

User Manual

GHP500N05

High-voltage Half-bridge Power Module (IPM)

Version: V1.0

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1 Product Overview

1.1 Introduction

The GHP500N05 is a high-performance MOSFET half-bridge intelligent power module. It consists of a 600V gate drive IC and a 500V FRVDMOS device internally, and integrates a high-side bootstrap diode and a temperature sensor. The drive IC is not only optimized for the FRVDMOS switching characteristics but also features over-temperature protection and negative voltage interference protection.

The GHP500N05 features a specific package structure. Owing to its small package size and good heat dissipation capability, the product is widely applicable to brushless DC motors, especially high-voltage and high-density motors.

1.2 Main characteristics

- Built-in high-performance 500V/5A MOSFET
- Supply voltage operating range: 10V~20V
- Built-in VCC and VBS under voltage lock out (UVLO)
- Built-in straight-through prevention function
- Built-in 400ns dead time
- Matching of high and low-side channels
- Built-in pull-down resistor of input pin
- 3.3V/5V input logic compatibility
- Built-in temperature sensor output
- Built-in over-temperature protection
- Built-in bootstrap diode
- Excellent EMI performance

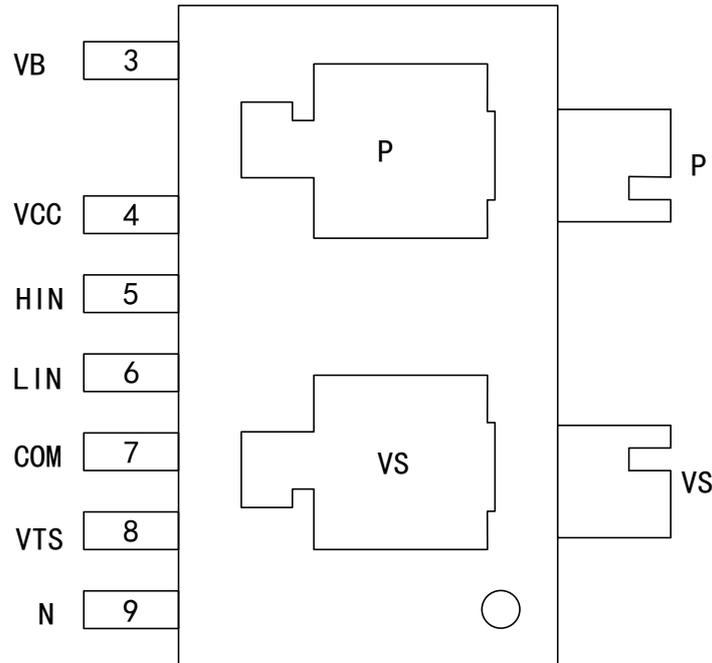
1.3 Application scope

- High-speed fans, high-voltage ceiling fans, high pressure water pumps, and other three-phase DC brushless motor drives

2 Pin Information

2.1 Pin distribution

Figure 1 Distribution Diagram of ESOP9 Pins



2.2 Pin functional description

Table 1 Legends/Abbreviations Used in Output Pin Table

Name	Abbreviation	Definition
Pin name		Unless otherwise specified in the bracket below the pin name, the pin functions during and after reset are the same as the actual pin name
Pin type	P	Power supply pin
	I	Only input pin
	O	Only output pin
	I/O	Input/Output pin

Table 2 Description of Sorting by Pin Number of GHP500N05

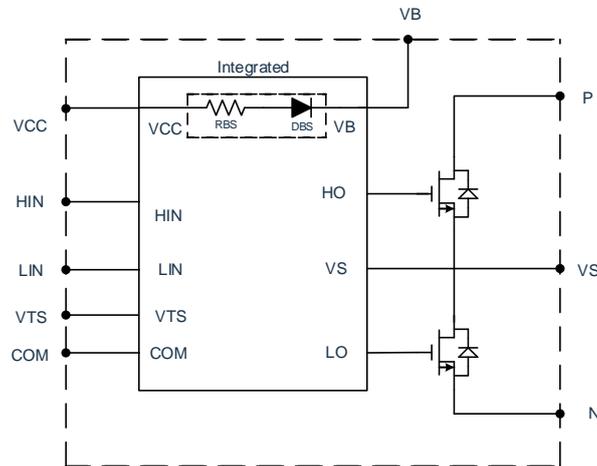
Pin No.	Name	Type	Functional description
1	VS	P	High-side floating end
2	P	P	Drain stage of high-side power transistor, DC input positive terminal
3	VB	P	High-side bootstrap power end

Pin No.	Name	Type	Functional description
4	VCC	P	Drive power supply positive terminal
5	HIN	I	Logic input signal, active high, controlling the On and Off states of the high-side power devices
6	LIN	I	Logic input signal, active high, controlling the On and Off states of the low-side power devices
7	COM	P	Drive power supply negative terminal
8	VTS	O	Temperature voltage signal output
9	N	P	Source electrode of low-side power transistor

3 Block Diagram Logic

3.1 Internal block diagram

Figure 2 GHP500N05 Internal Block Diagram



4 Electrical Characteristics

4.1 Absolute maximum rated value

Unless otherwise specified, the following test parameters are obtained from the test conducted at $T_A=25^{\circ}\text{C}$, with all pins taking GND as the reference point.

Table 3 Absolute Maximum Ratings

Symbol	Parameter	Test condition	Min value	Max value	Unit
VB	High-side floating offset absolute voltage		-0.3	520	V
VS	High-side floating offset relative voltage		VB-25	500	V
V_{IN}	Maximum input voltage (HIN/LIN)		-0.3	10	V
VCC	Control-side supply voltage		-0.3	25	V
VDSS	MOSFET drain-source voltage	IDSS=250 μ A	-	500	V
ID	MOSFET continuous current	TC=25 $^{\circ}$ C		5	A
		TC=100 $^{\circ}$ C		3	A
dVS/dt	Maximum slew rate of offset voltage		-	50	V/ns
PD	Maximum power dissipation ⁽¹⁾	TC=25 $^{\circ}$ C	-	8.3	W
θ_{JA}	Junction-to-ambient thermal resistance		-	15	$^{\circ}\text{C}/\text{W}$
TJ	Junction temperature		-	150	$^{\circ}\text{C}$
TS	Storage temperature		-55	150	$^{\circ}\text{C}$
TL	Pin welding temperature	(For a duration of 10s)	-	260	$^{\circ}\text{C}$

Note:

- (1) PD shall not be exceeded under any circumstances. The formula for calculating maximum power consumption at different ambient temperatures is: $P_D=(150^{\circ}\text{C}-T_A)/\theta_{JA}$; T_A is the ambient operating temperature of the circuit, θ_{JA} is the thermal resistance of the package, and 150°C is the maximum operating junction temperature of the circuit.
- (2) For human body model, the 100pF capacitor is discharged through a 1.5k Ω resistor.
- (3) The circuit may be damaged if the operating conditions exceed the range specified by the absolute maximum ratings.

4.2 Recommended operating conditions

Unless otherwise specified, the following test parameters are obtained from the test conducted at $T_A=25^{\circ}\text{C}$, with all pins taking GND as the reference point.

Table 4 Recommended Operating Conditions

Symbol	Parameter	Min value	Typical value	Max value	Unit
VB	High-side floating offset absolute voltage	VS+10	VS+15	VS+20	V
VS	High-side floating offset relative voltage	GND-5	310	400	V
V _{IN}	Maximum input voltage (HIN/LIN)	0	-	5	V
VCC	Control-side supply voltage	10	15	20	V
T _{dead}	Input dead time ⁽¹⁾	0.8	-	-	μs
T _A	Operating temperature ⁽²⁾	-40	-	105	°C
F _{PWM}	PWM switching frequency	-	20	40	KHz

Note:

- (1) Input dead time is the dead time given by MCU
- (2) T_A represents the ambient temperature at which the circuit operates
- (3) Operation outside the recommended conditions may affect its reliability. Therefore, it is not recommended to operate the IC beyond the recommended operating conditions.

4.3 Electrical Characteristics of Product

Table 5 Electrical Characteristics

Symbol	Parameter	Test condition	Min value	Typical value	Max value	Unit
Parameters of Power Transistor Section						
BV _{DSS}	Drain-source breakdown voltage of MOS transistor	V _{IN} =0V, I _D =250μA	500	-	-	V
I _{DSS}	Cut-off- leakage current of MOS transistor	V _{IN} =0V, V _{DS} =500V	-	-	1	uA
R _{DS(ON)}	Conduction resistance of MOS transistor	V _{GS} =10V, I _D =2.5A	-	1.8	2.2	Ω
V _{SD}	Forward conduction voltage drop of diode	V _{GS} =0V, I _{SD} =5A	-	-	1.4	V
T _{rr}	Reverse recovery time	I _D =2.5A, V _{PN} =300V	-	86	-	ns
t _{ON}	Output rising edge transmission time	V _{GS} =10V, V _{PN} =300V, V _{CC} =V _{BS} =15V	-	350	-	ns

Symbol	Parameter	Test condition	Min value	Typical value	Max value	Unit
t_{OFF}	Output falling edge transmission time			370		ns
E_{on}	Turn-on switch loss			80		μ J
E_{off}	Turn-off switch loss			10		μ J
Parameters of Drive Section						
I_{CCQ}	VCC quiescent current	$V_{HIN}=V_{LIN}=0$	500	700	1000	μ A
I_{BSQ}	VBS quiescent current	$V_{HIN}=0$	50	80	150	μ A
I_{IN+}	Input high-level current	V_{HIN} or $V_{LIN}=5V$	8	11	14	μ A
I_{IN-}	Input low-level current	V_{HIN} or $V_{LIN}=0$	-	0	1	μ A
V_{IN}	Input high-level potential	$V_{HIN}=5V, V_{LIN}=0V$	1.7	2.1	-	V
V_{IL}	Input low-level potential	$V_{HIN}=0V, V_{LIN}=5V$	-	1.4	1.9	V
V_{INHY}	Input hysteresis level		0.4	0.7	1.2	V
V_{CCHY+}	VCC undervoltage high-level potential		8.3	8.8	9.5	V
V_{CCHY-}	VCC undervoltage high-level potential		7.7	8.2	8.7	V
V_{CCHY}	VCC undervoltage hysteresis level		0.3	0.6	0.8	V
V_{BSHY+}	VBS undervoltage high-level potential		8.1	8.6	9.3	V
V_{BSHY-}	VBS undervoltage high-level potential		7.5	8.0	8.5	V
V_{BSHY}	VBS undervoltage hysteresis level		0.3	0.6	0.8	V
DT	Dead time	No Load	300	400	500	ns
I_{BSD15L}	Bootstrap charging current	$V_{CC}=15V, V_B=13V$	-	7	-	mA
I_{BSD15H}		$V_{CC}=15V, V_B=0V$	-	45	-	mA
V_{TS20}	Temperature sensor output	Temp=20°C	0.37	0.52	0.67	V
V_{TS100}	Temperature sensor output	Temp=100°C	1.73	1.88	2.03	V

4.4 Temperature Sensor VTS Parameters

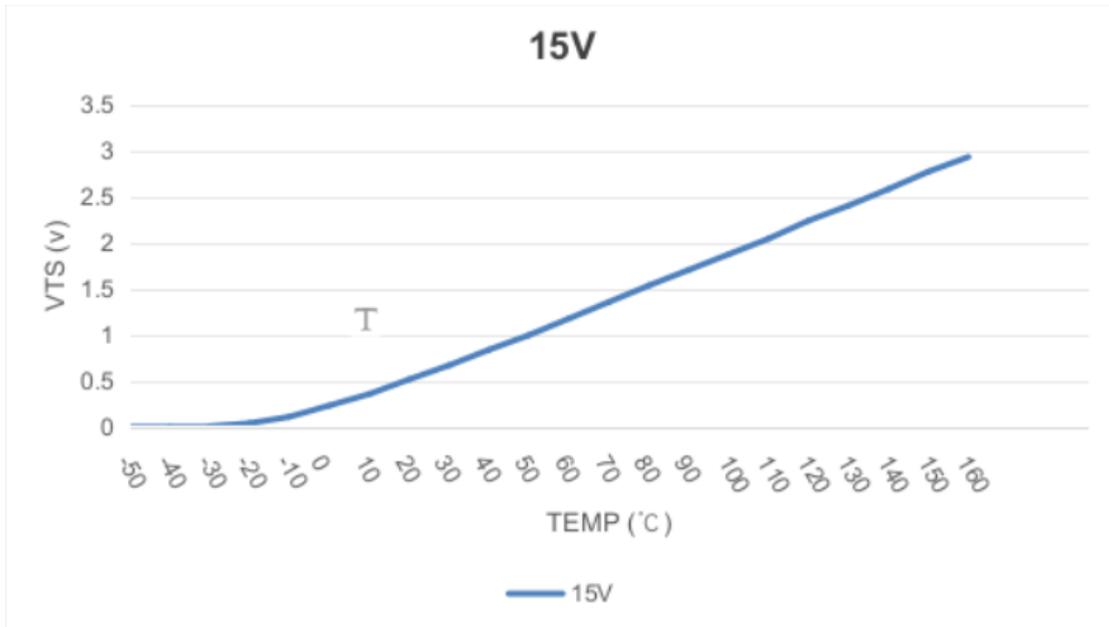
The temperature sensor output supports multi-chip parallel output, and the typical output data and curve are shown in the following figure. This range is only effective between -40°C and 150°C.

Table 6 VTS Parameters

TEMP (°C)	-20	-10	0	10	20	30	40	50	60	70
VTS (V)	0.039	0.11	0.233	0.358	0.518	0.671	0.841	1.00	1.18	1.36

TEMP (°C)	80	90	100	110	120	130	140	150	160	
VTS (V)	1.54	1.71	1.88	2.05	2.246	2.41	2.59	2.78	2.94	

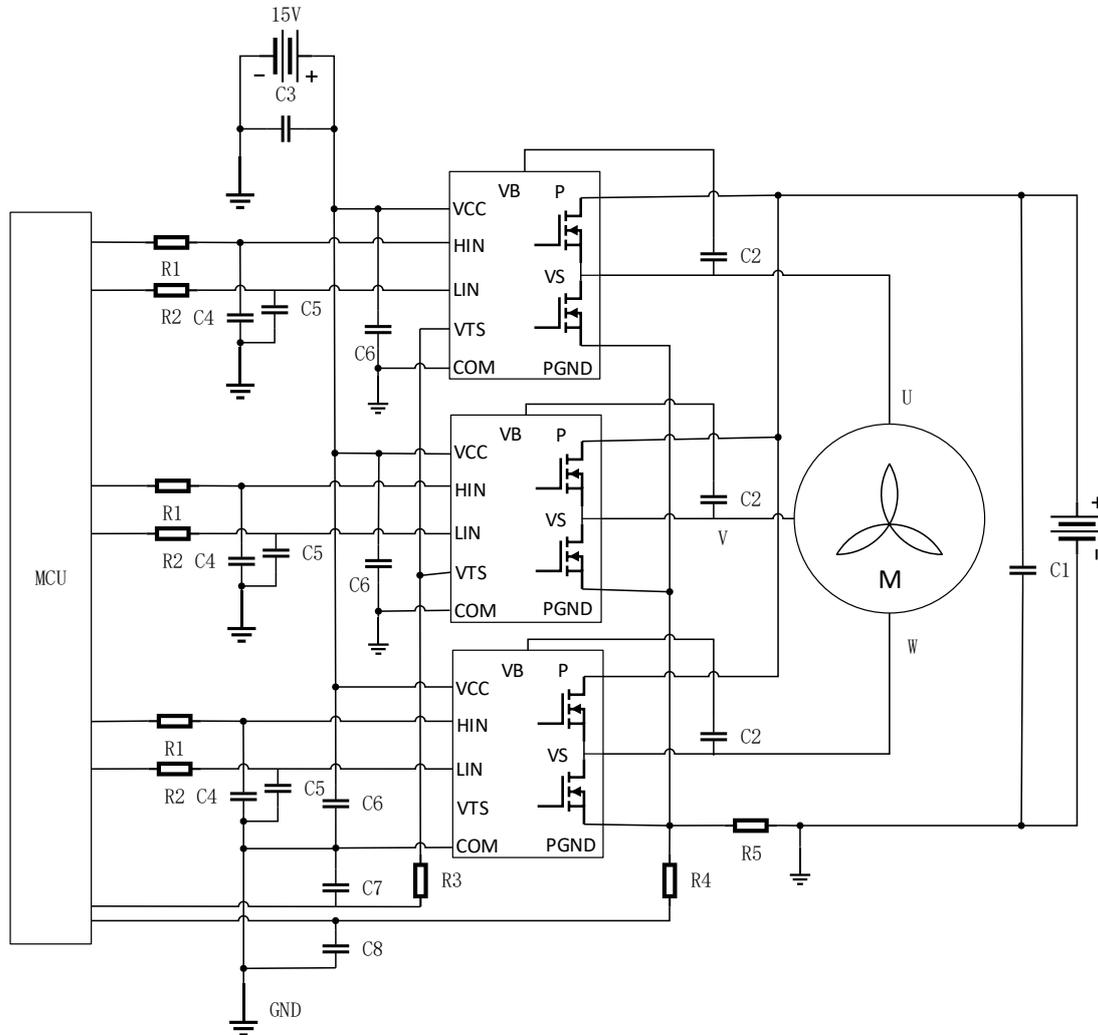
Figure 3 Typical Output Curve



5 Description of Application

5.1 Recommended application circuit diagram

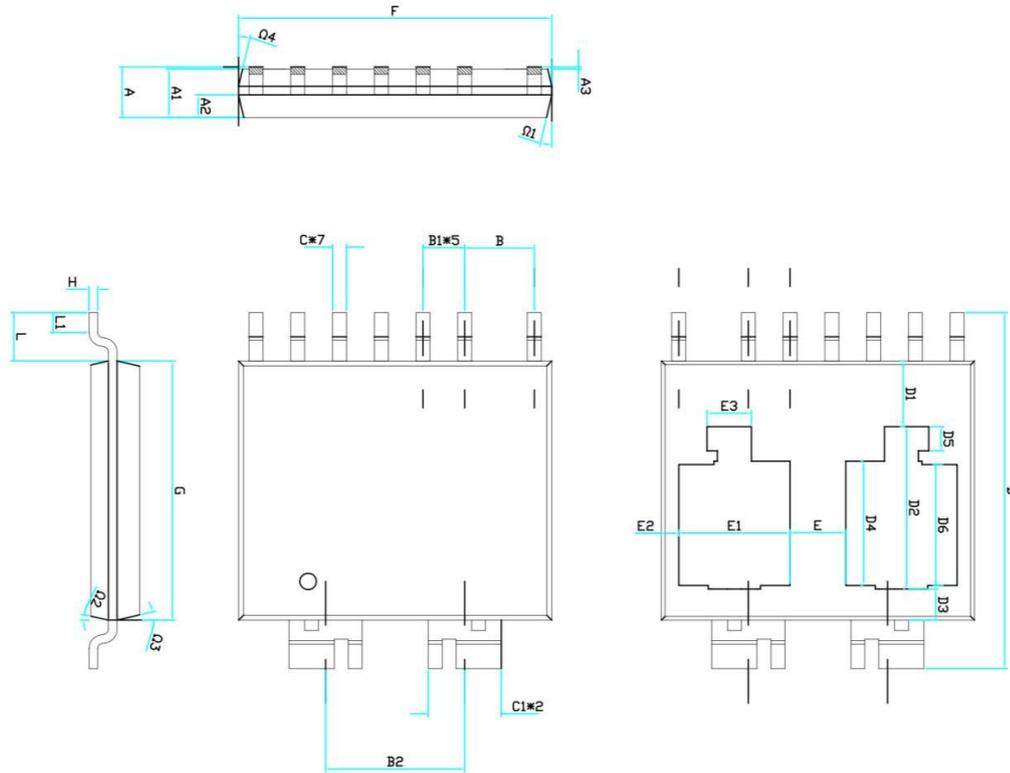
Figure 4 Application Circuit



6 Package Information

6.1 ESOP9

Figure 5 ESOP9 Package Diagram and Parameters



SYMBOL	MILLIETER(mm)		
	MIN	NOM	MAX
A	--	1.4600	--
A1	--	1.4000	--
A2	--	0.6500	--
A3	--	0.0600	--
B	--	2.0000	--
B1	--	1.2000	--
B2	--	4.0000	--
C	--	0.4000	--
C1	--	2.1000	--
D	--	10.3000	--
D1	--	1.9000	--
D2	--	4.7000	--
D3	--	0.9000	--
D4	--	3.6000	--
D5	--	0.7000	--
D6	--	3.5000	--
E	--	1.6000	--
E1	--	3.2000	--

E2	--	0.5000	--
E3	--	1.2760	--
F	--	9.0000	--
G	--	7.5000	--
L	--	1.4000	--
H	--	0.2500	--
Ω1	--	13°	--
Ω2	--	13°	--
Ω3	--	13°	--
Ω4	--	13°	--

Figure 6 ESOP9 Package Identification

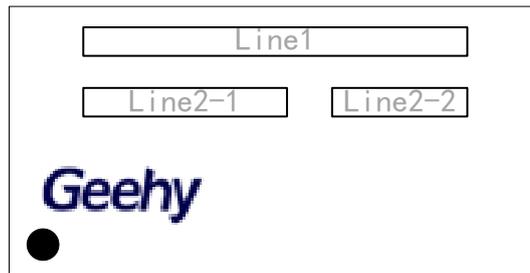


Table 7 Instructions for ESOP9 Silk Screen Printing Diagram

Symbol and icon	Description
Geehy	Geehy
Line1	Product model
Line2-1	Product batch code
Line2-2	Year and number of weeks
●	Location of PIN1

7 Ordering Information

Table 8 Ordering Information List

Product model	Package	Packaging	SPQ
GHP500N05	ESOP9	Reel	2500

Note: SPQ= Smallest Packaging Quantity

8 Revision History

Table 9 Document Revision History

Date	Version	Revision History
2026.2	1.0	● Initial version

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