

Electric Toy DC Motor Drive Circuit

Features

- H bridge drive with Built-in PMOS/NMOS power switch;
- provide with load motor forward/reverse/stop/brake functions;
- low standby current (typ.0.1uA);
- low quiescent operation current (typ.300uA,VCC=3V);
- Build-in spark-killing diode, eliminate motor spark(up to 28V pp/0.2mS)
- wide operation voltage range (1.8V~6.5V);
- low output impedance(0.5Ω);
- the peak current value of DIP8 is 2.8A,continue at 1.4A; and the peak current of SOP8 is 1.5A,continue at 1.0A.
- built-in Hysteresis effect thermal shutdown (TSD).

Discription

BPM4512 is a single channel toy dc motor drive IC for the system worked under low voltage. It contains H bridge drive, use PMOS/NMOS power transistors with low output resistance.And the low conduction resistance ensures low power consumption when the circuit worked under sustained huge current,make the circuit worked sustainly for a long time.

BPM4512 contains built-in thermal shutdown function,when the low resistance load motor plugging turn or output short circuit, the output current and power consumption of the circuit increase momentarily, and the chip temperature(Type=150℃, and the outside surface temperature is lower than 71℃)rise sharply. When the chip temperature exceed the internal protection circuit highest temperature the internal circuit will shut off the BPM4512 build-in power switch tube,then cut off the load current, eliminate the security hidden danger as plastic packaging smoking and firing by excessively high temperature. The build-in temperature hysteresis circuit ensures that when circuit recovery to safety temperature, then recontrol the circuit.

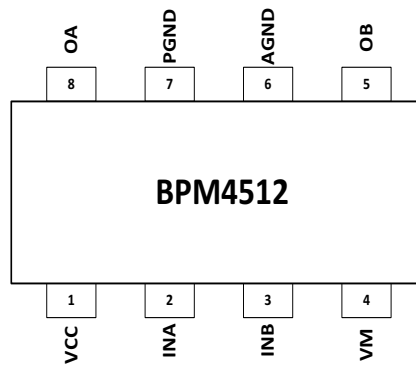
Applications

- 2-4 batteries occasions toy motor drive
- electronic toy robot

Ordering Information

Part Number	package	operation temperature
BPM4512D	DIP-8	-20℃ ~ 85℃
BPM4512S	SOP-8	-20℃ ~ 85℃

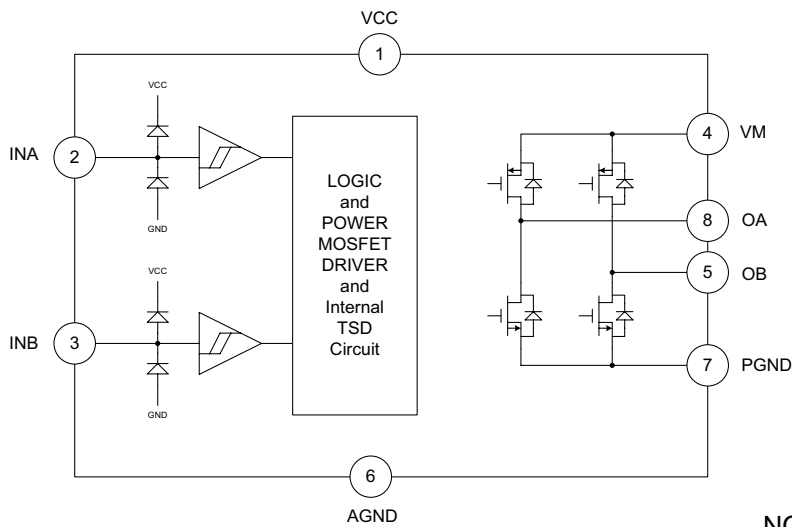
Pins Arrangement



Pins Definition

Pin No.	Pin Name	Output/Input	Functional Description
1	VCC	-	power end of Logic control circuit
2	INA	I	forward logical input
3	INB	I	reverse logical input
4	VM	-	power supply for motor
5	OB	O	reverse output
6	AGND	-	logical circuit GND
7	PGND	-	output power pipe GND
8	OA	O	forward output

Internal Function Module



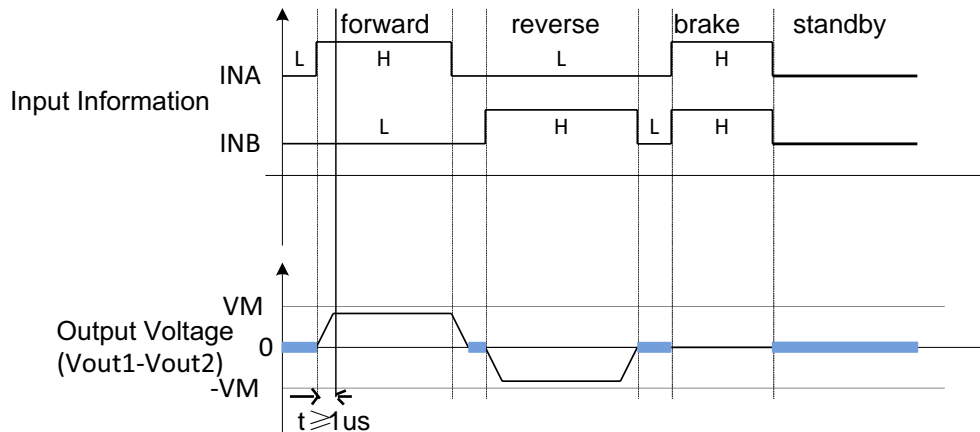
NOTE: BPM4512 Pin No.

Function Discription

Logic Truth Table

INA	INB	OA	OB	Function
L	L	Z	Z	Standby/Stop
H	L	H	L	Forward
L	H	L	H	Reverse
H	H	L	L	Brake

Type Waveform Figure



Absolute Maximum Ratings ($T_A=25^\circ C$)

parameter	symbol	value	unit
Max. logic and power control voltage	VCC(MAX)	7.0	V
power supply for motor	VM(MAX)	8.0	V
Max. output plus voltage	VOUT(MAX)	VM	V
Max. input plus voltage	VIN(MAX)	VCC	V
Channel peak output voltage(DIP-8)	IOOUT(PEAK)	2.8	A
Channel peak output voltage(SOP-8)	IOOUT(PEAK)	1.5	A
Max. Power Consumption	DIP8	1.16	W
	SOP8	0.86	W
junction environmental thermal resistance θ_{JA}	DIP8	107	$^\circ C/W$
	SOP8	184	$^\circ C/W$
operating temperature range	T_{opr}	-20~+85	$^\circ C$
junction temperature	T_J	150	$^\circ C$
storage temperature	T_{stg}	-55~150	$^\circ C$
soldering temperature	T_{LED}	260 $^\circ C$, 10 second	

NOTE: (1) The maximum power consumption under different temperature according to the following relationship calculation

$$P_D = (T_J - T_A) / \theta_{JA}$$

T_J is junction temperature of working circuit, T_A is environment temperature of working circuit, calculation of packaging thermal resistance according to JESD 51-7.

(2) Calculation of circuit consumption according to

$$P = I * I * R$$

P is circuit consumption, I is sustained output current, R is Output conduction resistance. circuit power consumption p must be smaller than the maximum power consumption P_D

Recomended Operating Conditions($T_A=25^\circ C$)

parameter	symbol	Min.	Typ.	Max.	Unit
logic and power control voltage	VCC	1.8		5	V
power supply for motor	VM	1.8		6.5	V
Channel sustained output current	DIP8 package	lout1	± 1.4	2.8	A
	SOP8 package	lout2	± 1.0	1.5	A

NOTE: Logic control power supply VCC and internal power sources VM fully independent, can supply power respectively.

Electrical Characteristics Parameters

($T_A=25^{\circ}\text{C}$, $V_{CC}=3\text{V}$, $V_{DD}=3\text{V}$ Unless otherwise specified)

parameter	symbol	condition	Min.	Typ.	Max.	Unit
VCC standby current	ICCST	INA=INB=L	--	0	10	uA
VM standby current	IVMST	VM=VCC=6V	--	0	10	uA
VCC static source current	ICC	INA=H, INB=L or INA=L, INB=H or INA=H, INB=H	--	0.3	1	mA
VM static source current	IVM	INA=H, INB=L or INA=L, INB=H or INA=H, INB=H	--	0.1	1	mA
Input high electrical level	VINH		0.8VCC	--	--	V
Input low electrical level	VINL		--	--	0.2VCC	V
Output resistance	RON	$I_O = \pm 200\text{mA}$	--	0.5	0.8	Ω
Spark-killing diode stray current	IDLEAK		--	--	100	uA
Spark-killing diode voltage drop	VD	$I_{OUT}=400\text{mA}$	--	0.8	1	V
Storage Temperature	TSD		--	150	--	$^{\circ}\text{C}$
TSD hysteresis	TSDH		--	25	--	$^{\circ}\text{C}$

Application Information

1. Thermal Shutdown(TSD)

When the junction temperature is up to 150°C , shut off all output circuit, to prevent the too high junction temperature cause the circuit in burnt. Hot off hysteresis is 25°C .

Typical Application Circuit

2 batteries power supply remote control car application reference

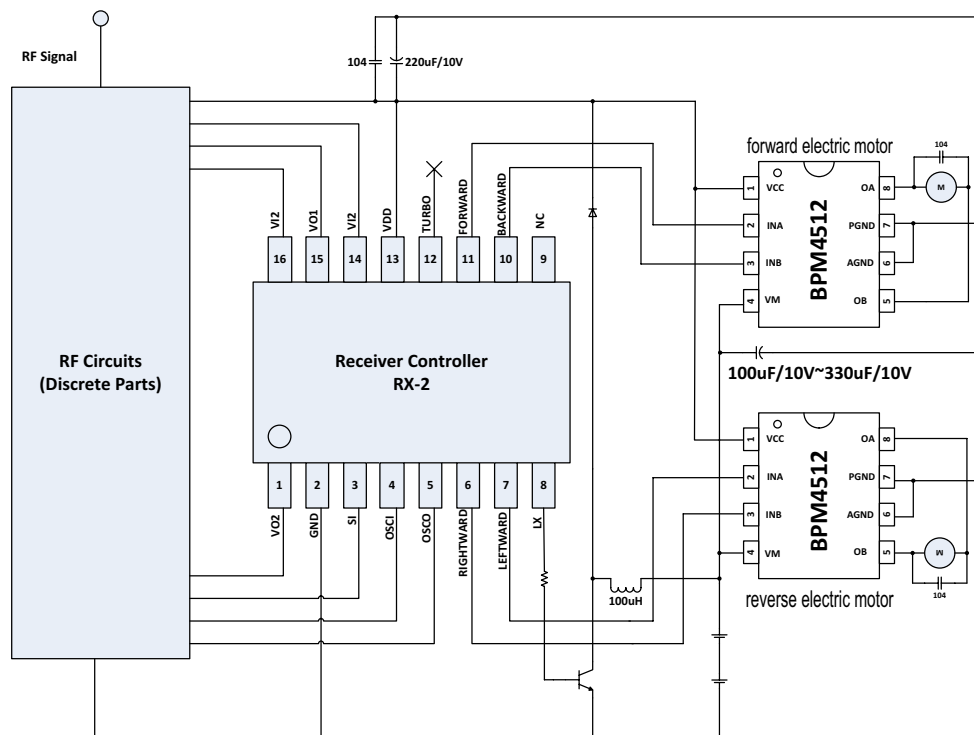


Figure 1 2 batteries power supply remote control car application schematic

Figure 1 that two batteries remote control toy car application circuit diagram use two BPM4512 circuit, used to drive forward/back and left/right motor respectively. Usually, RX2 power supply VM used the design of the boost, to ensure a stable supply when battery voltage reduced. RX2 power end (VDD) should connect a electrolytic capacitors 220uF/10V to GND and a 104 ceramics capacitors.

Note of power connection:

- 1、BPM4512 logic power supply VCC and the controller chip (RX2) VDD must be connected together.
- 2、BPM4512 power end VM connected directly to the battery positive.
- 3、BPM4512 logic GND power low GND connected directly and connected to GND of RX2.

Model selection and cautions:

- 1、Front wheel steering recommended BPM4512B
- 2、Drive rear wheel continue current does not exceed 800mA , can choose BPM4512B
- 3、Drive rear wheel continue current exceed 800mA , can choose BPM4512A
- 4、BPM4512 VDD and GND need to add a electrolytic capacitors,close to two chips-- recommended parameter 100uF/10V~330uF/10V, specific size please according to the actual application.

3-4 batteries power supply remote control car application reference

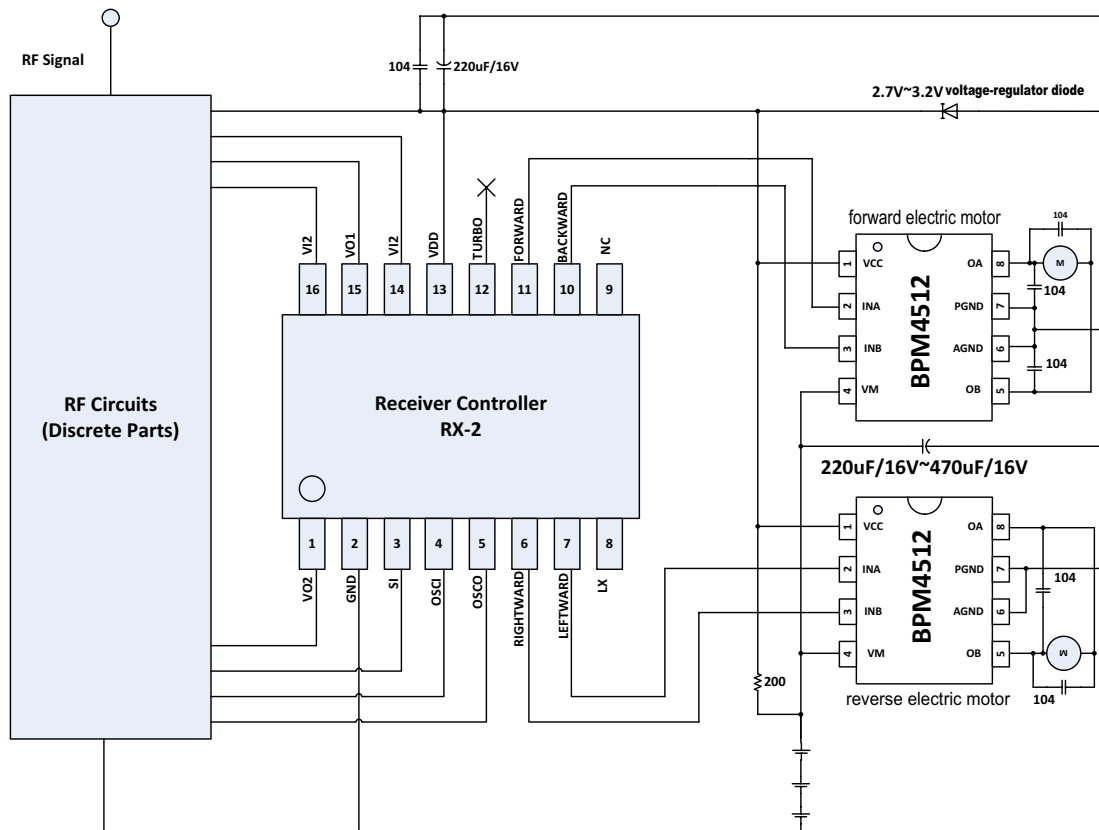


Figure 2 3 batteries power supply remote control car application schematic

Figure 2 that two batteries remote control toy car application circuit diagram use two BPM4512 circuit, used to drive forward/back and left/right motor respectively.Usually, RX2 power supply VDD used the set-down design, to ensure a stable supply when battery voltage reduced.RX2 power end (VDD) should connect a electrolytic capacitors 220uF/16V to GND and a 104 ceramics capacitors.

4 batteries application scheme is same to 3 batteries application schematic.

Note of power connection:

- 1、BPM4512 logic power supply VCC and the controller chip (RX2) VDD must be connected together.
- 2、BPM4512 power end VM connected directly to the battery positive.
- 3、BPM4512 logic GND power low GND connected directly and connected to GND of RX2.

Model selection and cautions:

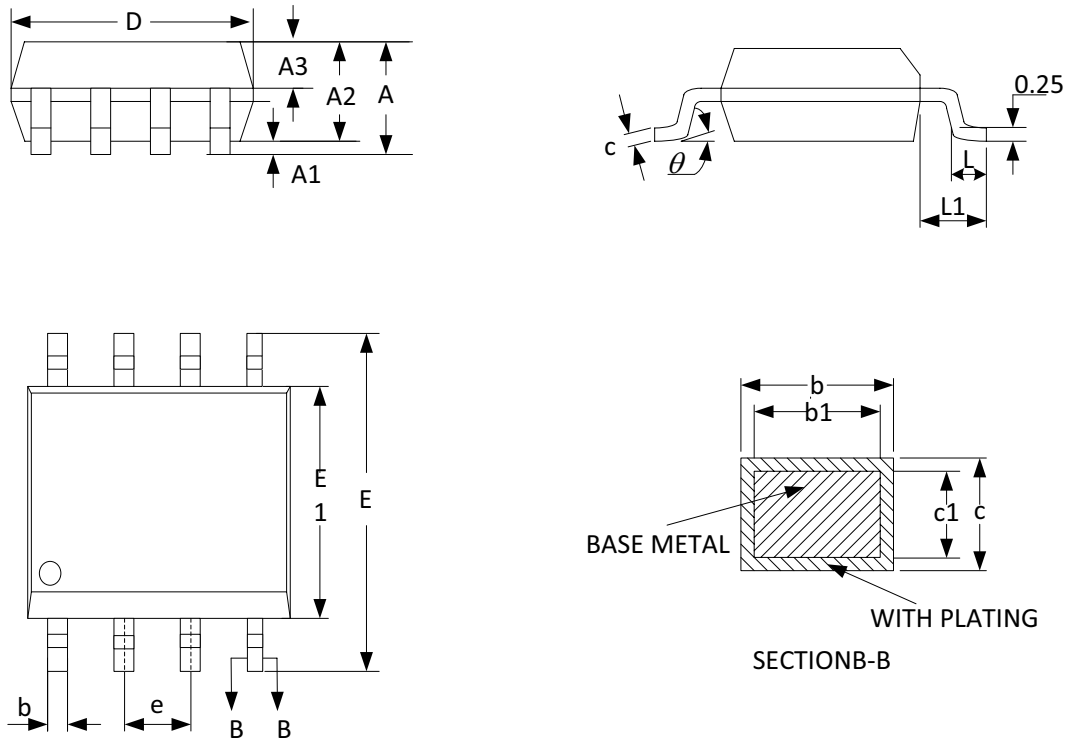
- 1、 Front wheel steering recommended BPM4512B
- 2、 Drive rear wheel continue current does not exceed 800mA , can choose BPM4512B
- 3、 Drive rear wheel continue current exceed 800mA , can choose BPM4512A
- 4、 BPM4512 VDD and GND need to add a electrolytic capacitors,close to two chips-- recommended parameter 220uF/16V~470uF/16V, specific size please according to the actual application.
- 5、 The working rear wheels motor is easy to cause large peak voltage,and to avoid chip damage,suggest to pick up a capacitance 104 on land close to each output end of the chip BPM4512 used for the rear wheels motor drive.
- 6、 the current of front wheel steering motor is small, and the peak voltage is smaller the rear wheels, still can cause damage to the circuit due to the high power supply voltage, Suggest pick up a capacitor 104 by cross nearby output side OA and OB ,or according to the connection of rear wheels. As shown in figure 2.
- 7、 3 batteries can chose connect front wheel steering motor capacitor or not according to actual situation,but for rear wheel steering suggest according to figure 2.

Chip use special note:

- 1、 Above recommended circuit and parameters apply only to ordinary remote control toy car,for other toys and motor driver please according to the practical situation.
- 2、 **BPM4512** input line can't appear wire control state
- 3、 Continuous current driver ability influenced by packaging form、 VM 、 VCC、 chip differences and environmental temperature and other factors, parameters Instruction provide are for reference only. Suggest to consider a surplus in practical situation.

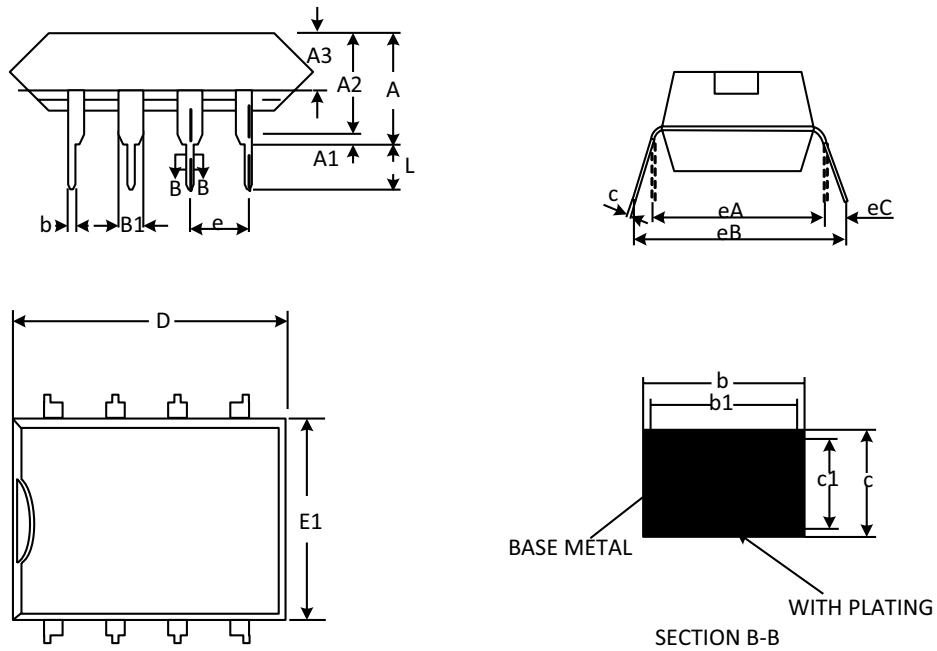
Outer Package Dimension Figure

SOP8:



SYMBOL	MILLIMETER		
	MIN	NOM	MAX
A	--	--	1.77
A1	0.08	0.18	0.28
A2	1.20	1.40	1.60
A3	0.55	0.65	0.75
b	0.39	--	0.48
b1	0.38	0.41	0.43
c	0.21	--	0.26
c1	0.19	0.20	0.21
D	4.70	4.90	5.10
E	5.80	6.00	6.20
E1	3.70	3.90	4.10
e	1.27BSC		
L	0.50	0.65	0.80
L1	1.05BSC		
θ	0	--	8°

DIP8:



SYMBOL	MILLIMETER		
	MIN	NOM	MAX
A	3.60	3.80	4.00
A1	0.51	—	—
A2	3.10	3.30	3.50
A3	1.50	1.60	1.70
b	0.44	—	0.53
b1	0.43	0.46	0.48
B1	1.52BSC		
c	0.25	—	0.31
c1	0.24	0.25	0.26
D	9.05	9.25	9.45
E1	6.15	6.35	6.55
e	2.54BSC		
eA	7.62BSC		
eB	7.62	—	9.50
eC	0	—	0.94
L	3.00	—	—