Low Voltage CMOS Driver Circuit

Features

- Four low resistance output drivers for bipolar or unipolar watch stepping motors.
- Low transversal transition current.
- Very low current consumption: 0.1 µA at 25°C.
- Two different output resistances programmable by metal mask.
- Wide power supply voltage range: 1.1 to 3.5 V.
- Tristate input for applications as fast bus driver.
- ESD and latch-up protections on input and output pads.

Description

The EM5060 (previously named H5060) is a low power integrated circuit in HCMOS Silicon Gate Technology designed to drive bipolar or unipolar stepping motors.
This device contains four identical and independent non-inverting circuits which can be connected by metal mask programation so as to obtain two identical non-inverting circuits with a lower resistance output.
Each buffer is driven by a special cell which dephases the P and N transistor signal input, for a minimization of the transversal transition current.
A tristate input HIZ, with internal pulldown resistor provides the high impedance state of the four outputs.

Application

- Motor driver for watch/clock application
- Bus drivers
- LED driver

Functional Diagram

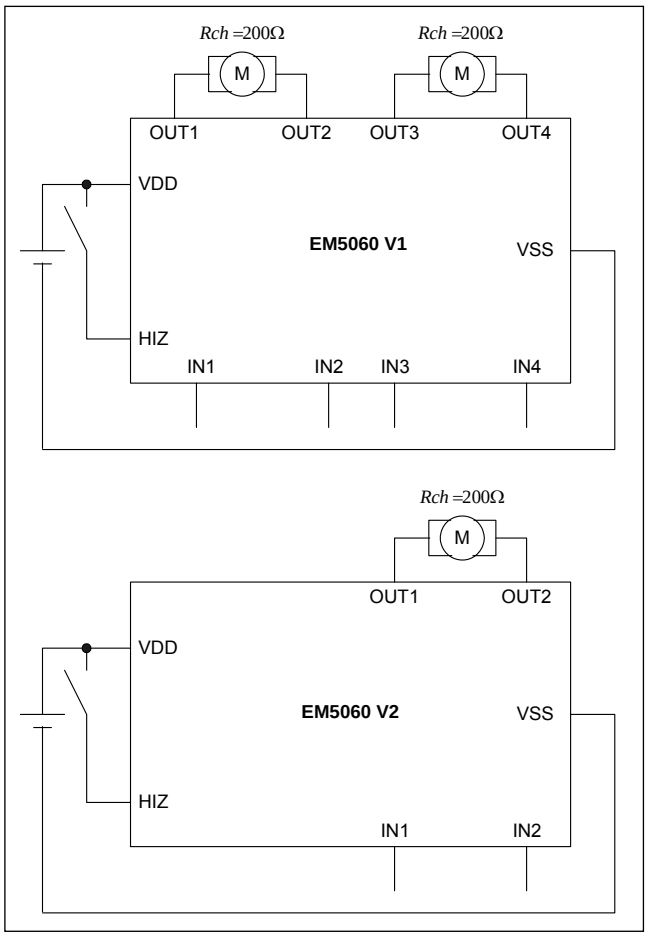


Fig. 1

Pin Assignment

Pad	Function
OUT4	Output buffer n°4
OUT3	Output buffer n°3
OUT2	Output buffer n°2
OUT1	Output buffer n°1
V_{DD}	Positive supply voltage
HIZ	Tri state input
IN1	Input buffer n°1
IN2	Input buffer n°2
IN3	Input buffer n°3
IN4	Input buffer n°4
V_{SS}	Negative supply voltage

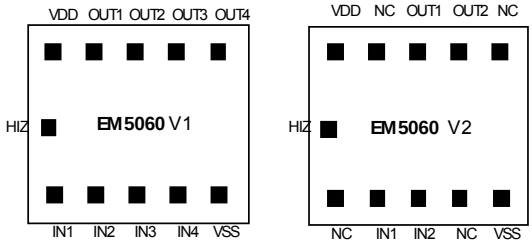


Fig. 2

Absolute Maximum Ratings

Parameter	Symbol	Min	Typ	Max	Unit
Supply Voltage	V_{DD}	-0.3		5.5	V
Voltage at remaining pin	V_{pin}	V_{SS}-0.3		V_{DD}+0.3	V
Storage temperature	T_{store}	-55		+120	°C

Table 1

Stresses above these listed maximum ratings may cause permanent damage to the device. Exposure to conditions beyond specified electrical characteristics may affect device reliability or cause malfunction.

Recommended Operating Conditions

Parameter	Symbol	Value	Units
Ambient temperature	T	25	°C
Motor resistance	R_{ch}	200	Ohms
Positive supply	V_{DD}	1.55	V
Negative supply	V_{SS}	0.0	V
Supply source resistance	R_I	10	Ohms

Table 2

Handling Procedures

This device contains circuitry to protect the terminals against damage due to high static voltages or electrical fields. However, it is advised that normal precautions be taken to avoid application of any voltage higher than minimum rated voltages to this circuit.

Operating Conditions

Parameter	Symbol	Min	Typ	Max	Units
Operating temperature	T_{opr}	-20		+70	°C

Table 3

Electrical and Switching Characteristics

at recommended operating conditions (valid unless otherwise specified)

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Supply voltage	V_{DD}	Operating	1.1	1.55	3.5	V
Standby current		Imot = 0 IN1, IN2, IN3, IN4 at V_{DD} or V_{SS} HIZ at V_{SS} or open			100	nA
Inputs						
Pulse width		V_{DD} = 1.2 V				
	t_{WL}	V_{IL} = V_{SS}	1			ms
	t_{WH}	V_{IH} = V_{DD}	1			ms
	V_{IL}	Overall voltage range		V_{SS}	0.4	V
Voltage	V_{IH}		V_{DD}-0.3	V_{DD}		V
HIZ Input Current	I_{HIZ}	HIZ at V_{DD}	0.5	2	5	µA
Outputs						
Motor Output Current	I_{OUT}	R_{ch} = 200 Ω,V_{DD} = 1.2 V				
		Version V1	±4.3			mA
		Version V2	±4.8	±5.0		mA
		V_{DD} = 1.50 V				
		Version V1	±6.0			mA
		Version V2	±6.4	±6.6		mA
		V_{DD} =3.0 V				
		Version V1	±13.0			mA
		Version V2	±13.3	±13.5		mA
Timing Characteristics						
Propagation delay	t_{PHL}	V_{DD} = 1.2 V,CL = 30pF		5	100	µs
	t_{PLH}	V_{DD} = 1.2 V,CL = 30pF		5	100	µs
Transition time	t_{THL}	V_{DD} = 1.2 V,CL = 30pF		3	100	µs
	t_{TLH}	V_{DD} = 1.2 V,CL = 30pF		3	100	µs

Table 4

Timing Waveforms

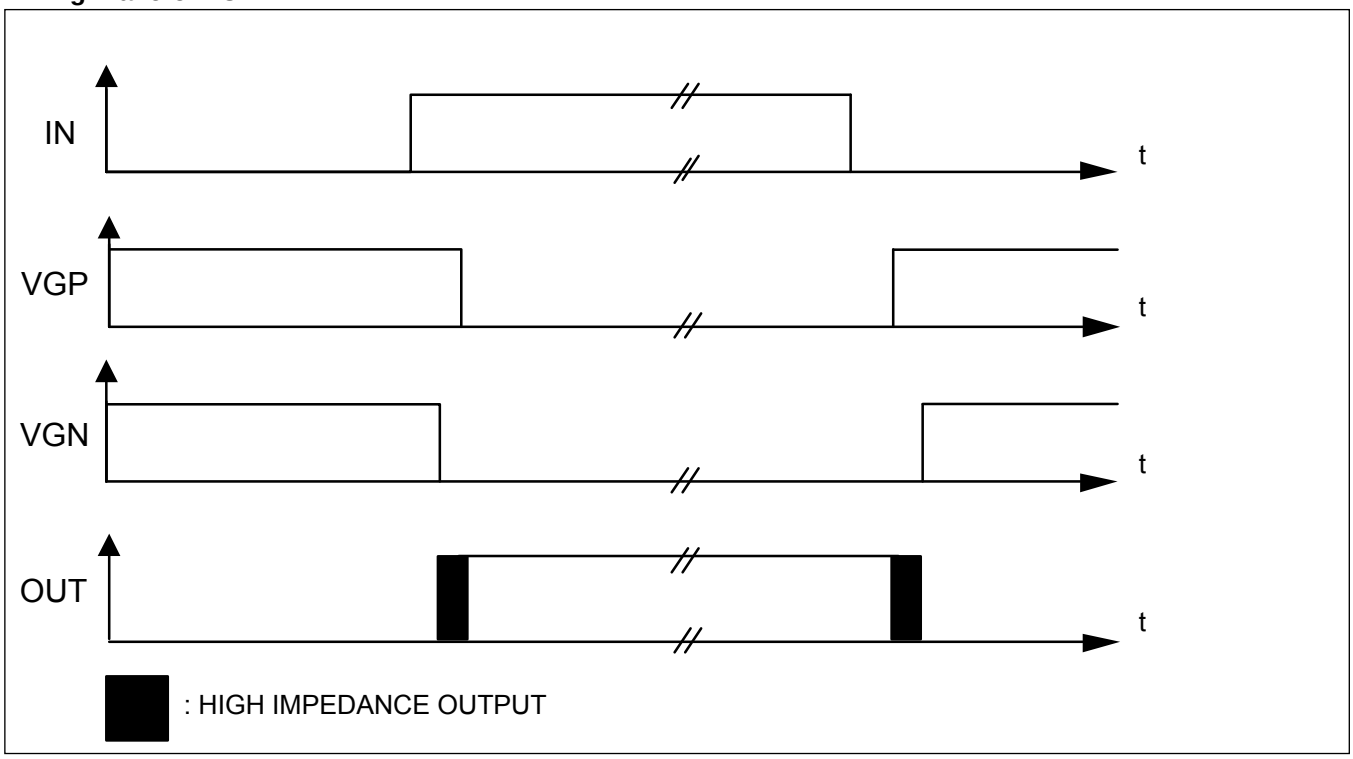


Fig. 3

Block Diagram

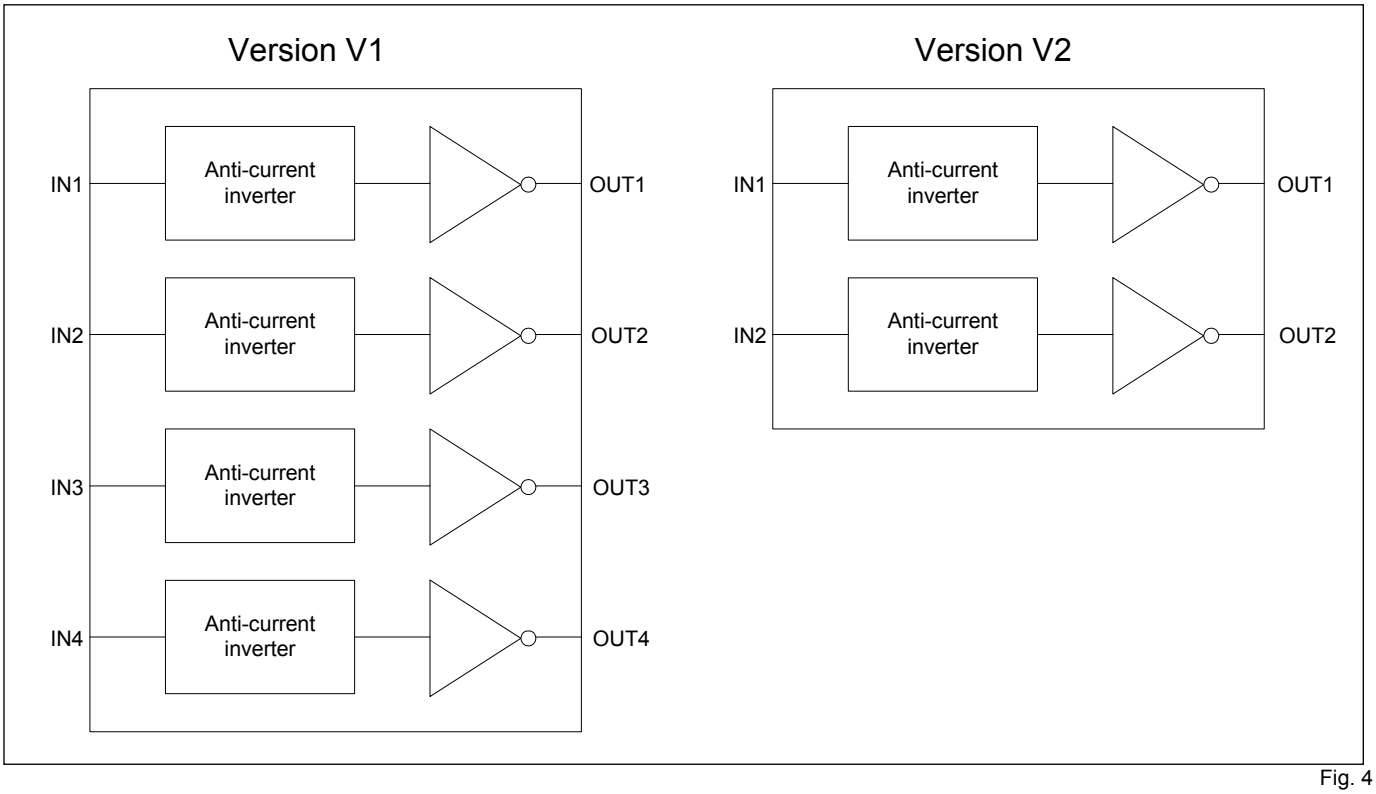


Fig. 4

Functional Description

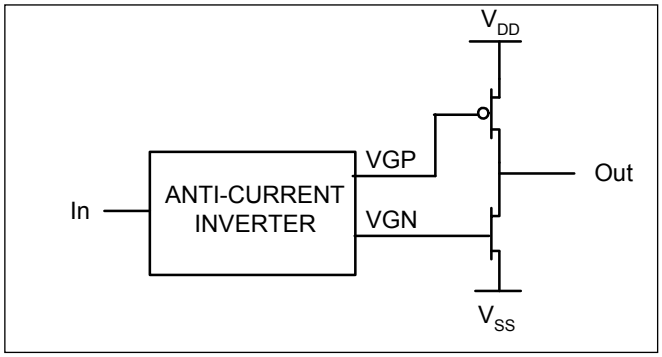
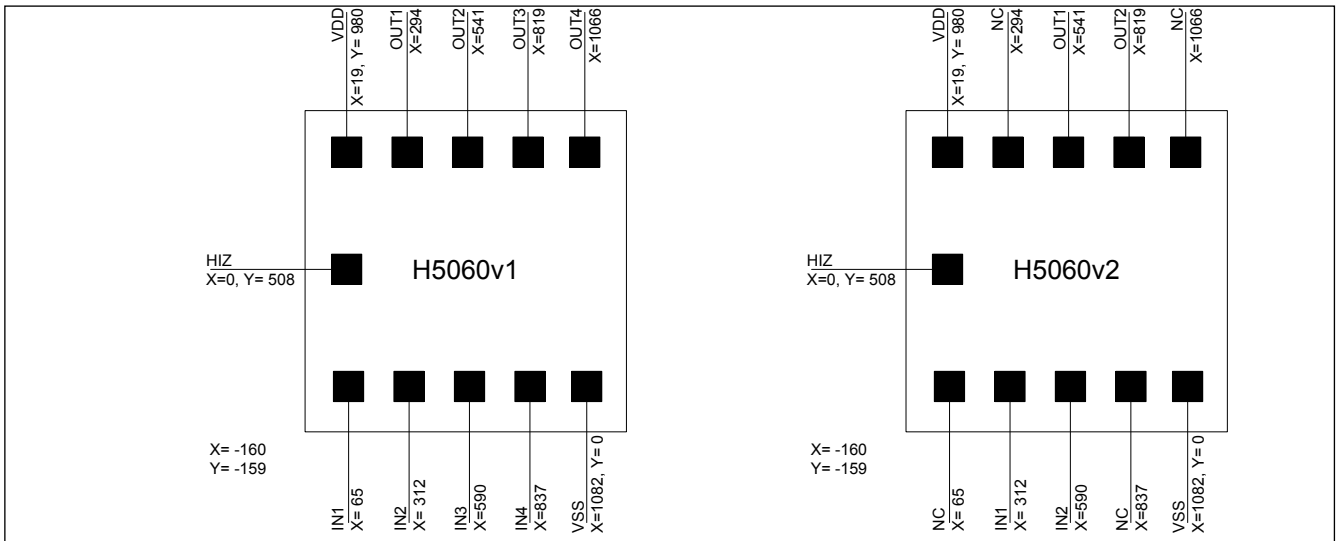


Fig. 5

Chip Information



Chip size is x = 1447 by y = 1295 microns or x = 57 by y = 51 mils

NOTE: The origin (0,0) is the lower left coordinate of center pads
The lower left corner of the chip shows distances
N.C. Not connected
All dimensions in microns

Fig. 6

Ordering Information

EM5060 is available in two versions:

- Version **V1** contains four input/outputs (INPUTS = IN1, IN2, IN3, IN4 ; OUTPUTS = OUT1, OUT2, OUT3, OUT4).
- Version **V2** contains two input/outputs (INPUTS = IN1, IN2 ; OUTPUTS = OUT1, OUT2).

When ordering, please specify the complete Part Number below.

Part Number	Version	Die & Delivery Form
EM5060V1WP11	V1	Die in waffle pack, 11 mils thickness
EM5060V1WS11	V1	Sawn wafer, 11 mils thickness
EM5060V2WP11	V2	Die in waffle pack, 11 mils thickness
EM5060V2WS11	V2	Sawn wafer, 11 mils thickness