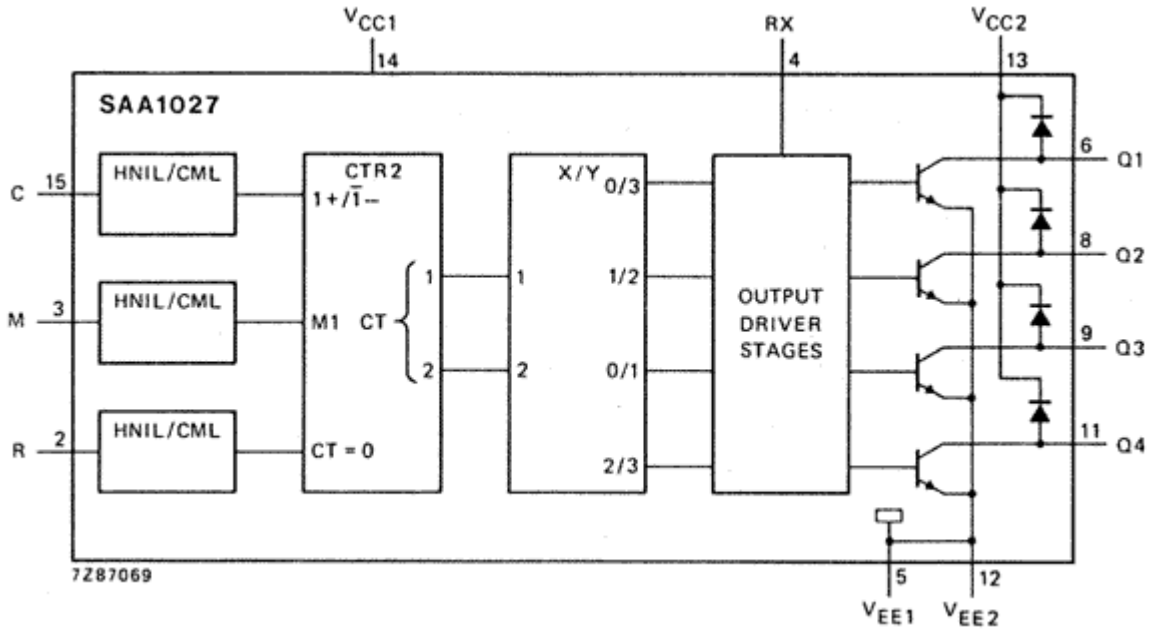
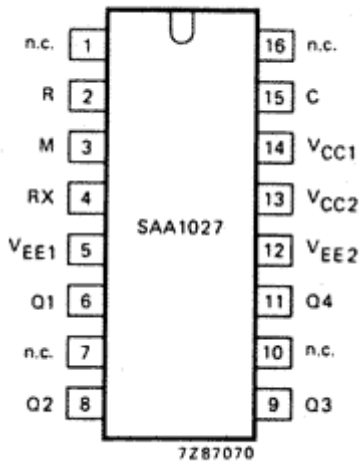


Fig. 1 Block diagram. The blocks marked HNIL/CML are high noise immunity input stages, the block marked CTR2 is a bidirectional sychronous 2-bit (4-state) counter and the block marked X/Y is a code converter. C is the count input, M the mode input to select forward or reverse counting and R is the reset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

Pinning



n.c. not connected

1		
2	R	reset input
3	M	mode input
4	RX	external resistor
5	V_{EE1}	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	V_{EE2}	ground
13	V_{CC2}	positive supply
14	V_{CC1}	positive supply
15	C	count input
16	n.c.	not connected

Functional Description

Count input C (pin 15)
The outputs change state after each L to H signal trasition at the count input.

Mode input M (pin 3)
With the mode input the sequence of output signals, and hence the direction 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 (pin 2)
A LOW level at the R input resets the counter to 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 pin 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
Supply V_{CC1} and **V_{CC2}** (pins 14 and 13) Supply Current at V_{CC1} = 12 V; unloaded; all inputs HIGH; pin 4 open	I_{CC}	2	4.5	6.5	mA
Inputs C, M and R (pins 15, 3 and 2) Input voltage:					
HIGH	V_{IH}	7.5	-	-	V
LOW	V_{IL}	-	-	4.5	V
Input current:					
HIGH	I_{IH}	-	1	-	µA
LOW	$-I_{IL}$	-	30	-	µA
External resistor pin RX (pin 4) Voltage at RX at V_{CC} = 12 V ± 15% R4 = 130 ohm ± 5%	V_{RX}	3	-	4.5	V
Outputs Q1 to Q4 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_Q = 18 V	$-I_{OH}$	-	-	50	µA

* See figs 3 and 4

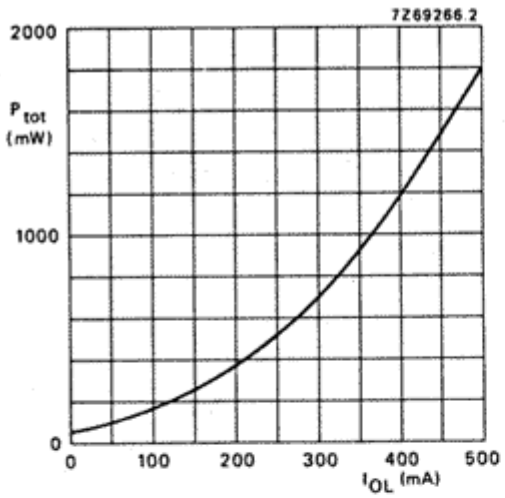


Fig. 3 Total power dissipation P_{tot} as a function of output current I_{OL}.

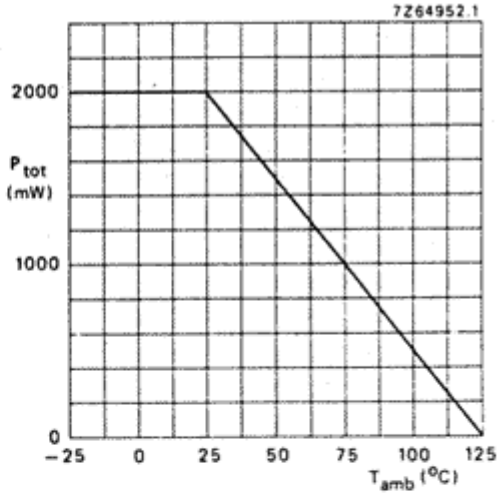


Fig. 4 Power derating curve.

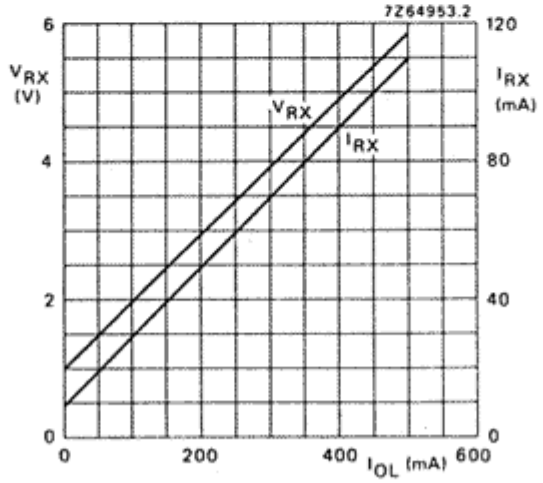


Fig. 5 Current I_{RX} into RX and voltage V_{RX} on RX as a function of required output current I_{OL}.

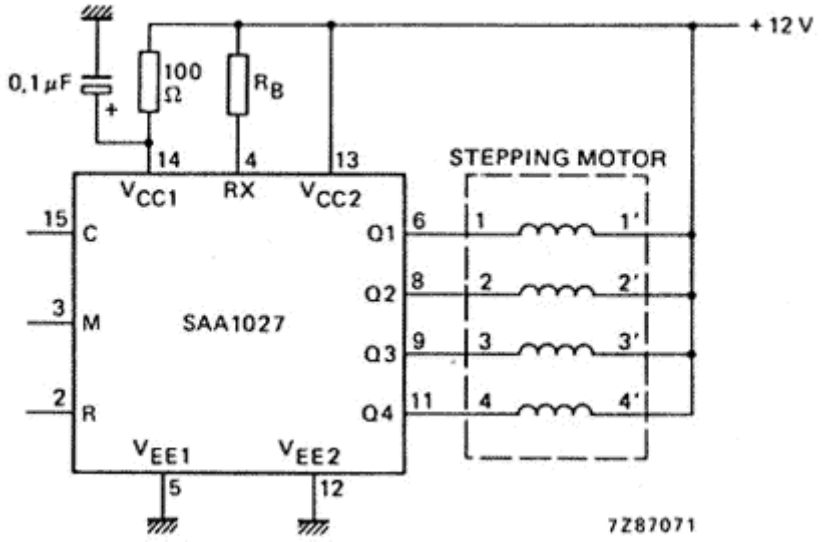


Fig.6 Typical application of the SAA1027 as a stepping motor driver.

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