

MAS6013

Stepper Motor Driver IC

- Four Stepper Motor Driver Outputs
- Low Voltage Operation
- Very Low Standby Current

DESCRIPTION

The MAS6013 Stepper Motor Driver is low power and low voltage stepper motor driver IC ideally suited for driving miniature bipolar stepper motors of watches and clocks. The circuit has four stepper motor driver circuits being capable of driving two bipolar stepper motors.

MAS6013 provides high load currents even at low supply voltages. Supply voltage ranges from 1.0 V to 5.0 V. The low voltage operation extends the battery lifetime. For higher current driving capability it is also possible to connect inputs and outputs in parallel.

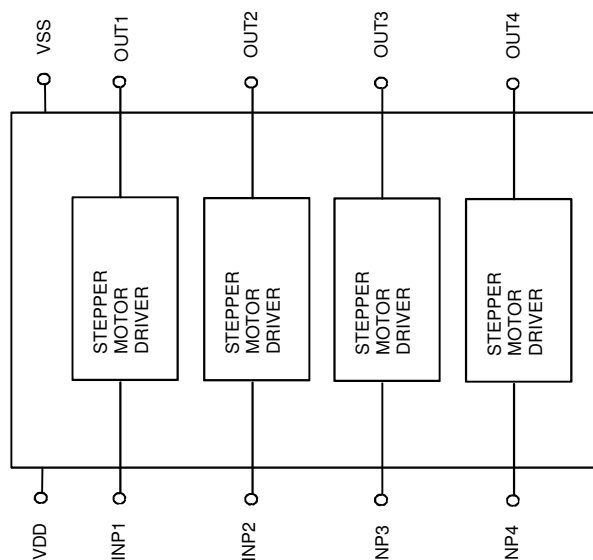
FEATURES

- Four Stepper Motor Driver Outputs Capable of Driving Two Bipolar Stepper Motors (14 mA @ VDD = 3 V)
- Wide Supply Voltage Range 1.0 V..5.0 V
- Very Low Standby Current

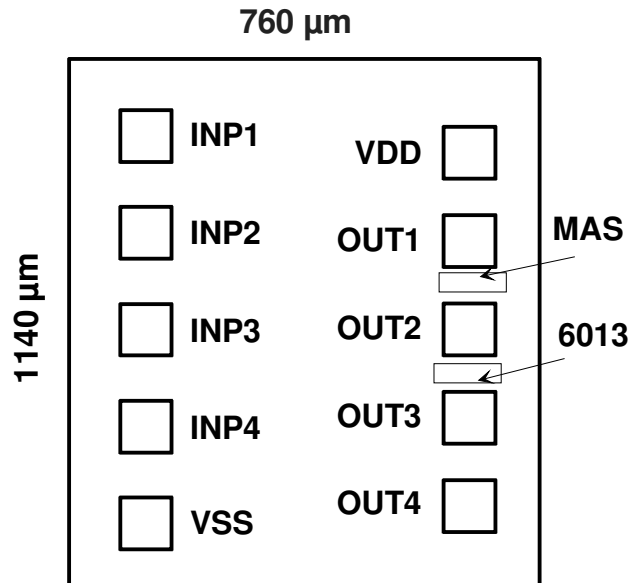
APPLICATIONS

- Watch and Clock Stepper Motor Driver
- Motor Driver
- LED Driver
- Relay Driver

BLOCK DIAGRAM



PAD LAYOUT



DIE size = 760 μm x 1140 μm ; PAD size = 80 x 80 μm

Note: Because the substrate of the die is internally connected to VSS, the die has to be connected to VSS or left floating. Please make sure that VSS is the first pad to be bonded. Pick-and-place and all component assembly are recommended to be performed in ESD protected area.

Note: Pad coordinates are measured from the left bottom corner of the chip to the center of the pads. The coordinates may vary depending on sawing width and location, however, distances between pads are accurate.

Pad Identification	Name	X-coordinate [μm]	Y-coordinate [μm]	Note
Stepper Motor Driver Input 1	INP1	152 μm	941 μm	
Stepper Motor Driver Input 2	INP2	152 μm	755 μm	
Stepper Motor Driver Input 3	INP3	152 μm	569 μm	
Stepper Motor Driver Input 4	INP4	152 μm	382 μm	
Supply Ground	VSS	152 μm	194 μm	
Stepper Motor Driver Output 4	OUT4	609 μm	216 μm	
Stepper Motor Driver Output 3	OUT3	609 μm	407 μm	
Stepper Motor Driver Output 2	OUT2	609 μm	597 μm	
Stepper Motor Driver Output 1	OUT1	609 μm	788 μm	
Supply Voltage	VDD	609 μm	938 μm	

ABSOLUTE MAXIMUM RATINGS

Parameter	Symbol	Conditions	Min	Max	Unit
Supply Voltage	$V_{DD}-V_{SS}$		-0.2	6.0	V
Input Voltage	V_{IN}		$V_{SS}-0.3$	$V_{DD}+0.3$	V
Operating Temperature	T_{OP}		-20	+70	°C
ESD Rating	V_{ESD}	For all pins, Human Body Model (HBM), ESD Association Standard Test Method ESD-STM5.1- 1998, $C_{ESD} = 100$ pF, $R_s = 1500 \Omega$,	-2	2	kV
Latchup Current Limit	I_{LUT}	For all pins, test according to Micro Analog Systems specification ESQ0141.	- 100	+ 100	mA
Junction Temperature	T_{Jmax}			+ 175	°C
Storage Temperature	T_{ST}		-55	+150	°C

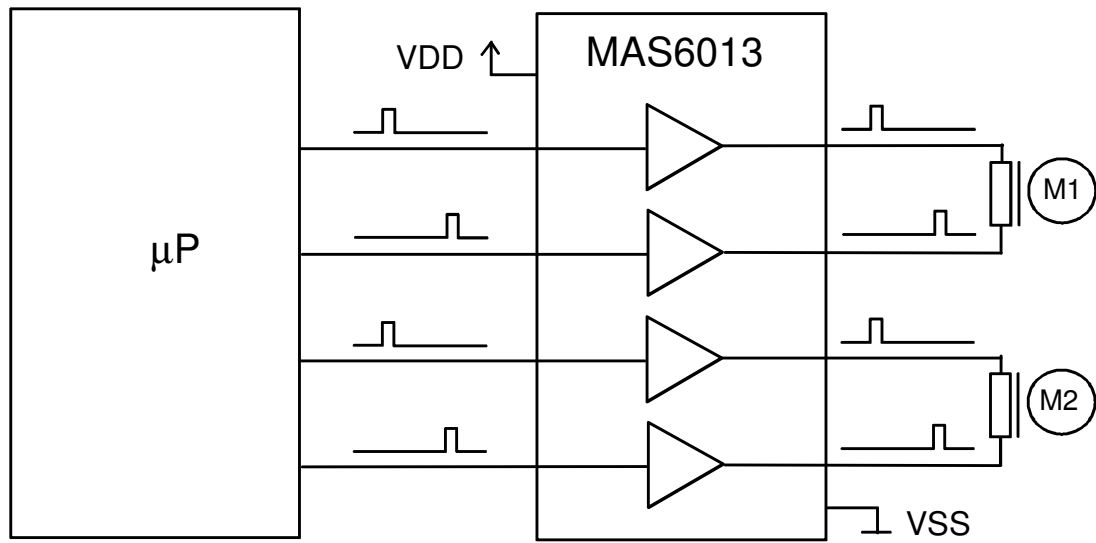
Stresses beyond those listed may cause permanent damage to the device. The device may not operate under these conditions, but it will not be destroyed.

ELECTRICAL CHARACTERISTICS

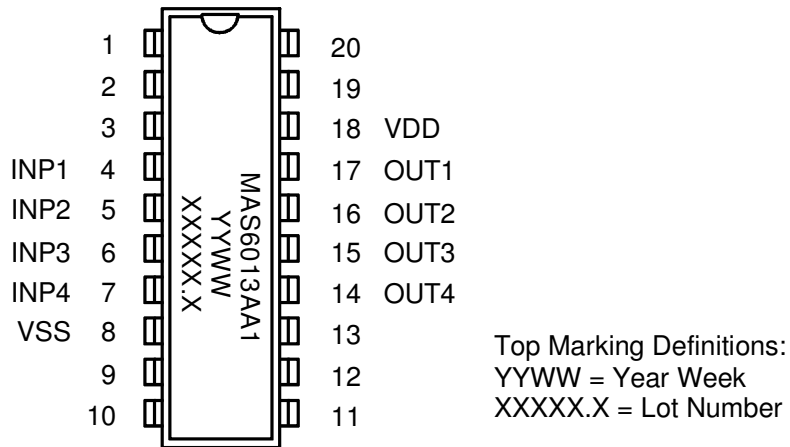
Operating Conditions: $V_{DD}=3$ V, Temperature = 25 °C Unless Otherwise Specified.

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Supply Voltage	V_{DD}		1.0		5.0	V
Operating Temperature	T_{OP}		-20		+70	°C
Input Voltage LO	V_{IL}		0		20% VDD	V
Input Voltage HI	V_{IH}		80% VDD		VDD	V
Input Current	I_{P_IN}	$V_{INPD}=V_{INP1..4}=0$ V		-5		nA
		$V_{INPD}=V_{INP1..4}=3$ V		5		nA
VDD Standby Current	$I_{DD_STANDBY}$	$V_{INPD}=V_{INP1..4}=0$ V		0.1	1	μA
		$V_{INPD}=0$ V, $V_{INP1..4}=3$ V		0.1	1	μA
Motor Driver Output Current ($R_L=200\Omega$, $V_{INP1/3}=0$ V, $V_{INP2/4}=V_{DD}$ or $V_{INP1/3}=V_{DD}$, $V_{INP2/4}=0$ V)	$ I_{P_OUT} $	$V_{DD}=1.0$ V	1.4	3.8		mA
		$V_{DD}=1.2$ V	3.5	5.0		mA
		$V_{DD}=1.5$ V	5.0	6.6		mA
		$V_{DD}=3.0$ V	12.5	14		mA
		$V_{DD}=3.6$ V	15.5	16.9		mA
		$V_{DD}=5.0$ V	22.5	23.7		mA
Motor Driver Output Delay Time	T_P	$R_L=200\Omega$, $C_L=30$ pF $V_{DD}=3.0$ V $V_{DD}=1.0$ V		90 420		ns

TYPICAL APPLICATION



SAMPLES IN SBDIL 20 PACKAGE



PIN DESCRIPTION

Pin Name	Pin	Type	Function	Note
	1	NC		
	2	NC		
	3	NC		
INP1	4	DI	Stepper Motor Driver Input 1	
INP2	5	DI	Stepper Motor Driver Input 2	
INP3	6	DI	Stepper Motor Driver Input 3	
INP4	7	DI	Stepper Motor Driver Input 4	
VSS	8	G	Ground	
	9	NC		
	10	NC		
	11	NC		
	12	NC		
	13	NC		
OUT4	14	DO	Stepper Motor Driver Output 4	
OUT3	15	DO	Stepper Motor Driver Output 3	
OUT2	16	DO	Stepper Motor Driver Output 2	
OUT1	17	DO	Stepper Motor Driver Output 1	
VDD	18	P	Supply Voltage	
	19	NC		
	20	NC		

A = Analog, D = Digital, P = Power, G = Ground, I = Input, O = Output, NC = Not Connected

ORDERING INFORMATION

Product Code	Product	Package	Comment
MAS6013AA1WA300	Stepper Motor Driver IC	EWS-tested 150 mm diameter wafer, Thickness 400 µm	

Contact Micro Analog Systems Oy for other wafer thickness options.

LOCAL DISTRIBUTOR

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MICRO ANALOG SYSTEMS OY CONTACTS

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