

Datasheet Dual Stepping Motor Driver IC

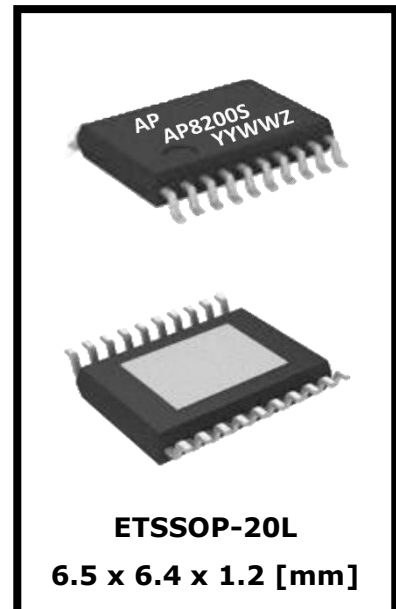
Description

The AP8200S is Dual Stepping motor driver IC. It consists of TTL compatible input circuits, quad bridge driver outputs with flyback diodes, and stand-by mode circuit.

Features

Dual Stepping Motor Driver including four H-bridge drivers

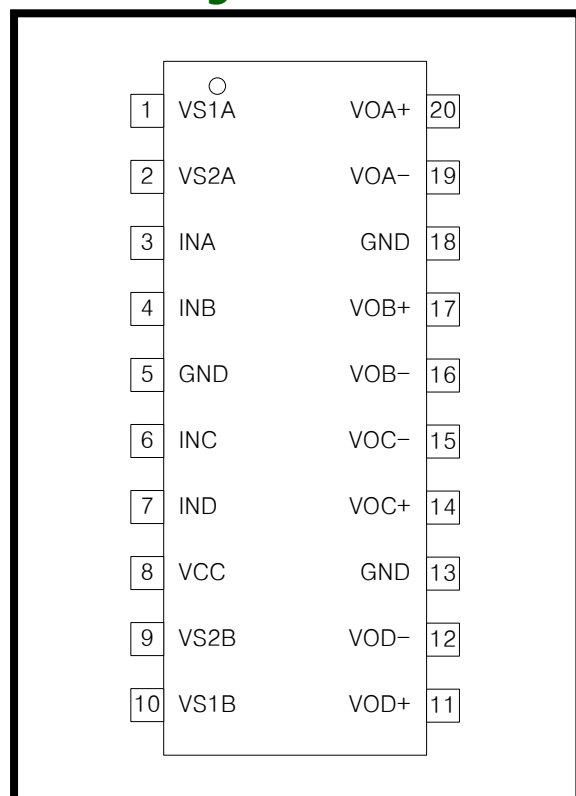
- Stand-by Operation
- Short-Through Current Restriction Circuit
- TTL Compatible Inputs
- Output Current up to 400mA (Peak)
- Thermal Shutdown Circuit
- Under Voltage Lockout Circuit
- Pull-down Resistance for Input



Application

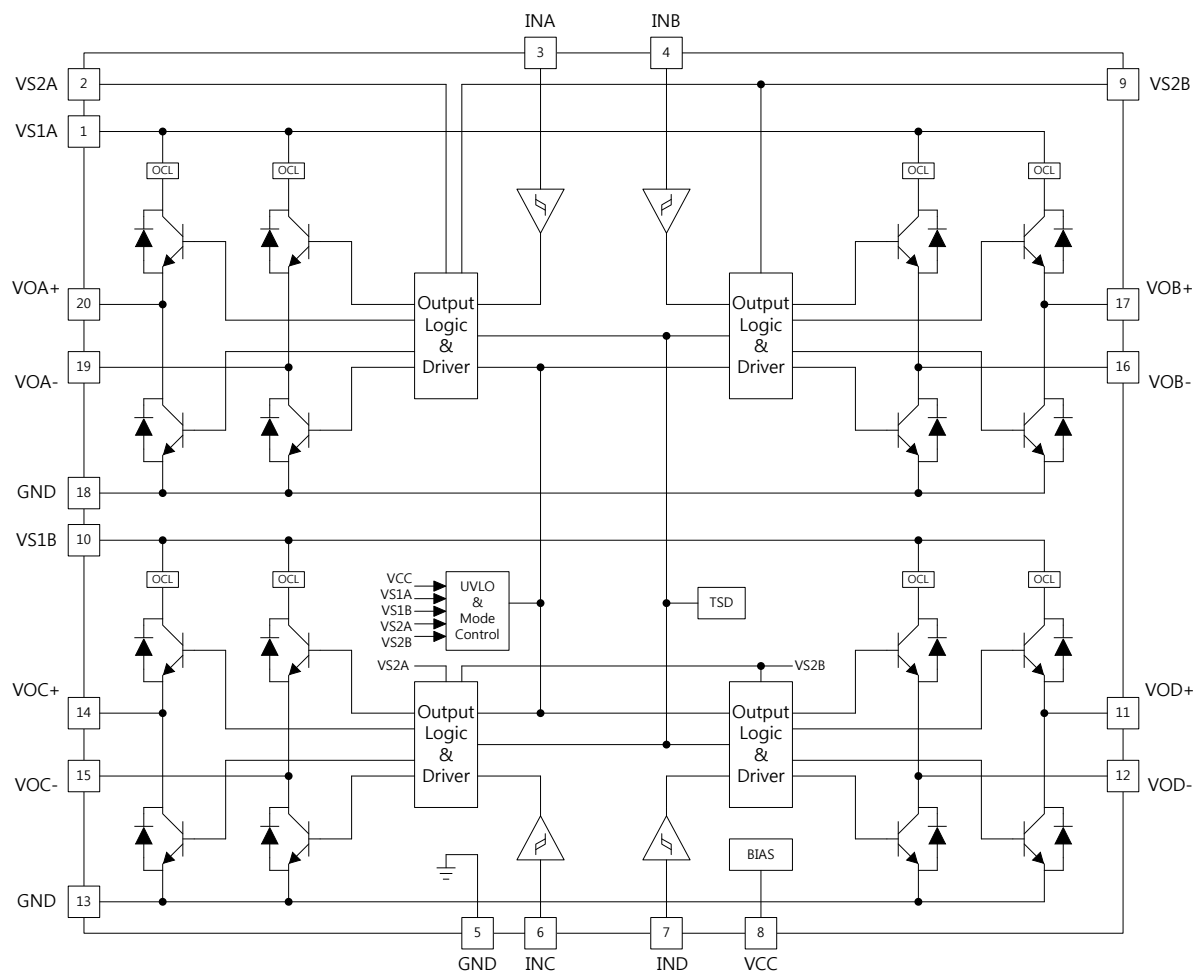
- Refrigerator Actuators
- Printers
- Scanners
- Office Automation Machines
- Vacuum Cleaners
- Robotics

Pin Configuration



REV. 00

Block Diagram



Note : Pin 5, 13, and 18 must be connected on PCB Board. ([Refer to Layout Example](#))

Pin Description

No	Symbol	Functional Description
1	VS1A	Motor power supply terminal
2	VS2A	Low-Side Driver power supply terminal
3	INA	A-ch signal input terminal, Truth Table 1
4	INB	B-ch signal input terminal, Truth Table 1
5	GND	Signal GND terminal
6	INC	C-ch signal input terminal, Truth Table 1
7	IND	D-ch signal input terminal, Truth Table 1
8	VCC	Power Supply terminal for control
9	VS2B	Low-Side Driver power supply terminal, Standby signal input terminal, Truth Table 2
10	VS1B	Motor power supply terminal
11	VOD+	Output D+ pin
12	VOD-	Output D- pin
13	GND	Power GND terminal
14	VOC+	Output C+ pin
15	VOC-	Output C- pin
16	VOB-	Output B- pin
17	VOB+	Output B+ pin
18	GND	Power GND terminal
19	VOA-	Output A- pin
20	VOA+	Output A+ pin

Truth Table 1.

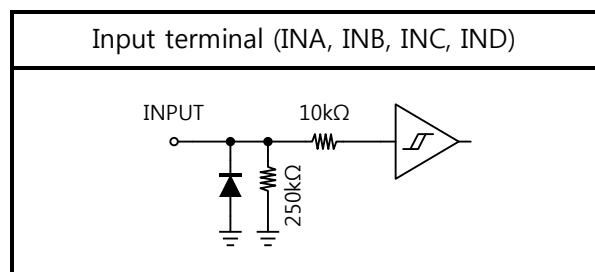
IN _x	Output (x : A, B, C, D)		
	VO _x +	VO _x -	Mode
L	L	H	ENABLE VS1
H	H	L	ENABLE VS1

Truth Table 2.

VS2B	Mode
L	POWER OFF (Standby mode)
H	OPERATION

Note : Apply 5V to VS2A as a supply terminal.

Terminal Circuit



The diagram is partly-provided and omitted or simplified for explanatory purposes.

Maximum Ratings Characteristics

($T_A = 25^{\circ}\text{C}$ unless otherwise specified)

Characteristics	Symbol	Value	Unit
Supply voltage	VCC	7.0	V
	VS1A	17.0	
	VS1B	17.0	
	VS2A	VCC	
	VS2B	VCC	
Output current	IOUT (PEAK)	± 400	mA
	IOUT (START)	± 350	
	IOUT (HOLD)	± 100	
Input voltage	VIN	VCC	V
Power dissipation	PD	2.5	W
Operating temperature	Topr	$-30 \sim 75$	$^{\circ}\text{C}$
Storage temperature	Tstg	$-55 \sim 150$	$^{\circ}\text{C}$

ESD Rating

Characteristics		Value	Unit
Electrostatic Discharge	HBM : Human body model (REF. JS-001-2017)	± 8000	V
	MM : Machine Model (REF. JESD22-A115C : 2010)	± 800	
	CDM : Charged Device Model (REF. JESD22 -C101F : 2013)	± 2000	V

Recommended Operating Conditions

($T_A = 25^{\circ}\text{C}$ unless otherwise specified)

Characteristics	Symbol	Min	Typ.	Max	Unit
Supply voltage	VCC	4.5	5.0	5.5	V
	VS1A	8.5	12.0	15.5	
	VS1B	8.5	12.0	15.5	
	VS2A	4.5	5.0	5.5	
	VS2B	4.5	5.0	5.5	
	VIN	-	-	VCC	

* Operating Voltage Restriction : $V_{S1} \geq V_{S2}$

Electrical Characteristics

($T_A = 25^\circ\text{C}$, $V_{CC} = 5\text{V}$, $V_{S1A} = V_{S1B} = 12\text{V}$, $V_{S2A} = V_{S2B} = 5\text{V}$ unless otherwise specified)

Characteristics	Symbol	Condition	Min.	Typ.	Max.	Unit
UNDER VOLTAGE LOCKOUT SECTION						
VCC UVLO Recovery Voltage	VUV_VCCH	VCC Rising	3.20	4.20	4.45	V
VCC UVLO Threshold Voltage	VUV_VCCL	VCC Falling	3.10	4.10	4.35	
VCC UVLO Hysteresis	VUV_VCC_Hys		-	0.1	-	
VS1 UVLO Recovery Voltage	VUV_VS1H	VS1 Rising	5.0	6.5	8.0	V
VS1 UVLO Threshold Voltage	VUV_VS1L	VS1 Falling	4.5	6.0	7.5	
VS1 UVLO Hysteresis	VUV_VS1_Hys		-	0.5	-	
SUPPLY CURRENT SECTION						
V _{CC} Supply Current	IVCC1	VS2 = 5V	-	4.3	6.5	mA
	IVCC2	VS2 = 0V	-	70	100	μA
V _{S1} Supply Current	IVS1		-	2.6	5.0	mA
V _{S2} Supply Current	IVS2		-	3.0	4.5	mA
INPUT VOLTAGE/CURRENT SECTION						
Input Logic High Level	V _{INH}	VS2 = 5V	2.0	-	V _{CC}	V
Input Logic Low Level	V _{INL}		0	-	0.8	V
Logic Input Current	I _{IN}	V _{INx} = 5V	-	20	30	μA
VS2B Input Current	IVS2B	VS2B = 5V	-	40	60	μA
OUTPUT VOLTAGE SECTION						
Output Saturation Voltage	VSAT1	I _{OUT} = 100mA	-	1.5	3.0	V
	VSAT2	I _{OUT} = 400mA	-	2.2	4.0	
DIODE SECTION						
Diode Forward Voltage	VFU1	IF = 100mA	-	1.10	1.60	V
	VFD1		-	0.90	1.40	
	VFU2	IF = 400mA	-	1.70	2.20	
	VFD2		-	1.20	1.70	



Characteristics	Symbol	Condition	Min.	Typ.	Max.	Unit
OUTPUT DELAY SECTION						
Delay Time	TPLH	Input Rising to Output Rising	-	7.0	9.0	us
	TPHL	Input Falling to Output Falling	-	0.7	4.5	
PROTECTION SECTION*						
Thermal Shutdown	TSD	-	-	170	-	°C
TSD Hysteresis	TSDhys	-	-	25	-	
Output Limit Current	Ilimit	-	0.4	0.8	-	A

*: These parameters, although guaranteed, are not 100% tested in production.

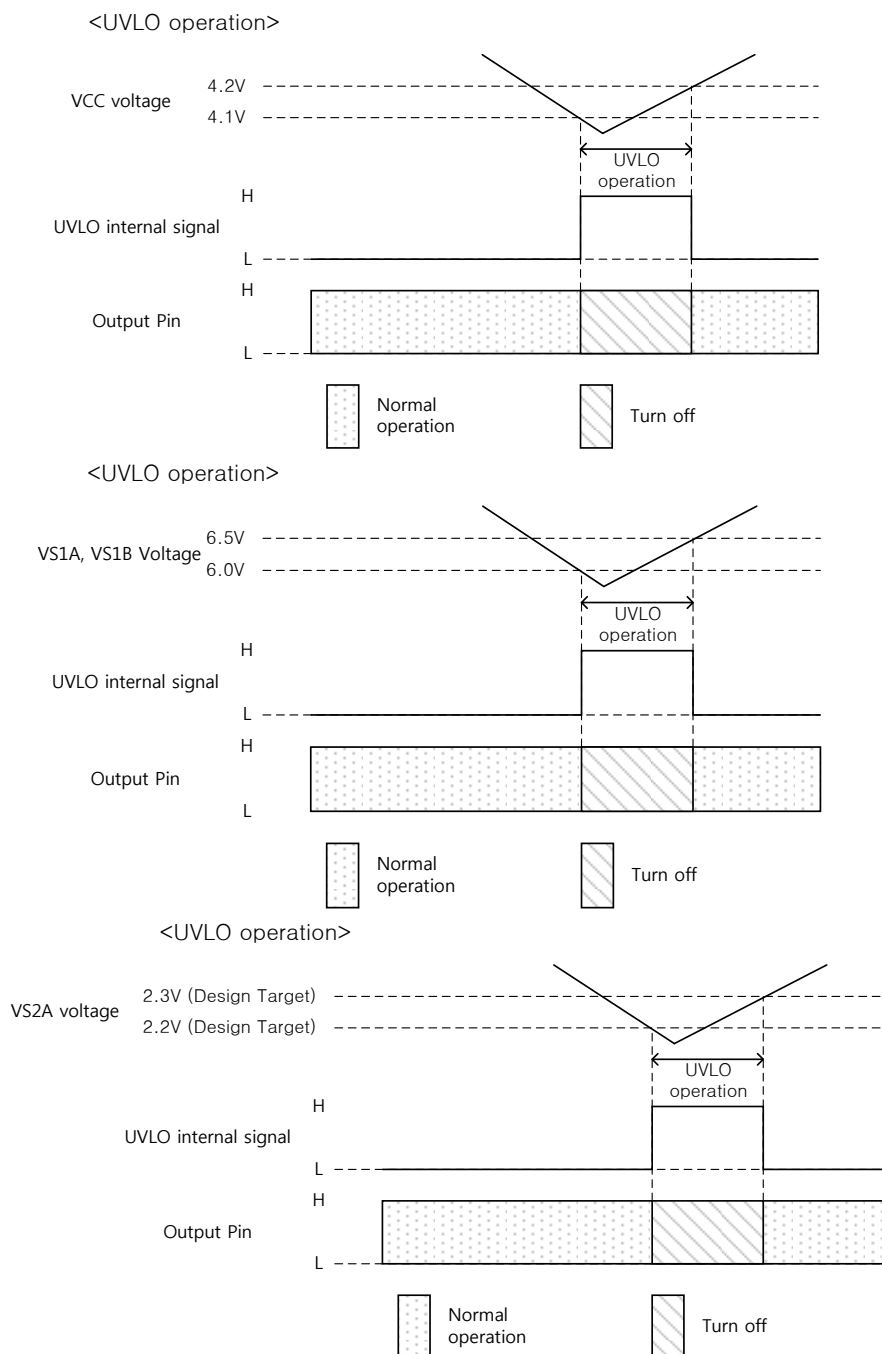
Under Voltage Lockout Circuit (UVLO)

An under voltage lockout circuit is included. Outputs are turned off under the conditions as follows;

$V_{CC} > 4.1V$, $V_{S1A}/V_{S1B} > 6.0V$, or $V_{S2A} > 2.2V$ (Design target)

The UVLO circuit has a hysteresis and the function recovers under the conditions as follows;

$V_{CC} \leq 4.2V$, $V_{S1A}/V_{S1B} \leq 6.5V$ and $V_{S2A} \leq 2.3V$ (Design target)

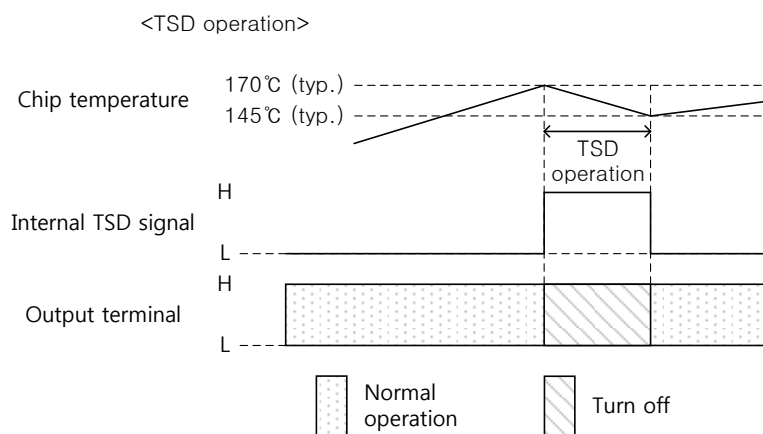


Thermal Shutdown Circuit (TSD)

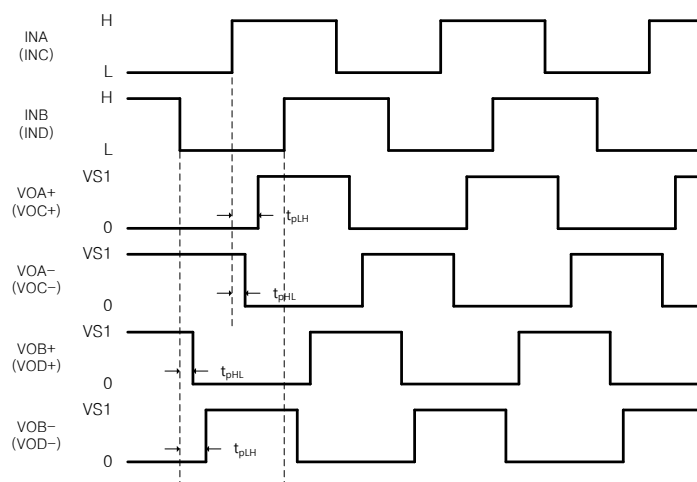
The AP8200S has a thermal shutdown circuit. If the junction temperature (T_j) exceeds 170°C (design target only), all the outputs are turned off.

It recovers automatically at 145°C. It has a hysteresis width of 25°C.

TSD = 170°C (Design target only)

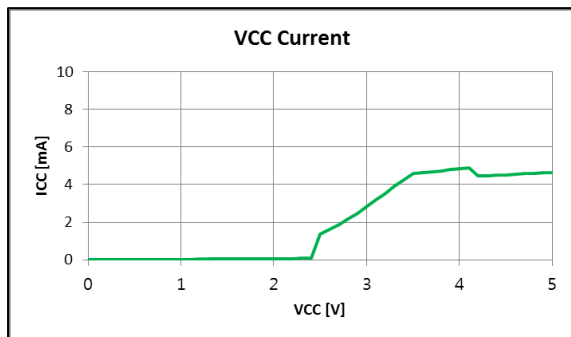
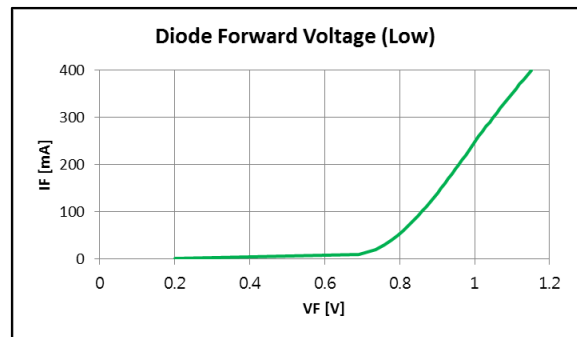
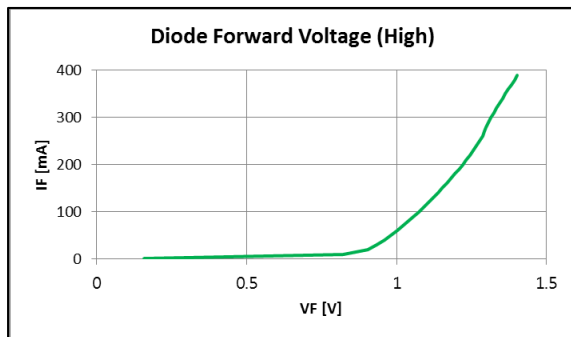
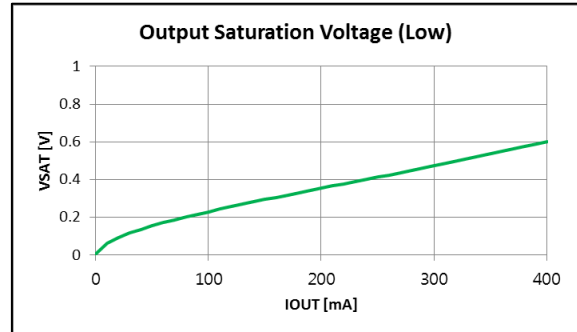
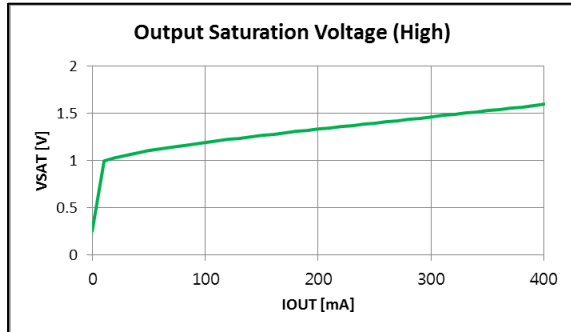


Timing Chart

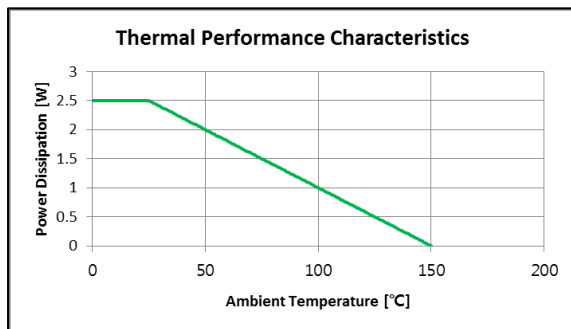




Typical Performance Characteristics



Thermal Performance Characteristics

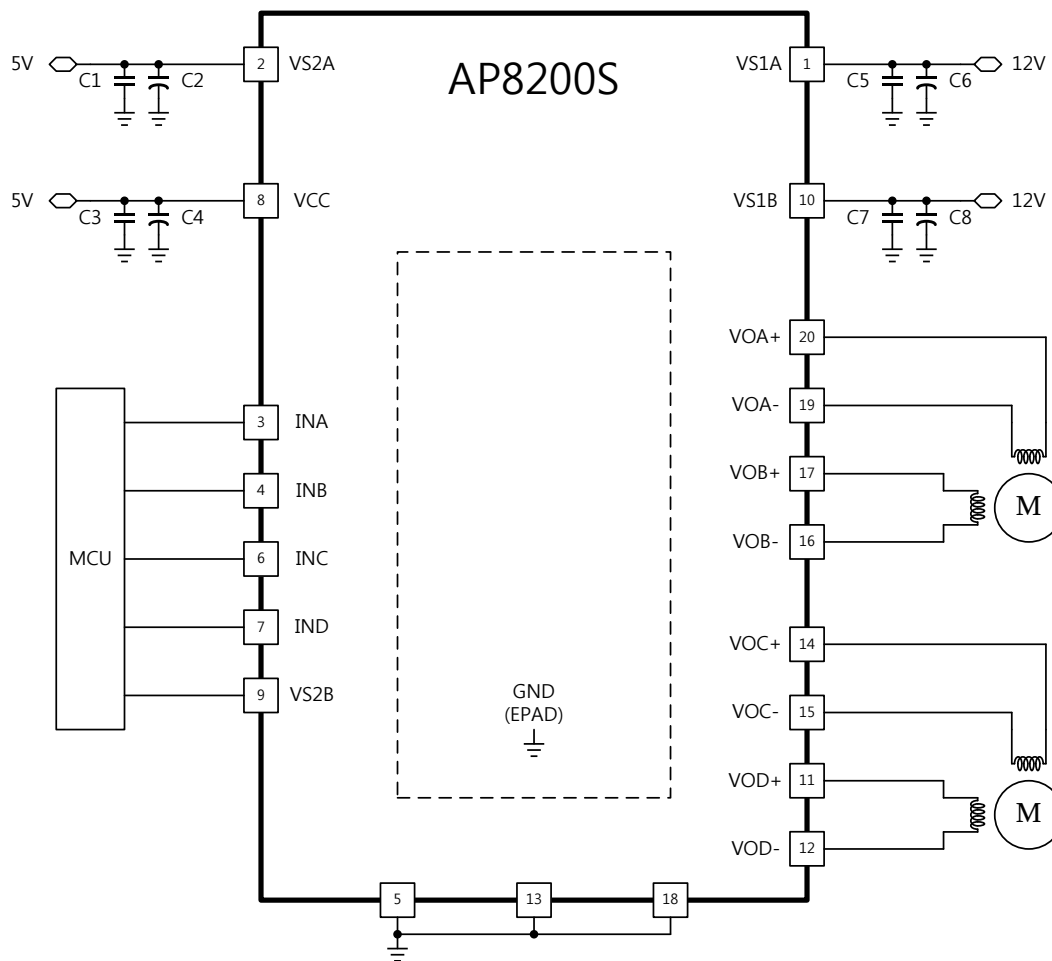


Application Circuit

Information in the following application Circuits is not part of the APsemi component specification, and APsemi does not warrant its accuracy or completeness. APsemi's customers are responsible for determining suitability of components for their purposes. Customers should validate and test their design implementation to confirm system functionality.

Dual Step Motor Operation (Example)

If customers would like to drive two step motor, it recommend the following circuit.



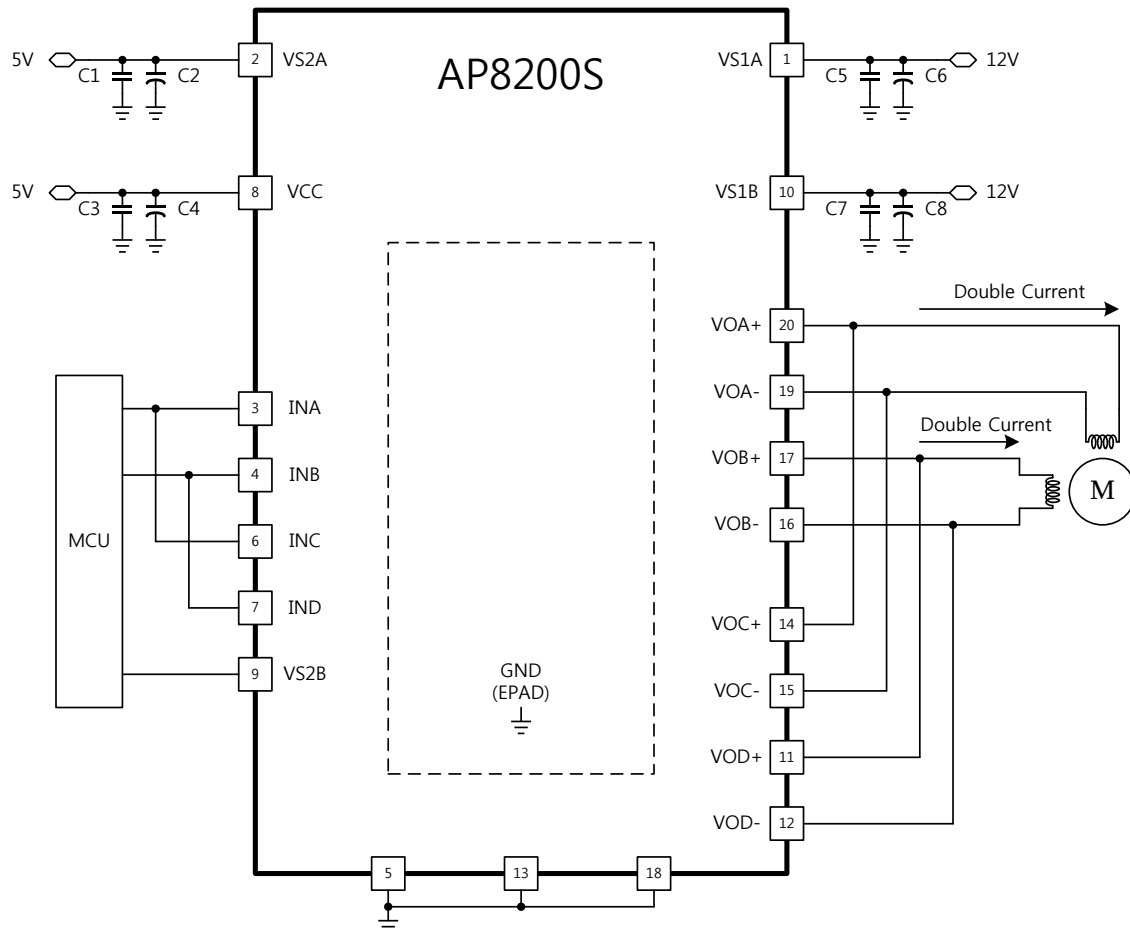
Example Value

- . C1, C3, C5, C7, C9 : 0.1uF
- . C2, C4, C6, C8, C10 : 4.7uF
- . MCU should have five outputs.

Application Circuit (Cont.)

Parallel Step Motor Operation (Example)

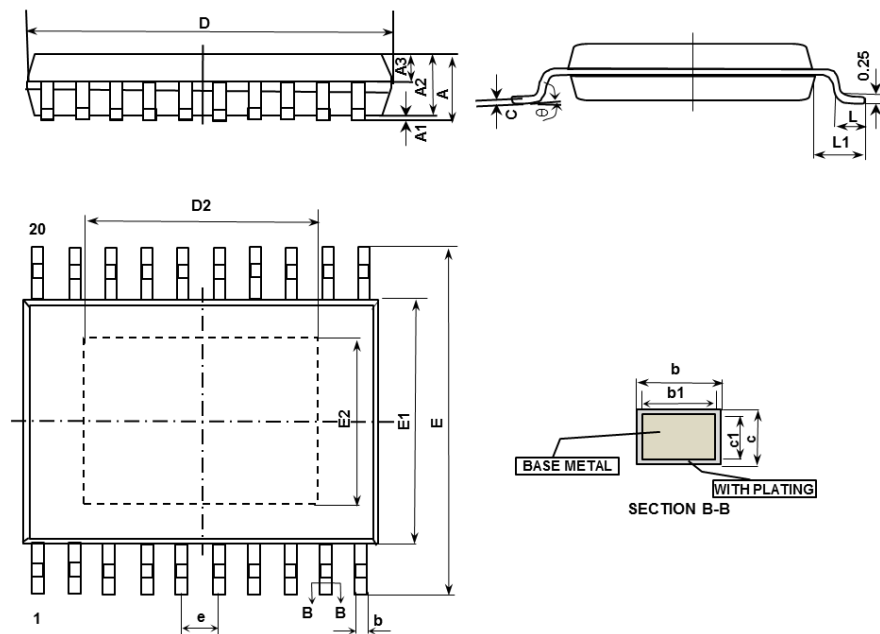
If customers would like to drive the step motor with twice the current, it recommend the following circuit.



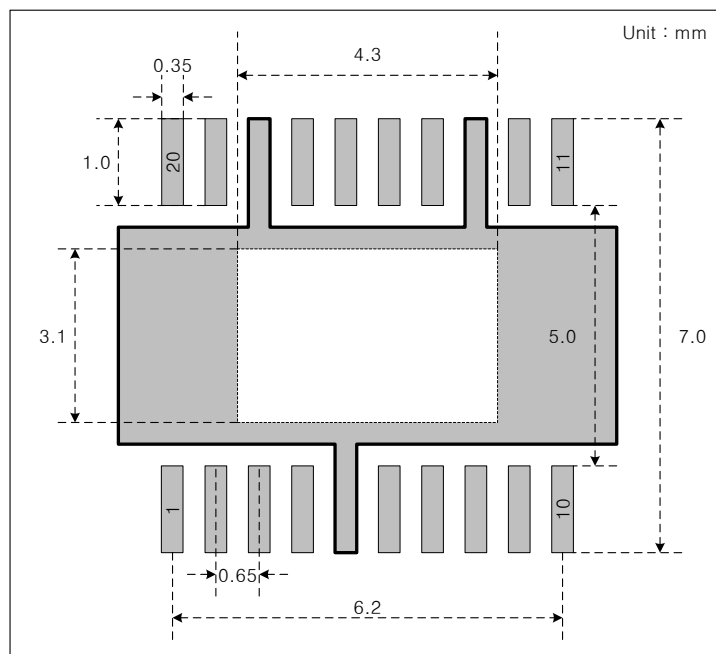
Example Value

- . C1, C3, C5, C7, C9 : 0.1uF
- . C2, C4, C6, C8, C10 : 4.7uF
- . MCU should have three outputs.

Package Dimensions



Layout Example





Revision History

No	Date	Contents
REV00	2020-10-13	Datasheet Release

<http://www.apsemi.com>

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