STEPPER MOTOR DRIVER   SAA1027

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}		9.5 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	T_{amb}		-20 to $+70$	°C

PACKAGE OUTLINE

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

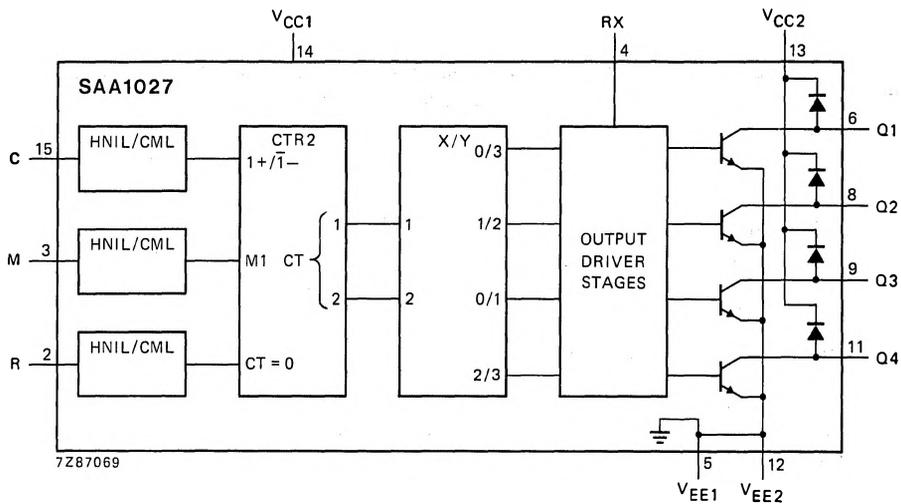# STEPPER MOTOR DRIVER   SAA1027

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.

Fig. 2 Pinning diagram.

PINNING

1	n.c.	not connected
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

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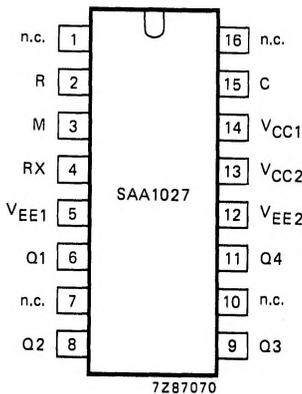
FUNCTIONAL DESCRIPTION

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.

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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 Ω ± 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.

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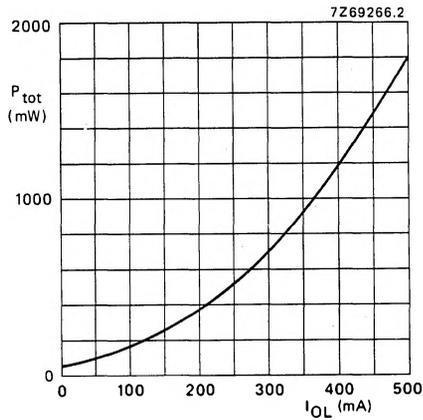# STEPPER MOTOR DRIVER   SAA1027

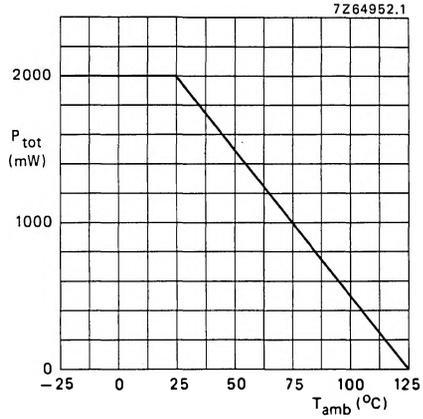Fig. 3 Total power dissipation P_{tot} as a function of output current I_{OL}.
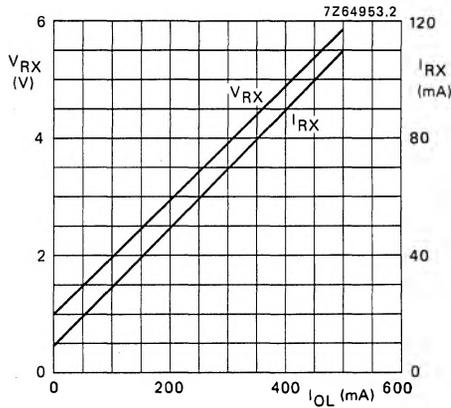

Fig. 4 Power derating curve.

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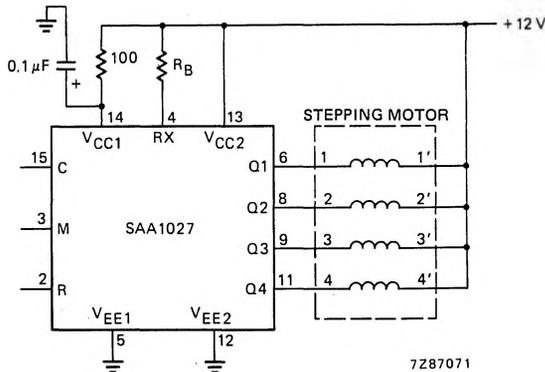

Fig. 6 Typical application of the SAA1027 as a stepping motor driver.

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