Overview

The SDC9150 is a DC motor driver with pulse width modulation (PWM) function, a peak output current of 3.5A and an upper operating voltage limit of 40V.

By adding a PWM signal to the corresponding input pin, the speed and direction of the DC motor can be controlled, while the internal synchronous rectification circuit will reduce the chip power consumption.

Internal circuit protection includes overcurrent protection, motor lead short-circuit protection to ground or supply, thermal shutdown protection, undervoltage monitoring and cross-current protection.

SDC9150 is a SOP8-PP package. There is an exposed thermal pad on the bottom of the package, and it is lead-free.

Features

ÿ**Low output** on- **resistance**ÿ**Output** overcurrent **protection**ÿ**Motor** short-circuit protectionÿMotor **to** ground short-circuit protectionÿMotor **to** power supply short-circuit protectionÿLow **power** standby modeÿAdjustable operating current limitÿSynchronous **rectification** functionÿInternal **undervoltage** lockoutÿOutput **commutation** control

application

ÿDC motor driver

Figure 1. Package types

Pin Distribution

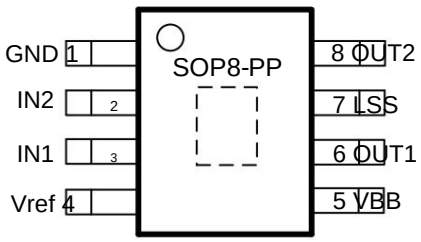


Figure 2. Pin distribution

Pin Name	Chip Model	Function
	SDC9150	
GND	1	land
IN1	3	Logic input 1, PWM control or logic high and low control
IN2	2	Logic input 2, PWM control or logic high and low control
LSS	7	Current detection resistor end, limiting current Ipeak=VREF/10/Rs
OUT1	6	Full bridge output 1
OUT2	8	Full bridge output 2
VBB	5	Supply voltage
VREF	4	Analog voltage input, used with the LSS pin to set the current limit. 0~5V

Table 1. Pin Description

Functional Block Diagram

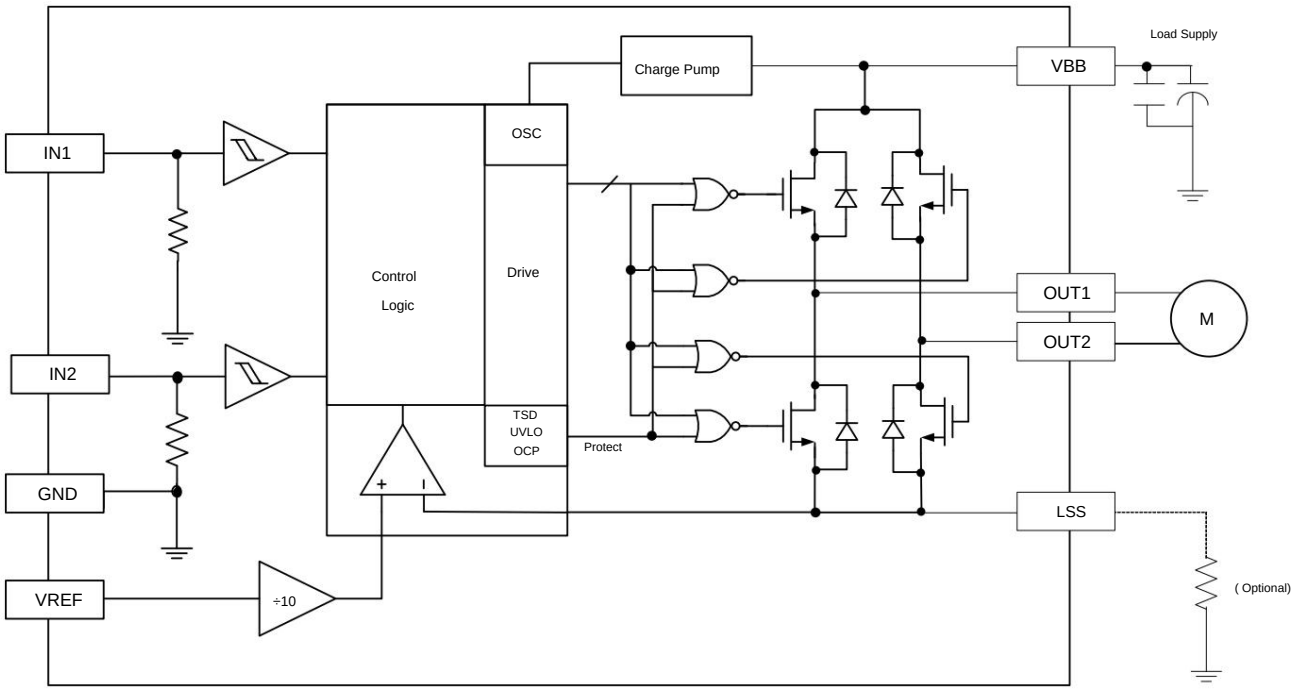
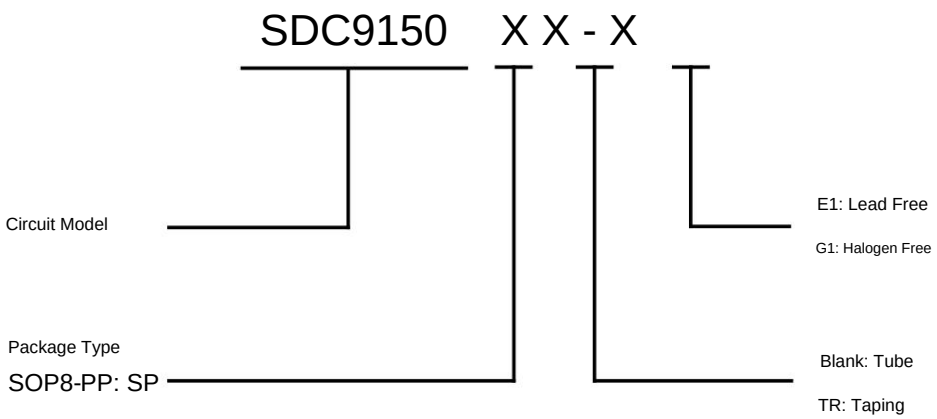


Figure 3. Functional module block diagram

Ordering Information



Package Type	Temperature Range	Device Model		Print logo		Packaging Type
		Lead Free	Halogen Free	Lead Free	Halogen Free	
SOP8-PP	-40°C~85°C	SDC9150SPTR-E1	SDC9150SPTR-G1	9150	9150G Taping	
		SDC9150SP-E1	SDC9150SP-G1	9150	9150G Tube	

Absolute Maximum Ratings (Note: Any conditions greater than those listed below may cause permanent damage to the device)

parameter	Symbol	Condition	Value	unit
Load power supply	VBB		40	V
voltage Logic input voltage	COME		–0.3~6	V
VREF Input voltage Sense	VREF		–0.3~6	V
voltage Output	VS		–0.5~0.5	V
voltage Output	VOUT		–2~42	V
current	IOUT	Duty cycle = 100%, peak current	3.5	A
Instantaneous output current	IOUT	duration < 500 ns	6	A
Operating	FACING		–40~85	°C
temperature	TJ(max)		150	°C
Maximum junction temperature Storage temperature	Tstg		–55~150	°C

Table 2. Maximum values

Electrical Parameters (Unless otherwise specified, TA = 25°C, VBB = 24V)

parameter	symbol	condition	Min.	Typ.	Max.	Unit
Overall part						
Load power supply voltage	VBB		6.8	-	40	V
Output on-resistance (upper tube + lower tube)	RDS(on)	IOUT = |1.5A|, TJ = 25°C	-	0.6	1.0	Oh
		IOUT = |1.5A|, TJ = 125°C	-	1.2	1.6	Oh
Quiescent Current	IBB	PWM frequency < 30 kHz	-	3	-	mA
		Low-power standby mode	-	-	5	ÿA
Body diode conduction voltage	Vf	Body diode (upper side), If = –1 A	-		1.5	V
		Body diode (lower side), If = 1 A	-		1.5	V
		– Logic input section				
Logic input voltage	VIN(1)	INx pins	2.0	-	-	V
	come(0)	INx pins	-	-	0.8	V
	VIN(STANDBY)	INx pins, low power standby mode		-	0.4	V
Logic input pull-down resistor	RLOGIC(PD)	VIN= 0V= IN1= IN2	-	65	-	kÿ
Logic input current	IIN(1)	INx pins, VIN=2.0 V	-	40	100	ÿA
	IIN(0)	INx pins, VIN=0.8 V	-	13	40	ÿA
Logic Input Hysteresis	VHYS		–	300	550	mV
Timing						
Dead time	tCOD		50	-	200	ns
VREF Input Voltage	VREF		0	-	5	V
Current Gain	OF	VREF/ ISS , VREF = 5 V	9.5	-	10.5	V/V
		VREF/ ISS , VREF = 2.5 V	9.0	-	10.0	V/V
		VREF/ ISS , VREF = 1 V	8.0	-	10.0	V/V
Blanking time	tBLANK		2	4	6	ÿs
Constant off time	toff		20	25	32	ÿs
Standby delay time	tst	IN1= IN2 < VIN(STANDBY)	-	1	1.5	ms
Power-on delay time	tpu		-	-	30	ÿs
Protection Circuit						
Undervoltage lockout recovery threshold	VBB_UVLO	VBB rises	6	6.3	6.7	V
Undervoltage hysteresis	VBBUVLO_hys		–	400	-	mV
Thermal shutdown	TSD	Temperature rise	–	160	-	°C
temperature Thermal shutdown hysteresis	TSD_hys		-	20	-	°C

Table 3. Electrical parameters

PWM control timing diagram

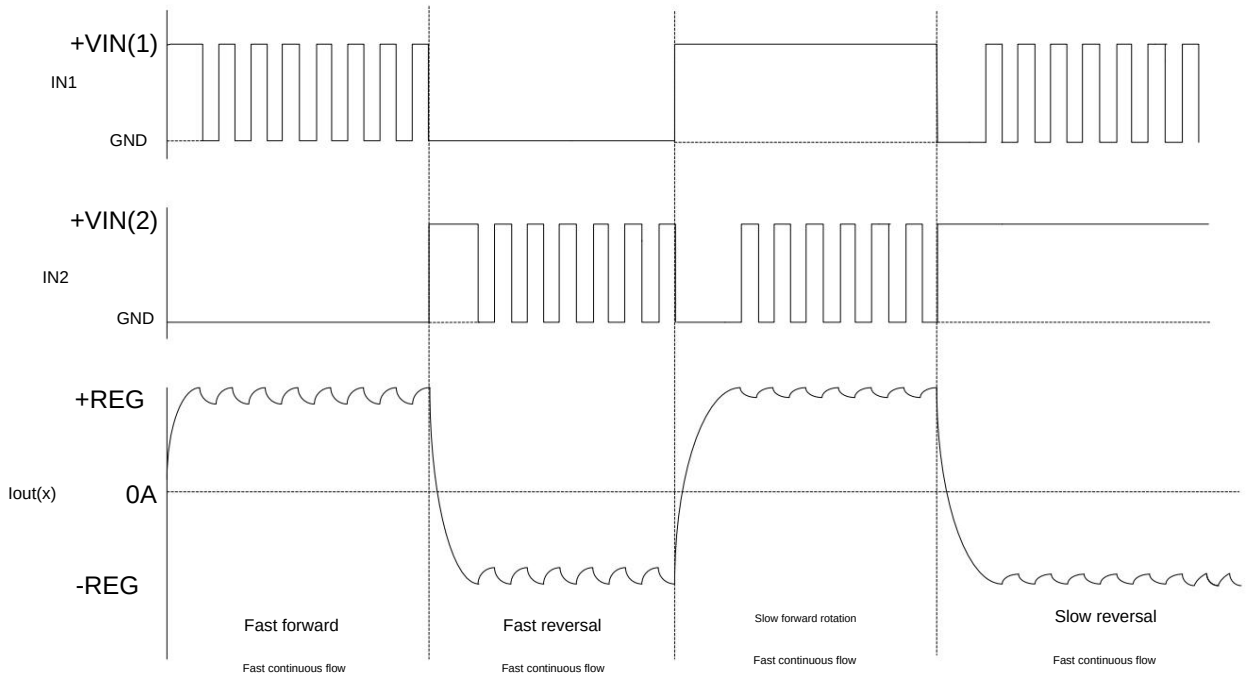


Figure 4. PWM control timing diagram

Truth Table

IN1	IN2	10×VS > VREF OUT1 OUT2			Function
0	1	No	L	H	Reversal
1	0	No	H	L	Forward
0	1	Yes	H/L	L	Reverse, mixed flow
1	0	Yes	L	H/L	Forward, mixed continuous
1	1	No	L	L	Braking (slow follow-up)
0	0		WITH	WITH	Enter low power standby mode after 1 millisecond

Table 4. Truth table

Note: Z means high impedance.

Functional

Description

Device Operation SDC9150 is a chip designed to control DC motors. The output drivers all have low on-resistance DMOS drivers and synchronous rectification to reduce power consumption. The output current is regulated by PWM with a fixed off time. The IN1 and IN2 inputs allow two-wire control of the output.

Protection circuits include internal thermal shutdown, as well as protection against load shorts, output shorts to ground or supply. Undervoltage shutdown keeps the output off until the operating voltage returns to normal.

When both input

(INX) pins are low for more than 1 millisecond, the low-power standby mode is activated. The low-power standby mode disables most of the internal circuits, including the charge pump and voltage regulator circuits. When the SDC9150 exits standby mode, it takes a certain delay (maximum delay of 30ÿs) for the charge pump to reach normal operation.

Internal PWM current control

First, during normal operation, the two output tubes in the full bridge are working in opposite directions, and the current flows through the motor coil and the external current detection resistor. When the voltage of the detection resistor reaches the preset threshold, the internal comparator resets the PWM switch, and then turns off the two output tubes to enter mixed freewheeling.

VREF

The maximum operating current setting is determined by the external detection resistor and the voltage on VREF. The value can be calculated by the following formula:

ITripMAX = VREF/ (AV* RS) Where VREF is the

voltage applied to the VREF pin, and RS is the current limiting resistor connected to the LSS pin.

Overcurrent protection

The SDC9150 has a current sensing function to protect the IC from output short circuit damage. During overcurrent protection, there may be a short period of time before the device protection latches, which exceeds the maximum limit of the IC.

Shutdown If the chip temperature rises to 160°C, the full-bridge output will be turned off until the temperature drops below the temperature hysteresis, which is typically 20°C. The undervoltage lockout function on the VBB pin prevents the IC from operating at low voltage.

The

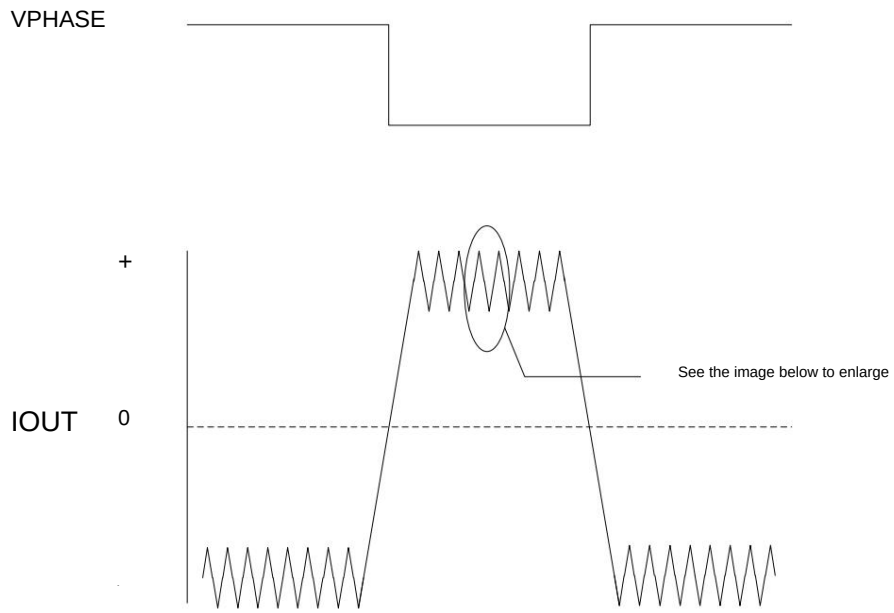
braking function is achieved by applying a high level to both inputs at the same time, so that the IC enters the slow freewheeling mode. At this time, the two output lower tubes are turned on, and the back electromotive force of the motor is used to freewheel through the output lower tube. The maximum current is approximately VBEMF / RL. At the same time, it should be ensured that the current and voltage in the worst environment (high speed and high inertia load) do not exceed the limit value of the IC.

Synchronous

Rectification When the PWM off cycle is triggered by the internal fixed off time, the load current will continue to flow. The SDC9150 synchronous rectification function will turn on the appropriate DMOS tube to short the body diode during the current continuing period. This will reduce power consumption. When zero current is detected, the synchronous rectification will be turned off to prevent reverse current in the load.

The hybrid freewheeling

mode full bridge works in hybrid freewheeling mode. Refer to the figure below. When the trigger point is reached, the device enters the fast freewheeling mode, which lasts for 50% of the fixed off time. After the fast freewheeling mode, the device switches to the slow freewheeling mode, which lasts for the remaining 50% of the fixed off time. When the output tube switches from fast to slow freewheeling, the output off-time dead time is used to prevent direct damage. Synchronous rectification does not work during the dead time, and the device only works in fast and slow freewheeling modes.



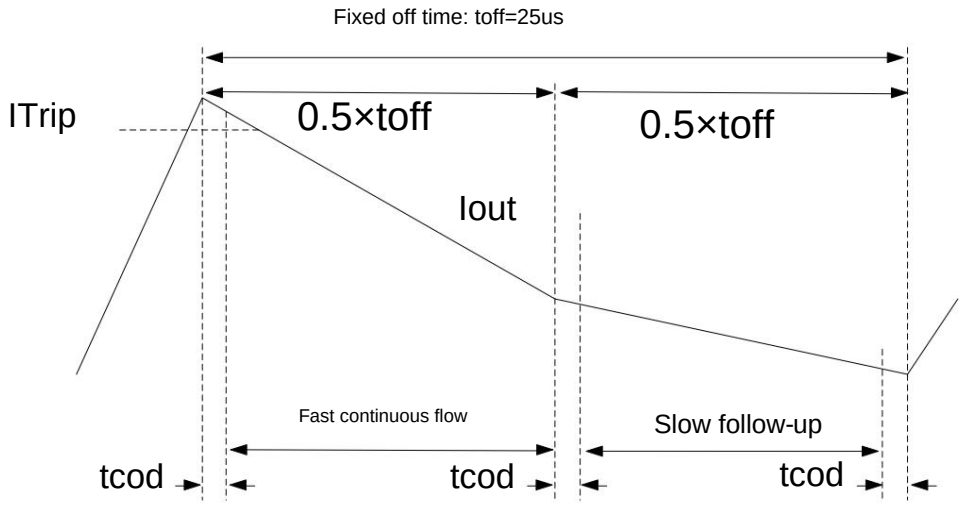
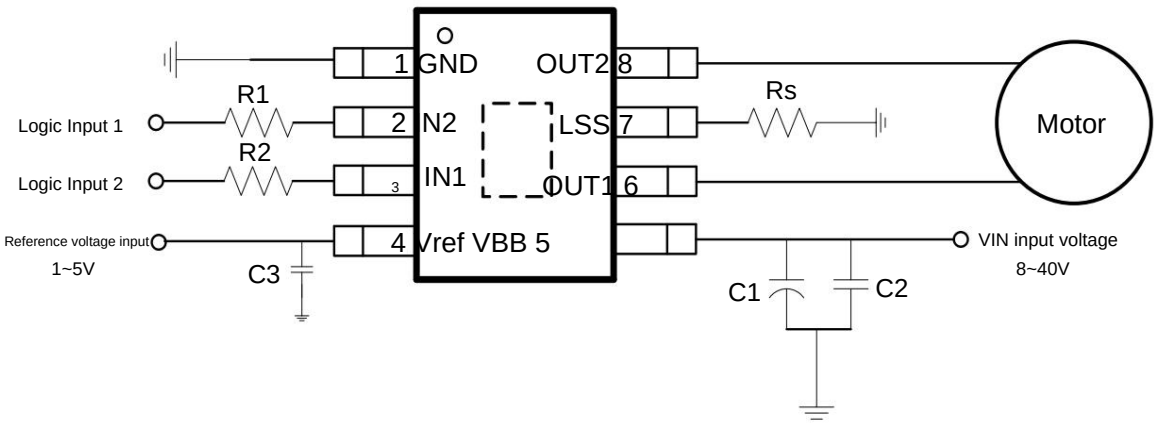


Figure 5. Hybrid freewheeling mode

Typical application circuit



illustrate:

1. The combination of Rs resistor and reference voltage input forms the current limit setting, current limit value Ilimit=Vref/10/Rs.

   The reference voltage input is generally 1~5V, and the Rs value is 0.1~1ohm.

2. C1 and C2 form a coupling filter circuit at the power supply end, which can effectively reduce the interference pulses and noise generated by the circuit.

   C1 uses an electrolytic capacitor with a value between 20 and 200uF. When the motor drive current is large, the value should be closer to the upper limit.

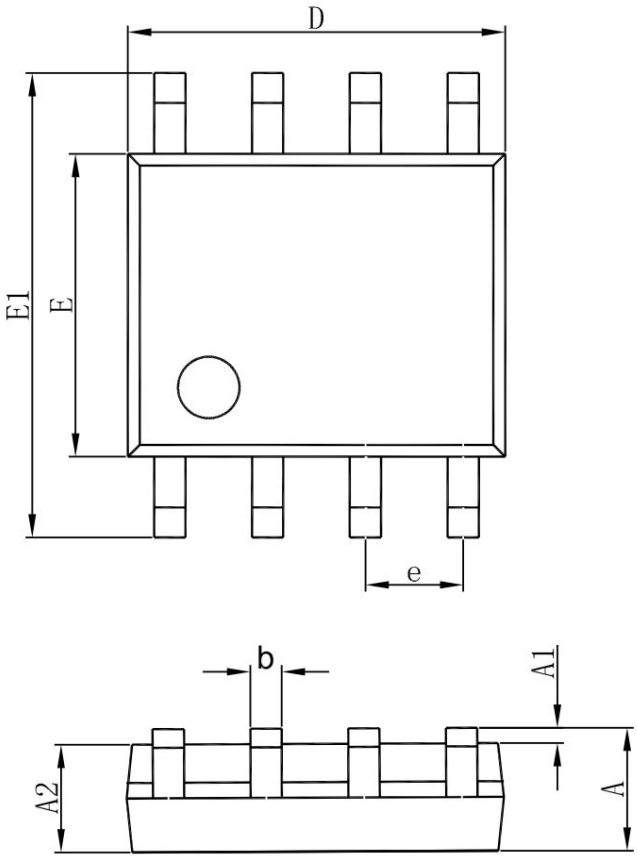
   C2 is used to filter out high-frequency noise, and the recommended value is 0.01~0.1uF. C3 is used to filter out reference voltage ripple, and the recommended value is 0.01~0.1uF.

   0.1~4.7uF.

3. R1, R2 are input resistors, and the recommended value is 0.1~1K.

Package size

SOP8-PP



symbol	Unit: mm Min.		Unit: Inch	
	Max.		Minimum	Maximum
A	**1.350**	**1.750**	**0.053**	**0.069**
A1	**0.100**	**0.250**	**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**	**0.007**	**0.010**
D	**4.700**	**5.100**	**0.185**	**0.201**
and	**1.270(BSC)**		**0.050(BSC)**	
AND	**3.800**	**4.000**	**0.150**	**0.157**
E1	**5.800**	**6.200**	**0.228**	**0.244**
L	**0.400**	**1.270**	**0.016**	**0.050**
i	**0°**	**8°**	**0°**	**8°**

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