

5~16V, Single Channel, Continuous Current 6A, H-Bridge Driver Chip

General Description

IU9028E is a single channel low on resistance DC motor drive IC designed for multi battery power supply system. The motor forward backward stop brake functions are integrated. IU9028E has built-in overcurrent and output short-circuit protection functions. When the current through MOS exceeds the limit value, the internal circuit will turn off the MOS power tube and cut off the load current. When the current drops to the set value, it will automatically return and turn on the MOS power transistor. IU9028E has a built-in temperature protection function. When the chip temperature exceeds the maximum temperature set by the internal temperature protection circuit, the internal circuit turns off the built-in power switch and cuts off the load current.

IU9028E has a PWM (in1/in2) input interface, which supports compatibility with industry standard devices.

Features

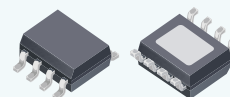
- Operating Voltage Range: 5-16V
- Continuous Current: 6A, Peak Value: 12A
- Low On Resistance: 70mΩ (HS+LS)
- Support PWM Control
- Integrated Power Undervoltage Protection
- Integrated Overcurrent Protection
- Integrated Short Circuit Protection
- Integrated Over Temperature Protection
- Low Standby Current(<1.5mA)
- Low Turn Off Current(<2.0 μA)

Applications

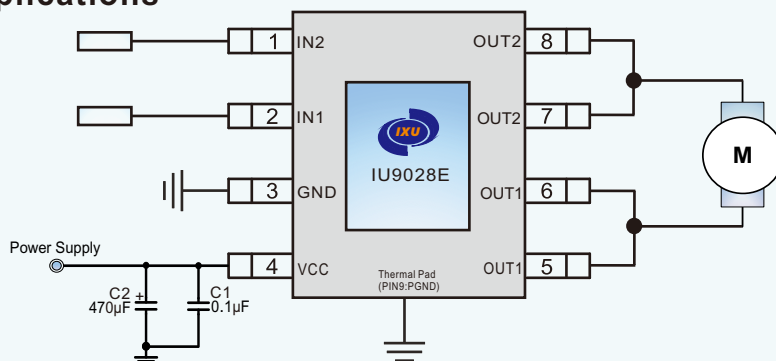
- Fully Automatic Intelligent Lock • Massage Device
- High Torque Electric Toys • Household Appliances

Package

- ESOP8L

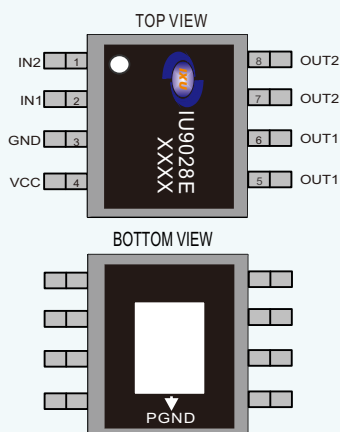


Typical Applications



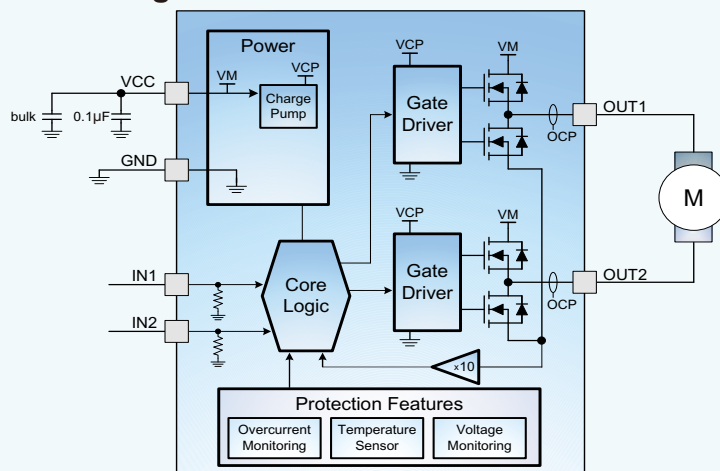
IU9028E Application Circuit

PIN Configuration and Functions



PIN	NAME	I/O	DESCRIPTION
1	IN2	I	Backward input
2	IN1	I	Forward input
3	GND	-	Power ground
4	VCC	P	External power input
5	OUT1	O	Forward output
6	OUT1	O	Forward output
7	OUT2	O	Backward output
8	OUT2	O	Backward output
9	Thermal PAD	PGND	Power ground, must be connected to ground

Functional Block Diagram



Absolute Maximum Ratings ¹

SYMBOL	PARAMETER	VALUE	UNIT
VMAX	VCC, OUT1, OUT2	20	V
	IN1, IN2	7	V
T _J	Junction operating temperature range	-40~150	°C
T _{STG}	Storage temperature range	-55~150	°C
T _{SDR}	Lead temperature (Soldering, 10 sec.)	260	°C

Recommended Operating Conditions

SYMBOL	PARAMETER	VALUE	UNIT
VCC	Motor supply voltage	5~16	V
V _I	Logic input voltage IN1, IN2	0~6	V
I _{OUT}	Peak output current	12	A
f _{PWM}	Input PWM frequency	<50	KHz

Thermal Information ²

SYMBOL	PARAMETER	VALUE	UNIT
θ _{JA}	Package thermal resistance - chip to environment thermal resistance	40	°C/W

Ordering Information

Device	Package	Making	Reel Size	Tape Width	Quantity
IU9028E	ESOP8L		13"	12mm	4000 units

ESD Range

HBM (Human Body Model) ----- ±2kV

MM (Machine model) ----- ±200V

1. The above parameters are only the limit values of device operation. It is not recommended that the working conditions of the device exceed the limit values. Otherwise, the reliability and life of the device will be affected, and even permanent damage will be caused.

2. Where the PCB board is placed in IU9028E, a heat dissipation design is needed. The heat sink at the bottom of IU9028E is connected with the heat sink area of PCB board.

Electrical Characteristics ($V_{CC}=12V$, $T_A=25^{\circ}C$)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Power supply parameters						
Operating Voltage	V_{VCC}		5.0		16	V
Turn-off Current	I_{SDT}	$V_{CC}=12V$, $IN1=IN2=0V$, no load			2	μA
Quiescent Current	I_{BRAKE}	$V_{CC}=12V$, $IN1=IN2=5V$ or $IN1=5V$ & $IN2=0V$ or $IN1=0V$ & $IN2=5V$, no load		1.2	1.5	mA
PWM Current	I_{PWM}	$V_{CC}=12V$, $IN1=5V$, $IN2=50kHz$, no load	1	1.5	3	mA
Output Current	I_{OUT}			6.0		A
Logic input parameters						
Input High Level	V_{INH}		1.5		6	V
Input Low Level	V_{INL}				1.2	
Input High Level Current	I_{INH}	$V_{CC} = 12V$, $V_{IN} = 5V$		50	100	μA
Input Low Level Current	I_{INL}	$V_{CC} = 12V$, $V_{IN} = 0V$			1	μA
H-Bridge FETs parameters						
Conduction Internal	$R_{ds(on)}$	$I_{LOAD}=1A$, HS+LS		70		$m\Omega$
Resistance	$R_{ds(on)}$	$I_{LOAD}=3A$, HS+LS		72		$m\Omega$
Overheat Protection Parameters						
Overheat Protection Temperature	T_{OTP}			170		$^{\circ}C$
Thermal Shutdown Hysteresis	TSD_R			40		$^{\circ}C$
Overcurrent Protection Parameters						
Overcurrent Protection Current	I_{OCP}			12		A
Overcurrent Peak Time	t_{OCP}			2.5		μs
Overcurrent Restart Time	t_{RETRY}			2.4		ms

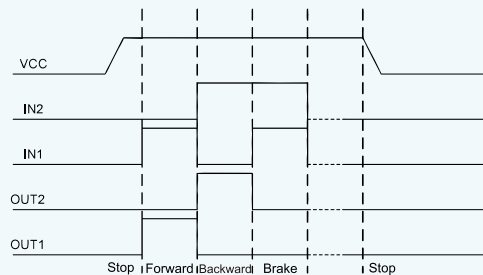
IU9028E Application Points

1. H-Bridge Control Logic

The input pins IN1 and IN2 control the output state of the H-bridge. The following table shows the logical relationship between them.

IN1	IN2	OUT1	OUT2	STATUS
H	L	H	L	Forward
L	H	L	H	Backward
H	H	L	L	Brake
L	L	Open	Open	Stop

2. Output Sequence Diagram



3. Application Circuit Description

The peripheral components on the typical application circuit are described as follows:

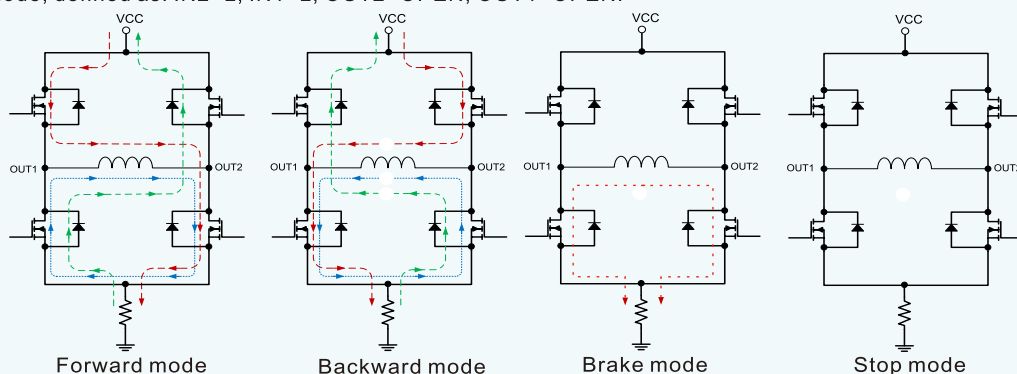
C1 and C2 are VCC input capacitors. Their main functions are as follows:

- (1). absorb the energy released by the motor to the power supply, stabilize the VCC power supply voltage, avoid the IC from being directly broken down due to high impulse voltage, and have the function of filtering ripple and interference noise.
- (2). at the moment when the motor starts, it can release current to help the motor start quickly.
- (3). the selection of VCC input capacitor C2 should be based on the voltage stability of VCC and the load current of motor. If the voltage wave of VCC is large or the load current of motor is large, a larger capacitance value must be selected.
- (4). in PCB configuration, C1 and C2 capacitors should be as close to VCC as possible.

4. Operating Mode Description

Basic operating mode:

1. Forward mode, defined as: IN2=L, IN1=H, OUT2=L, OUT1=H;
2. Backward mode, defined as: IN2=H, IN1=L, OUT2=H, OUT1=L;
3. Brake mode, defined as: IN2=H, IN1=H, OUT2=L, OUT1=L;
4. Stop mode, defined as: IN2=L, IN1=L, OUT2=OPEN, OUT1=OPEN.

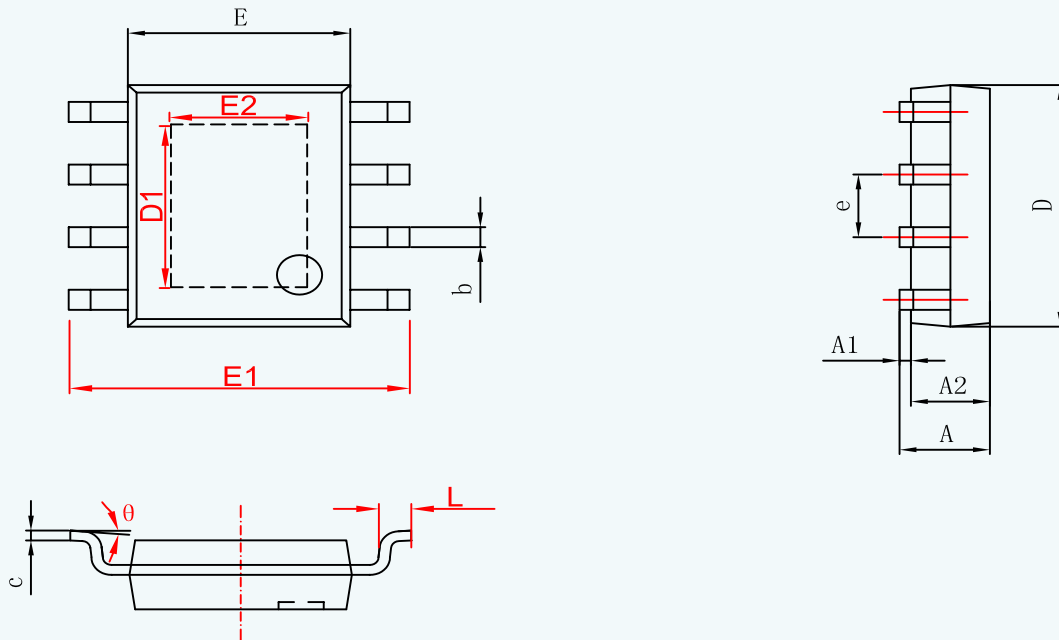


5. Description of Protection Mechanism

When using this IC, when the IC temperature exceeds 170°C (typical value), the built-in IC overheat protection circuit will forcibly turn off some drive MOS transistors to ensure the safety of customers' products. When the IC temperature drops to 130°C (typical value), the IC will quickly and automatically resume operation. If the current flowing through the motor is greater than the internal Overcurrent protection threshold, the internal integrated overcurrent protection circuit will turn off the MOS transistor and the IC will stop working. After the motor current is lower than the internal Overcurrent protection threshold, the IC will work normally.

Package Information

IU9028E ESOP8L



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	1.350	1.750	0.053	0.069
A1	0.050	0.150	0.004	0.010
A2	1.350	1.550	0.053	0.061
b	0.330	0.510	0.013	0.020
c	0.170	0.250	0.006	0.010
D	4.700	5.100	0.185	0.200
D	3.202	3.402	0.126	0.134
E	3.800	4.000	0.150	0.157
E1	5.800	6.200	0.228	0.244
E2	2.313	2.513	0.091	0.099
e	1.270(BSC)		0.050(BSC)	
L	0.400	1.270	0.016	0.050
θ	0°	8°	0°	9°

Notes:

- (1) All dimensions are in millimeters
- (2) Refer to JEDEC mo-187 standard