One Channel H-Bridge Power Driver AM1096D

Features and Benefits

- Wide supply voltage range up to 11V
- Low standby current
- Low operating supply current
- Maximum output continuous current up to 1.6A
- Low $R_{DS(ON)}$ for high efficient H-bridge output
- Built-in LDO Regulator 3.3V
- LDO output driver current 100mA
- Over current protection
- Over temperature protection
- DFN 3X3 package for small size PCB layout

Application

- Robotics (R/C servo, Sweeping robot)
- Small Appliances (Reduce PCB area and perimeter part)
- Any relevant DC motor applications

Description

The AM1096D is a channel H-Bridge driver with a build in Low Dropout Regulator (LDO). It provides integrated motor-driver solution for high current power motion control applications. The output driver block consists of N-channel and P-channel power MOSFETs configured as H-Bridge to driver DC motor.

The AM1096D maximum operational voltage is 11V. It can supply up to 1.6A of output continuous current and 2.5A of output peak current. There are internal shutdown function for over-temperature protection and over-current protection (I_{OCP} = 2.5 A).

Package material is Halogen-Free Green Product & RoHS compliant for the purpose of environmental protection and for sustainable development of the Earth.

Ordering Information

Orderable Part Number	Package	Marking
AM1096D	DFN 3X3	A1096

● Absolute Maximum Ratings (T_A=25℃)

Parameter	Symbol	Limits	Unit
Power Supply voltage	PVCC/VCC	12	V
Output continuous current	Iocont	1.6 (NOTE*)	A
Output peak current	Iomax	2.5	A
Operate temperature range	T_{opr}	-20～+85	℃
Storage temperature range	T_{stg}	-40～+150	℃

Note *: Based on 40mm^2 FR4 PCB (1 oz.) at double side PCB.

● Recommended operating conditions (T_A =25℃)

(Set the power supply voltage taking allowable dissipation into considering)

Parameter	Symbol	Min	Typ	Max	Unit
Power Supply voltage for H-Bridge	PVCC	2.0(Note**)		11	V
IC operating voltage	VCC	2.0(Note**)		11	V
Signal input IN_A and IN_B voltage	V_{IN_x}	-0.3		Vcc+0.3	V
H-bridge output continuous current	I_{OUT}	0		1.6(Note*)	A
Externally applied PWM frequency	F_{IN_x}	0.02		65	KHz

Note* : Based on 40mm^2 FR4 PCB (1 oz.) at double side PCB.

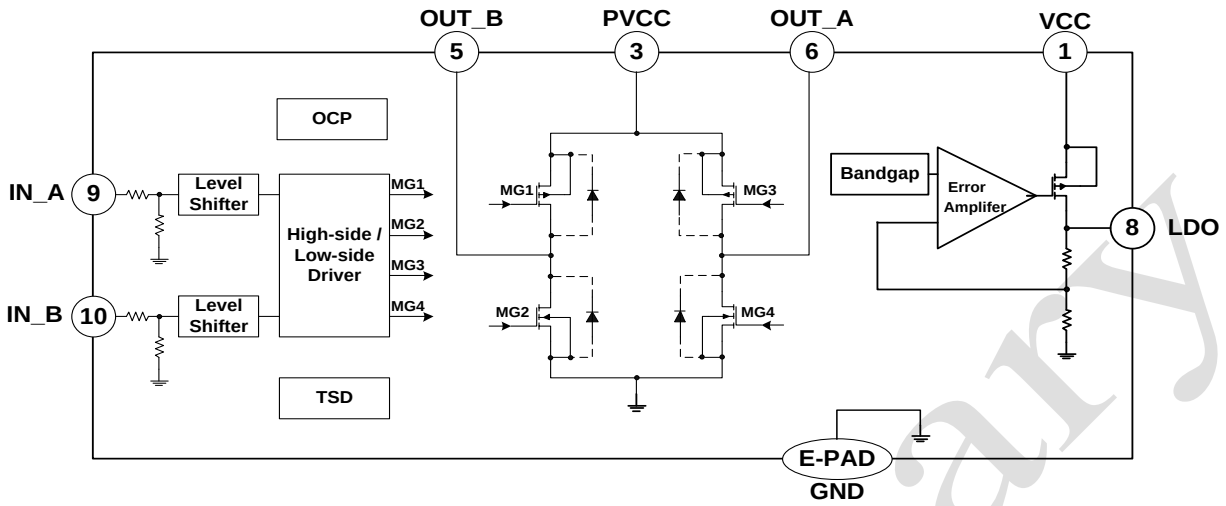
Note**: The VCC should be higher than 3.63V when using 3.3V LDO.

The VCC / PVCC minimum operated is 2V when 3.3V LDO is not used.

● Electrical Characteristics (Unless otherwise specified, TA = 25℃,PVCC=VCC=6V)

Parameter	Symbol	Limit			Unit	Conditions
		Min	Typ	Max		
Power Supplies						
Operating supply current	I_{CC}		35		uA	Input signal IN_A/B= L/H or H/L or H/H, No load on OUT_A/B, no load on LDO
Standby current	I_{STB}			20	uA	Input signal IN_A/B= L, No load on OUT_A/B, no load on LDO
IN_x Inputs						
Input H level voltage	V_{IN_xH}	2.0		Vcc	V	
Input L level voltage	V_{IN_xL}	0		0.7	V	
Input frequency	F_{IN_x}	0.02		65	KHz	
Input pull down resistance	R_{IN_X}		100		KΩ	
H-bridge FETs						
On-resistance	$R_{ds(on)}$		0.58		Ω	I_{OUT} = 0.6A Upper and Lower total
LDO parameter						
LDO output voltage	V_{LDO}	3.0	3.3	3.6	V	I_{LDO} = 100mA
Line regulation	$\triangle V_{LDO\text{-}Line}$			50	mV	I_{LDO} = 100mA,Vcc =3.93~11V
Load regulation	$\triangle V_{LDO\text{-}Load}$			50	mV	I_{LDO} = 0~100mA
Dropout voltage	$\triangle V_{Drop}$			330	mV	I_{LDO} =100mA
Power supply rejection ratio	PSRR		45		dB	I_{LDO} =10mA, f =120Hz Vripple = 1Vp-p
TSD Protection						
Thermal shutdown protection	TSD_p		160		℃	
Thermal shutdown release	TSD_r		100		℃	

Block Diagram



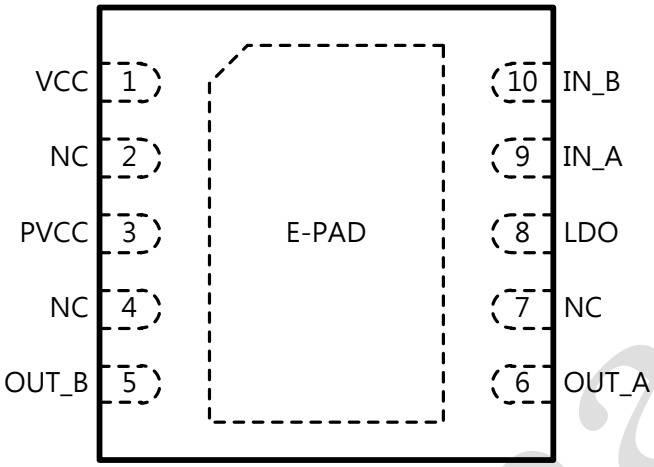
Input Logic Descriptions

Function truth table

IN_A	IN_B	OUT_A	OUT_B	Mode
L	L	Z	Z	Stop
L	H	L	H	Reverse
H	L	H	L	Forward
H	H	L	L	Brake

- **Pin configuration DFN 3X3**

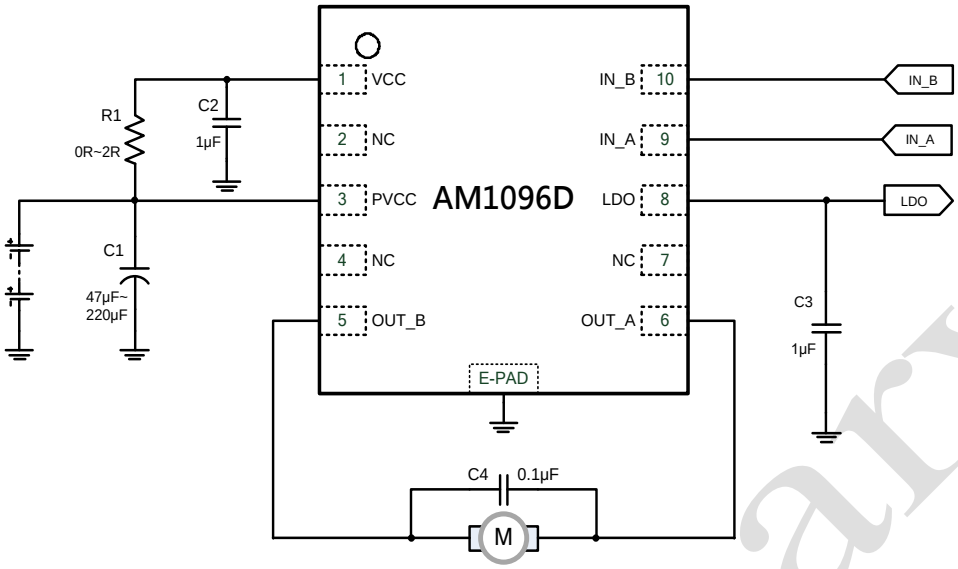
TOP VIEW



- **Pin Descriptions**

PIN No.	Pin Name	I/O	Description
1	VCC	-	Power Supply
2	NC	-	No Connect
3	PVCC	-	Power Supply for H-Bridge
4	NC	-	No Connect
5	OUT_B	O	Output B
6	OUT_A	O	Output A
7	NC	-	No Connect
8	LDO	O	Low Dropout Regulator Output
9	IN_A	I	Input signal A
10	IN_B	I	Input signal B
E-PAD	GND	-	Ground Pin

Application



Circuit Descriptions

The function descriptions of capacitors and resistor on the application circuit:

C1: Power supply PVCC pin capacitor:

1) The capacitor can reduce the power spike when the motor is in motion. To avoid the IC directly damaged by the PVCC peak voltage. It also can stabilize the power supply voltage and reduce its ripples.
2) The C1 capacitor can compensate power when motor starts running.
3) The capacitor value (μF) determines the stability of the PVCC during motor in motion. In general, 47μF capacitor is enough in low voltage power (PVCC). If the large voltage power or a heavy loading motor is used, then a larger capacitor would be needed.
4) On the PCB configuration, the C1 must be mounted as close as possible to PVCC pin (PIN3).

C2 & R1: VCC with RC low pass filter

1) By using RC low pass filter at VCC Pin, it can filter out the switching noise apart from loading. In general, C2=1uF and R1=2Ω is recommended for normal application. For PCB design consideration, the Cap & Res should be put near VCC pin as close as possible.

C3: The LDO output capacitor

1) The capacitor can reduce the power spike while motor is in motion; it also can stabilize the LDO output voltage and reduce its ripples.

C4: The across-output capacitor

1) The capacitors can reduce the power spike of motor when operating. Therefore, a 0.1μF capacitor is recommended.
2) On the PCB configuration, the C4 must be mounted as close as possible to OUT_A&B .
3) The C4 capacitor must be added to the general application.

Operating Mode Descriptions

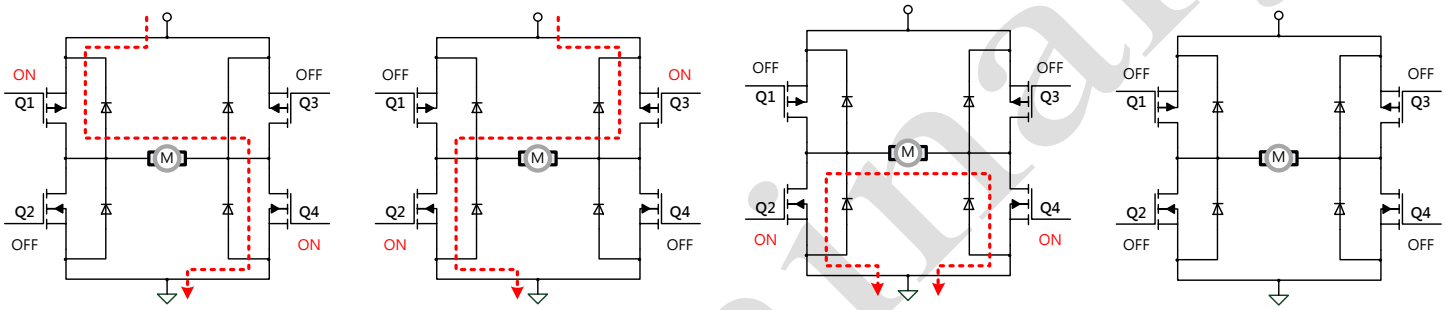
H-Bridge basic operating mode：

a) Forward mode
Definition：When IN_A=H，IN_B=L，then OUT_A=H，OUT_B=L

b) Reverse mode
Definition：When IN_A=L，IN_B=H，then OUT_A=L，OUT_B=H

c) Brake mode
Definition：When IN_A=IN_B= H，then OUT_A=OUT_B=L

d) Stop mode
Definition：When IN_A=IN_B= L，then OUT_A=OUT_B=Hi-Z



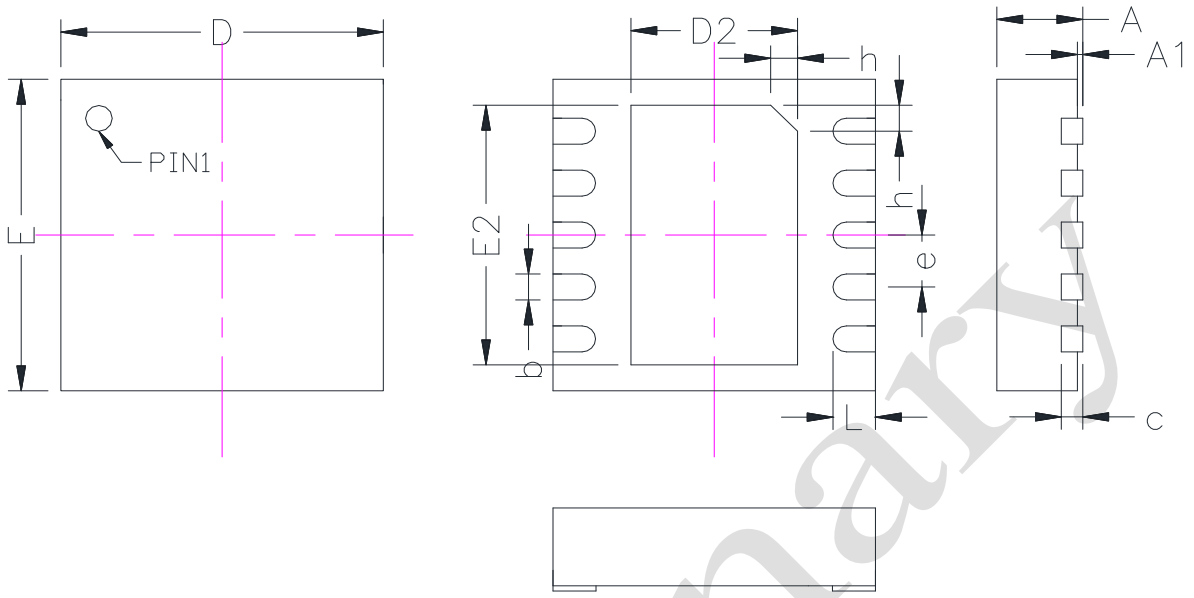
a) Forward mode　　b) Reverse mode　　c) Brake mode　　d) Stop mode

Protection Mechanisms Descriptions

1) Over-current protection (OCP)
While the IC conducts a large current, 2.5A (Typ), the internal over-current protection function will be triggered. The device enter protection mode of auto-recover to avoid damaging IC and system.

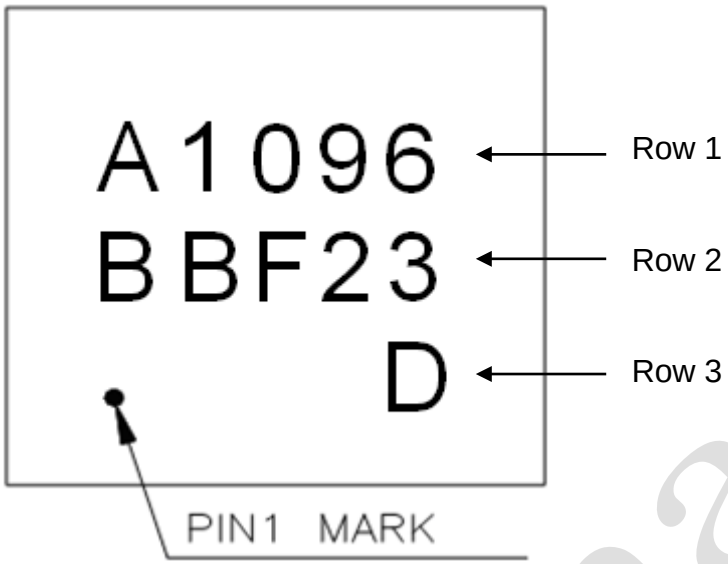
2) Over-temperature protection
If the IC junction temperature exceeds 160° C (Typ.), the internal over-temperature protection function will be triggered, all FETs in the H-bridge are disabled, that will ensure the safety of customers' products. If the IC junction temperature falls to 100° C(Typ.), the IC resumes automatically.

- **Packaging outline --- DFN 3X3** **Unit : mm**



SYMBOL	MILLIMETERS		INCHES	
	Min.	Max.	Min.	Max.
A	0.70	0.80	0.028	0.032
A1	0.00	0.05	0.000	0.002
c	0.20 REF		0.008 REF	
b	0.18	0.30	0.007	0.012
D	3.00 BSC		0.118 BSC	
D2	1.45	1.65	0.057	0.065
E	3.00 BSC		0.118 BSC	
E2	2.40	2.60	0.094	0.102
L	0.30	0.50	0.012	0.020
h	0.20	0.30	0.008	0.012
e	0.50 BSC		0.020 BSC	

● Marking Identification

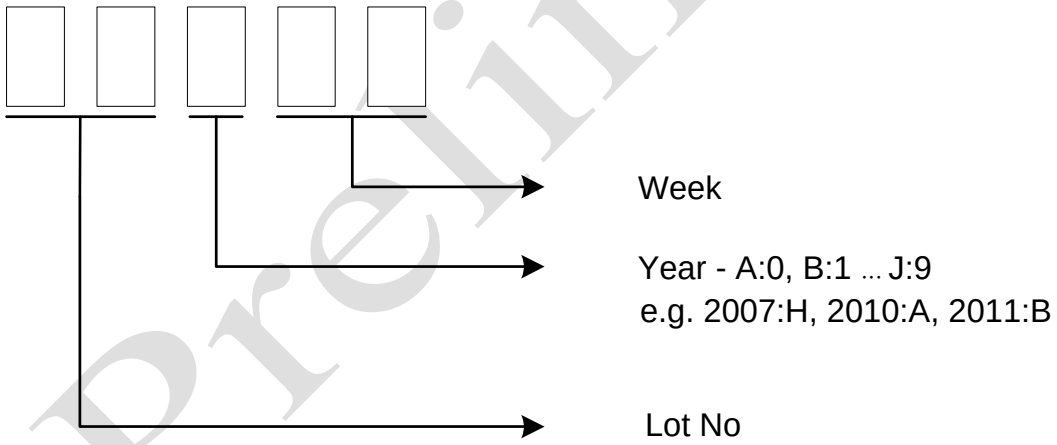


NOTE:

Row1 ： A1096

Row2 ： Wafer Lot No use two codes + Assembly Year use one code + Assembly Week use two codes

Row3 ： D for DFN 3X3



Example: Wafer Lot No is BB + Year 2015 is F + Week 23 is 23，then mark〝BBF23〞

The last code of assembly year, explanation as below:：

(Year： A=0,B=1,C=2,D=3,E=4,F=5,G=6,H=7,I=8,J=9. For example: year 2015=F)