M54672SP

2-PHASE STEPPER MOTOR DRIVER

DESCRIPTION

The M54672SP is a semiconductor IC to drive a stepper motor directly by controlling the coil current with the constant current method.

FEATURES

- Wide output current control range (20 – 1200mA)
- Bipolar and constant current drive
- Built in a thermal shutdown circuit
- Built in flywheel diodes

APPLICATION

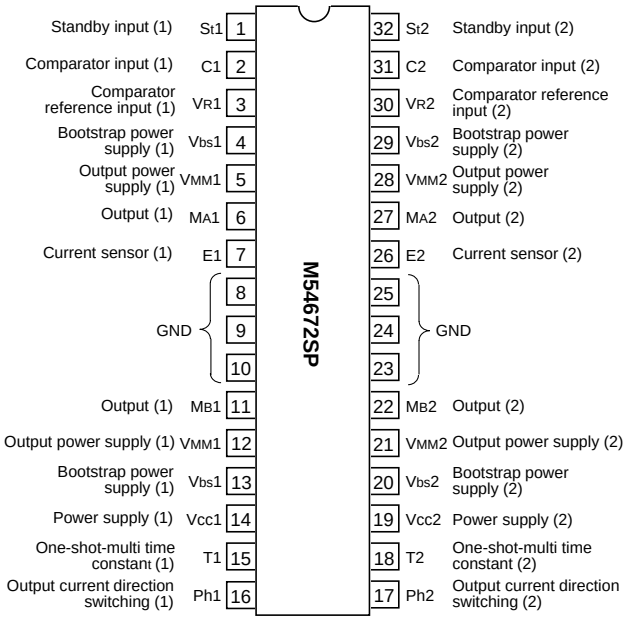
Office automation equipment such as printer, FDD, HDD and FAX

FUNCTION

The M54672SP can drive a stepper motor by the 2-phase bipolar method and also control the coil current. Furthermore, it controls the direction of the coil current with Ph input pins (pins 16 and 17) and the coil current value with V_R pins (pins 3 and 30).

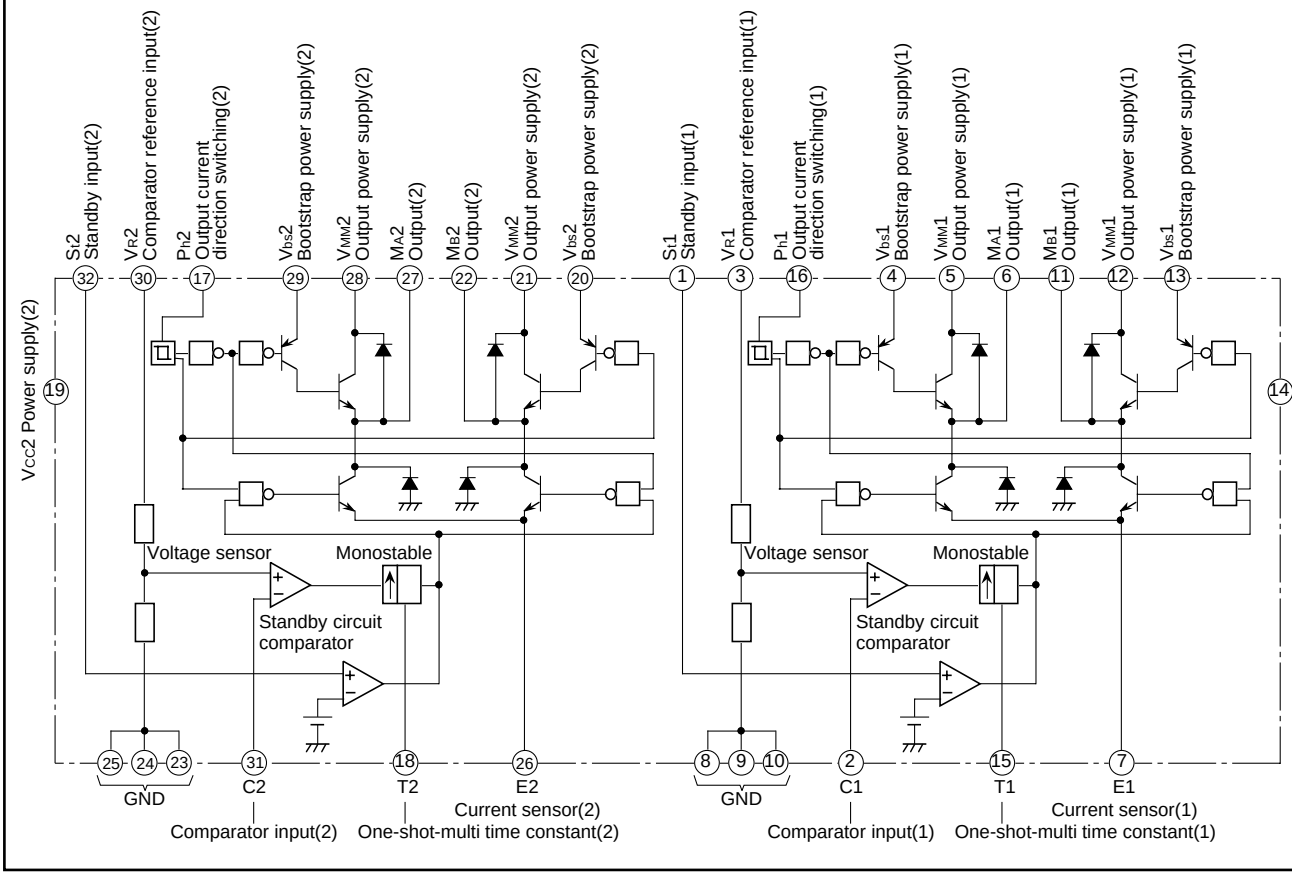
Because two control circuits are built in this IC, a stepper motor can be driven with a single IC by the 2-phase bipolar method.

PIN CONFIGURATION (TOP VIEW)



Outline 32P4B

BLOCK DIAGRAM



ABSOLUTE MAXIMUM RATINGS (Ta=25˚C, unless otherwise noted)

Symbol	Parameter	Conditions	Ratings	Unit
V_{CC}	Supply voltage		-0.3 – 7	V
V_{MM}	Output supply voltage		-0.3 – 24	V
V_{bs}	Bootstrap supply voltage		-0.3 – 27	V
V_L	Logic input voltage		-0.3 – 6	V
V_C	Analog input voltage		-0.3 – V_{CC}	V
V_R	Comparative input voltage		-0.3 – 15	V
I_L	Logic input current		-10	mA
I_C	Analog input current		-10	mA
I_{MM}	Output supply current		±1500	mA
P_d	Allowable loss		1.70	W
T_{opr}	Operating temperature		-20 – 75	°C
T_{stg}	Storage temperature		-55 – 125	°C

RECOMMENDED OPERATING CONDITIONS (Ta=25˚C, unless otherwise noted)

Symbol	Parameter	Limits			Unit
		Min.	Typ.	Max.	
V_{CC}	Supply voltage	4.5	5	5.5	V
V_{MM}	Output supply voltage	10	12	20	V
V_{bs}	Bootstrap supply voltage	$V_{bs} \geq V_{MM}+1V$		24	V
I_O	Output current	20	800	1200	mA
t_{PLH}	Logic input rise time			2	µs
t_{PHL}	Logic input fall time			2	µs
T_{ON}	Thermal shutdown temperature		160		°C

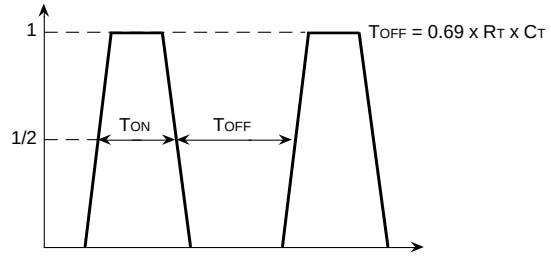
ELECTRICAL CHARACTERISTICS (Ta=25˚C, unless otherwise noted)

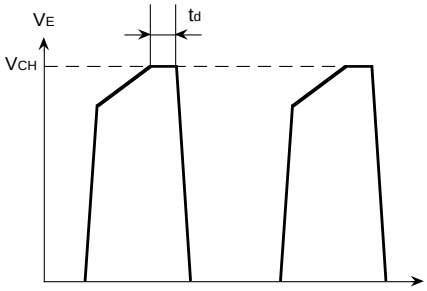
Symbol	Parameter		Test conditions	Limits			Unit
				Min.	Typ.	Max.	
V_{IH}	Logic input voltage	"H"	V_{CC}=5V	2.0		V_{CC}	V
V_{IL}		"L"		0		0.8	V
V_{CH}	Comparator threshold		V_R=5V	420	450	480	mV
I_{CO}	Comparator input current			-20		20	µA
I_{OFF}	Output cutoff current					100	µA
V_{sat}	Saturation voltage		Voltage at sensing resistor is not included. V_{bs}=12.7V, V_{MM}=12V, I_O=800mA		1.0	1.5	V
t_{OFF}	Cutoff time		V_{MM}=12V, $t_{ON} \geq$ 5µs	5	10	15	µs
t_d	Turn-off delay		dVK/dt ≥ 50mV/µs		1.6	2.0	µs
I_{CC}	Supply current		V_{CC}=5V, 1phase			25	mA
I_{IH}	Logic input current	"H"	V_I=2.4V			100	µA
I_{IL}		"L"	V_I=0.4V	-0.4			mA

SWITCHING CHARACTERISTICS

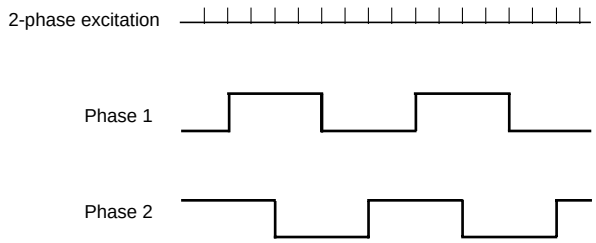
Switching waveforms

V_{MA}-V_{MB} or V_{MB}-V_{MA}





TIMING CHART



APPLICATION DESCRIPTION

(1) PHASE INPUT

Phase input decides the output mode.

PHASE	MA	MB
H	H	L
L	L	H

(2) V_R (Comparative voltage)

The current level can be continuously changed by changing the voltage at V_R continuously.

(3) Current sensor

When the voltage fall at the current sensing resistor and the selected current level become of the same level, the comparator triggers the monostable. Then the output stage is cut off for a certain time (T_{OFF}). During this cutoff time, the current volume decreases slightly and falls short of the comparative level.

After the cutoff time (T_{OFF}), the output stage is in ON state again. This operation is repeated.

(4) Single pulse generator

At the comparator output rise edge, the monostable is triggered. The pulse width of the monostable at the external timing C_T and R_T is as follows.

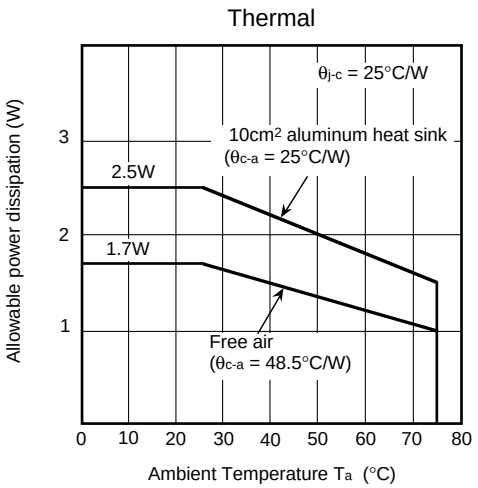
$T_{OFF} = 0.69 \times C_T \times R_T$

Retrigger during T_{OFF} is neglected.

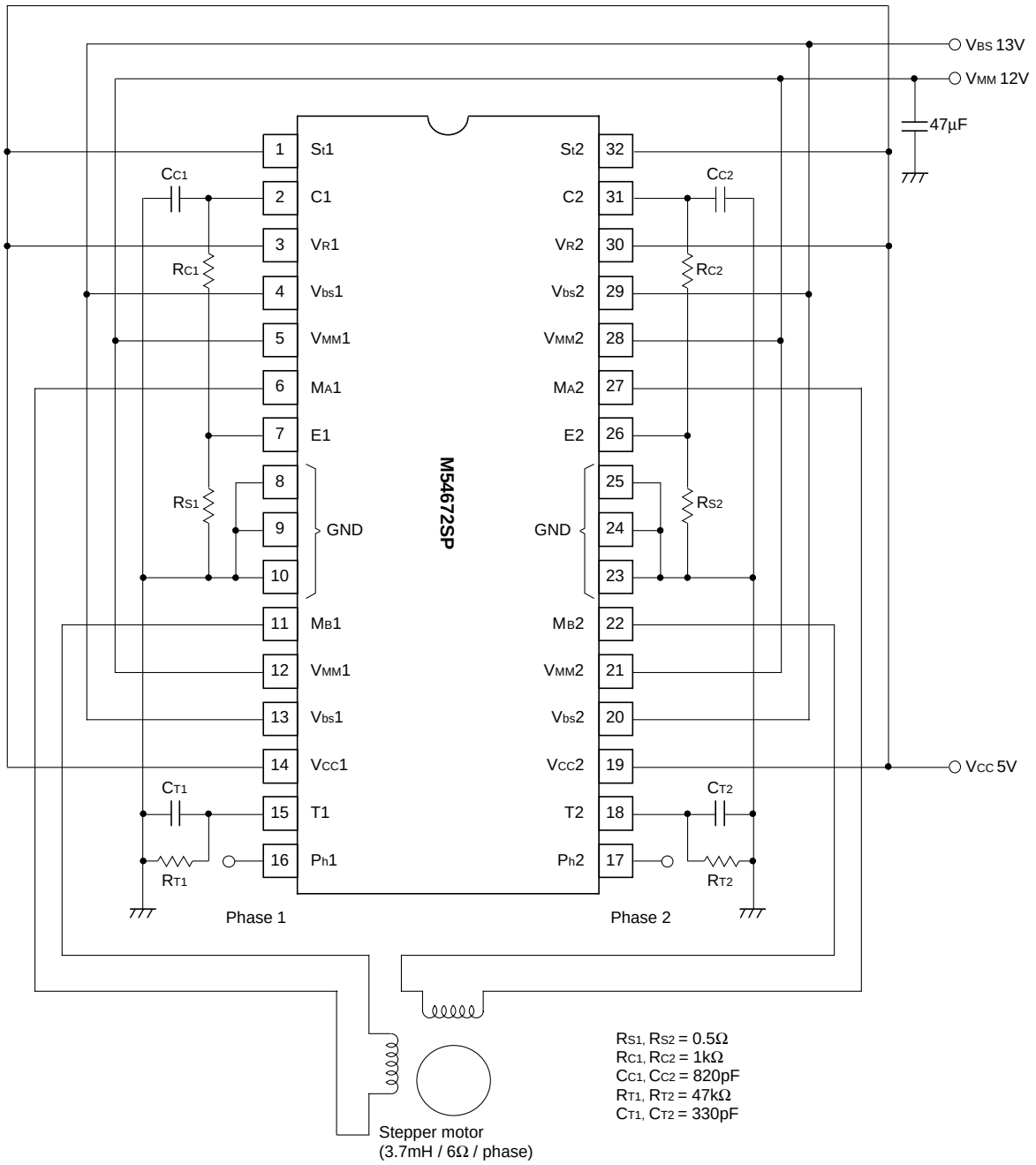
(5) Analog control

The output current level can be continuously changed by changing the voltage at V_R or the feedback voltage to the comparator.

TYPICAL CHARACTERISTICS



APPLICATION EXAMPLE (Stepping motor driver)



PRECAUTIONS FOR USE

(1) Before use, never forget to short-circuit $V_{CC}1$ and $V_{CC}2$.

(2) When the whole output current changes by a large margin (for example, when thermal shutdown operation causes intermittent flow of output current), the supply voltage may undergo a change. Therefore, selection and wiring of power supply should be conducted cautiously to avoid such a situation that the supply voltage exceeds the absolute maximum ratings.

(3) When the supply voltage changes by a large margin, the operation of this IC may become unstable. In this case, the change of supply voltage can be controlled by connecting a capacitor between Vcc pin and GND pin.

(4) Thermal shutdown function

The state of thermal shutdown operation may differ according to the way of wiring within a board. Therefore, sufficient board evaluation should be conducted before use. When the board is changed, operation on the replacing board should be evaluated.

The circuit board on which this IC is mounted is designed to realize low impedance between power supply and output pin. Therefore, it is desirable to take a safe measure such as fixing a fuse to avoid such a situation that the board is damaged by a fire when output pin is internally short-circuited by excessively applied surge voltage by accident.