

M56787FP

SPINDLE MOTOR DRIVER

DESCRIPTION

The M56787FP is a semiconductor integrated circuit in order to drive the spindle motor.

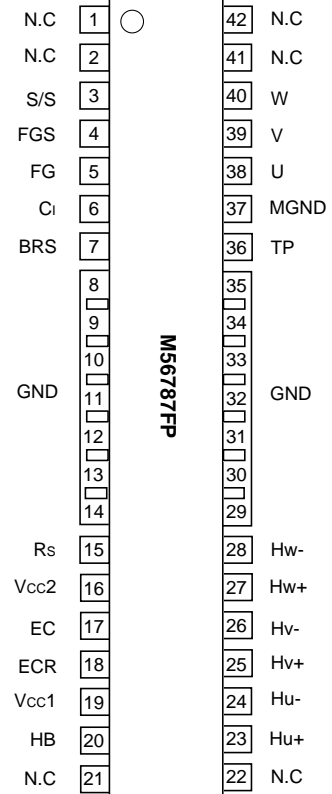
FEATURES

- Low motor echo noise.
- 3.3V DSP available.
- Large power dissipation package(Power Package).
- High motor drive current .
- Wide dynamic range.
- Motor current control for both motor torque directions.
- Reverse torque mode select [SHORT BRAKING,etc].
- Sleep mode.
- FG signal output terminal.
- FG pulse select.
- Automatic stop.

APPLICATION

CD-ROM, DVD, DVD-ROM, DVD-RAM etc.

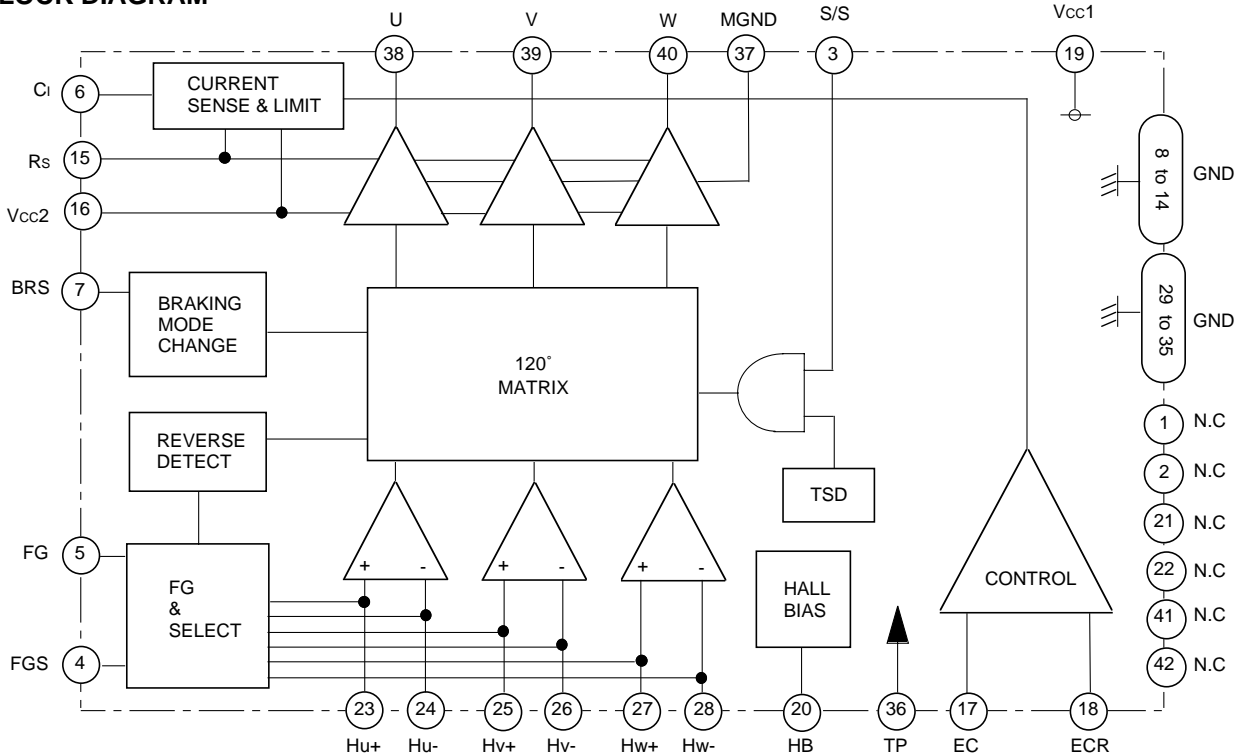
PIN CONFIGURATION (TOP VIEW)



Outline 42P9R-A

N.C: no connection

BLOCK DIAGRAM



PIN DESCRIPTIONS

Pin No.	Symbol	Function	Pin No.	Symbol	Function
①	N.C		④②	N.C	
②	N.C		④①	N.C	
③	S/S	Start / Stop	④④	W	Motor drive output W
④	FGS	FG pulse select	③⑨	V	Motor drive output V
⑤	FG	Frequency generator output	③⑧	U	Motor drive output U
⑥	Ci	Phase Compensation	③⑦	MGND	Motor GND
⑦	BRS	Reverse torque mode select	③⑥	TP	Test Note1
⑧-⑭	GND	GND	②⑨-③⑤	GND	GND
⑮	Rs	Motor current sense	②⑧	Hw-	Hw- Sensor amp. input
⑯	Vcc2	12V supply voltage	②⑦	Hw+	Hw+ Sensor amp. input
⑰	EC	Motor speed control	②⑥	Hv-	Hv- Sensor amp. input
⑱	ECR	The reference voltage for EC	②⑤	Hv+	Hv+ Sensor amp. input
⑲	Vcc1	5V supply voltage	②④	Hu-	Hu- Sensor amp. input
⑳	HB	Bias for Hall Sensor	②③	Hu+	Hu+ Sensor amp. input
㉑	N.C		②②	N.C	

* Pull-up resistors (10k Ω) are included in the circuits connected to [FG] pin.

* Note1. The ②③ pin (TP) is test terminal. Please make an open the ②④ pin (TP).

ABSOLUTE MAXIMUM RATING (Ta=25°C)

Symbol	Parameter	Conditions	Rating	Unit
Rs	Motor supply voltage	⑮ pin	16	V
Vcc2	12V supply voltage	⑯ pin	16	V
Vcc1	5V supply voltage	⑲ pin	7.0	V
Io	Output current	Note 2	1.5	A
VH(c)	Sensor amp. Differential input range	⑳-㉑ pins	4.5	V
Pt	Power dissipation	Free Air	1.2	W
K θ	Thermal derating	Free Air	9.6	mW/°C
Tj	Junction temperature		150	°C
Topr	Operating temperature		-20 - +75	°C
Tstg	Storage temperature		-40 - +125	°C

*Note2 ; The ICs must be operated within the Pt (power dissipation) or the area of safety operation

RECOMMENDED OPERATING CONDITIONS

Symbol	Parameter	Limits			Unit
		Min.	Typ.	Max.	
Vcc1	5V Power supply	4.5	5.0	5.5	V
Vcc2	12V Power supply	4.5	12.0	13.2	V
Io	Output drive current	—	—	1000	mA

ELECTRICAL CHARACTERISTICS (Vcc1=5V, Vcc2=12V , Ta=25°C unless otherwise noted.)

Symbol	Parameter	Conditions	Limits			Unit
			Min.	Typ.	Max.	
Isleep	Sleep Mode Supply current	Vcc1 & Vcc2 pin total Current (at S/S pin low or open)	—	—	10	μA
Icc	Supply current	Vcc1 & Vcc2 pin total Current (EC=ECR=1.5V) [S/S pin High]	—	—	10	mA
Vsat	Saturation voltage	Top and Bottom saturation voltage. (Load current :500mA)	—	1.2	1.9	V
ECdead- ECdead+	Control voltage dead zone	EC < ECR	-60	-30	0	mV
		EC > ECR	0	+30	+60	
ECR	Reference voltage Input range	⑱ pin [3.3V DSP available]	0	1.65	3.3	V
EC	Control voltage Input range	⑰ pin..[3.3V DSP available]	0	1.65	3.3	V
Gio	Control gain	Io = Gio / Rsense [A/V]	0.34	0.4	0.46	V/V
Vlim	Control limit	Ilim = Vlim / Rsense [A]	0.27	0.3	0.33	V
VH com	Hall sensor amp common mode input range	⑳ – ㉑ pins	1.3	—	4.4	V
VHmin	Hall sensor amp. input signal level	⑳ – ㉑ pins	60	—	—	mVp-p
VHb	Hall bias terminal output voltage	Load current (IHb) =10 mA.	0.6	0.85	1.2	V
IHb	Hall bias terminal sink current		—	—	30	mA
Von	Motor start voltage	[S/S]pin input voltage when it starts up the motor. *The IC is in the active condition. *The hall bias are available.	2.0	—	—	V
Voff	Motor stop voltage	[S/S]pin input voltage when it stops the motor. *The IC is in the sleep condition. *The hall bias are off.	—	—	0.8	V
ViH1	BRS input high voltage	BRS input voltage that the short braking is selected when the reverse torque.	3.6	—	—	V
ViM	BRS input middle voltage	BRS input voltage that the free run is selected when the reverse torque. Note3.	1.6	—	2.2	V
ViL1	BRS input low voltage	BRS input voltage that the reverse braking is selected when the reverse torque.	—	—	0.8	V
ViH2	Logic input high voltage	[FGS] input voltage when it is HIGH.	2.0	—	—	V
ViL2	Logic input Low voltage	[FGS] input voltage when it is LOW.	—	—	0.8	V
VoL	[FG] pin output low voltage	Io current = 1mA	—	—	0.5	V

*Note3. The ViM is the limit in case of external voltage input control. The free run mode is selected when the BRS pin is open, too.

THERMAL CHARACTERISTICS

Symbol	Parameter	Function start temperature of IC			Function stop temperature of IC			Unit
		Min.	Typ.	Max.	Min.	Typ.	Max.	
TSD	Thermal Shut Down		165			125		°C

The relationship with I/O control and the braking mode

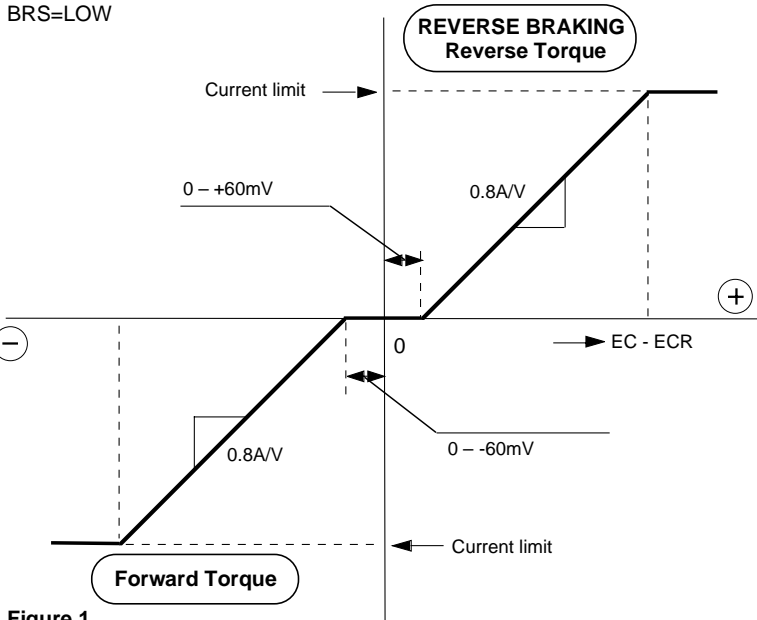


Figure 1.

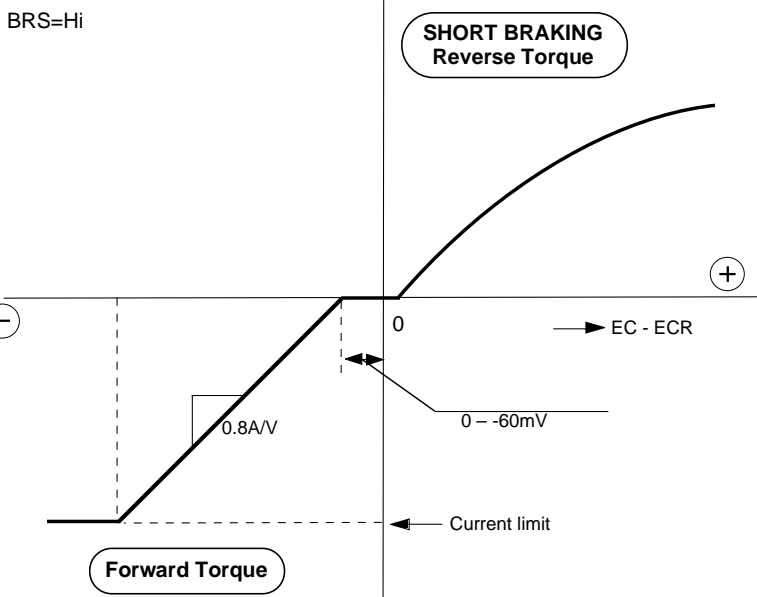


Figure 2.

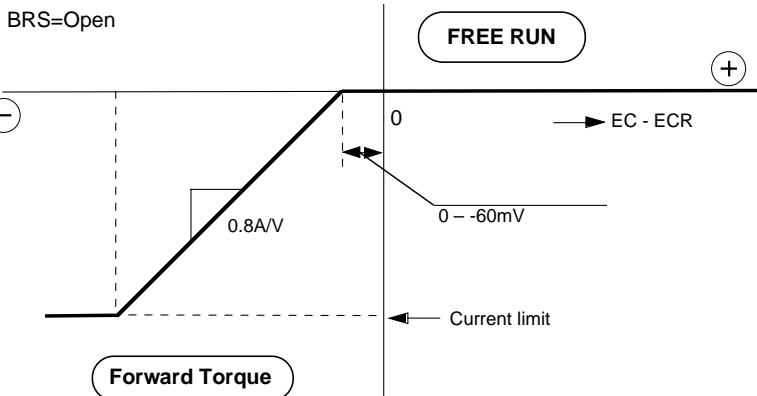


Figure 3.

The braking mode is selected flexibly by using the BRS terminal.

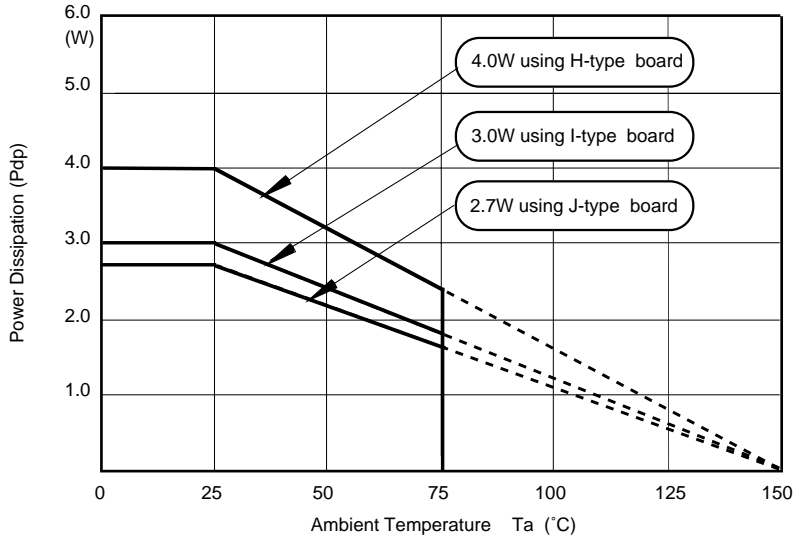
The relationship between the EC-ECR (the difference between EC <control voltage> and ECR <reference voltage>) and the torque is shown in Figure 1,2 and 3. The current gain is 0.8A/V (at sensing resistor :0.5ohm) in forward torque directions, and the dead zone is from 0mV to 60mV.

When the reverse brake mode(BRS=Lo) is selected, the coil current gain under the reverse torque control is the same with in forward torque directions.

When the short brake mode(BRS=Hi) is selected, the coil current under the reverse torque control depends on the back emf. and the coil resistance.

When the free run mode(BRS=open) is selected, the coil current under the reverse torque control (EC-ECR>0) becomes zero and in free run situation.

THERMAL DERATING



This IC's package is POWER-SSOP, so improving the board on which the IC is mounted enables a large power dissipation without a heat sink.
 For example, using an 1 layer glass epoxy resin board, the IC's power dissipation is 2.7W at least. And it comes to 4.0W by using an improved 2 layer board.
 The information of the H, I, J type board is shown in the board information.

HALL AMPLIFIER INPUT AND COMMUTATION

The relationship between the hall amplifier inputs voltage and the motor current outputs is shown in Figure 4.

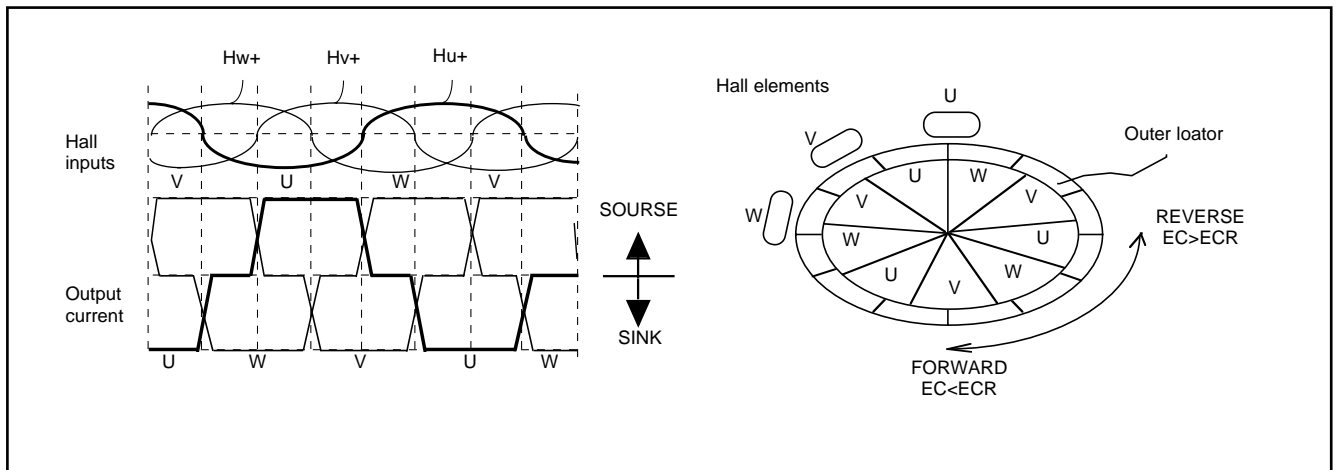


Figure 4.

SLEEP MODE FUNCTION

START / STOP (S/S pin)	
LOW or OPEN	HIGH
Motor Stop Bias off Hall-Bias off	Motor on Bias on Hall-Bias on

Figure 5.

Figure 5 shows the sleep mode function. If the [S/S] pin is set to be open or low, the motor drive outputs have high impedance and the motor stops. Then, the IC bias current will be a slight current (please refer to the electrical characteristics), and the hall bias output will be cut off. When the [S/S] pin input is high, all the circuits will work.

FG FUNCTION

FG pulse select (FGS pin)	
LOW or OPEN	HIGH
NX1 pulse	NX3 pulse

Figure 6.

It is possible for user to switch the output pulse numeric by external logic control using FG pulse select terminal [FGS].

Figure 6 shows the FG pulse select function.

The FG pin outputs the square pulse signal synchronizing with the hall inputs [Hv+ and Hv-] timing when FGS=LOW or OPEN. When FGS=HIGH, it outputs the square pulse signal of 3 times.

The FG pin is pulled-up to Vcc1 by an internal resistor [typ. 10Kohm].

BRAKING MODE SELECT FUNCTION

Braking mode select [BRS] pin	
HIGH	SHORT BRAKE
OPEN	FREE RUN
LOW	REVERSE BRAKE

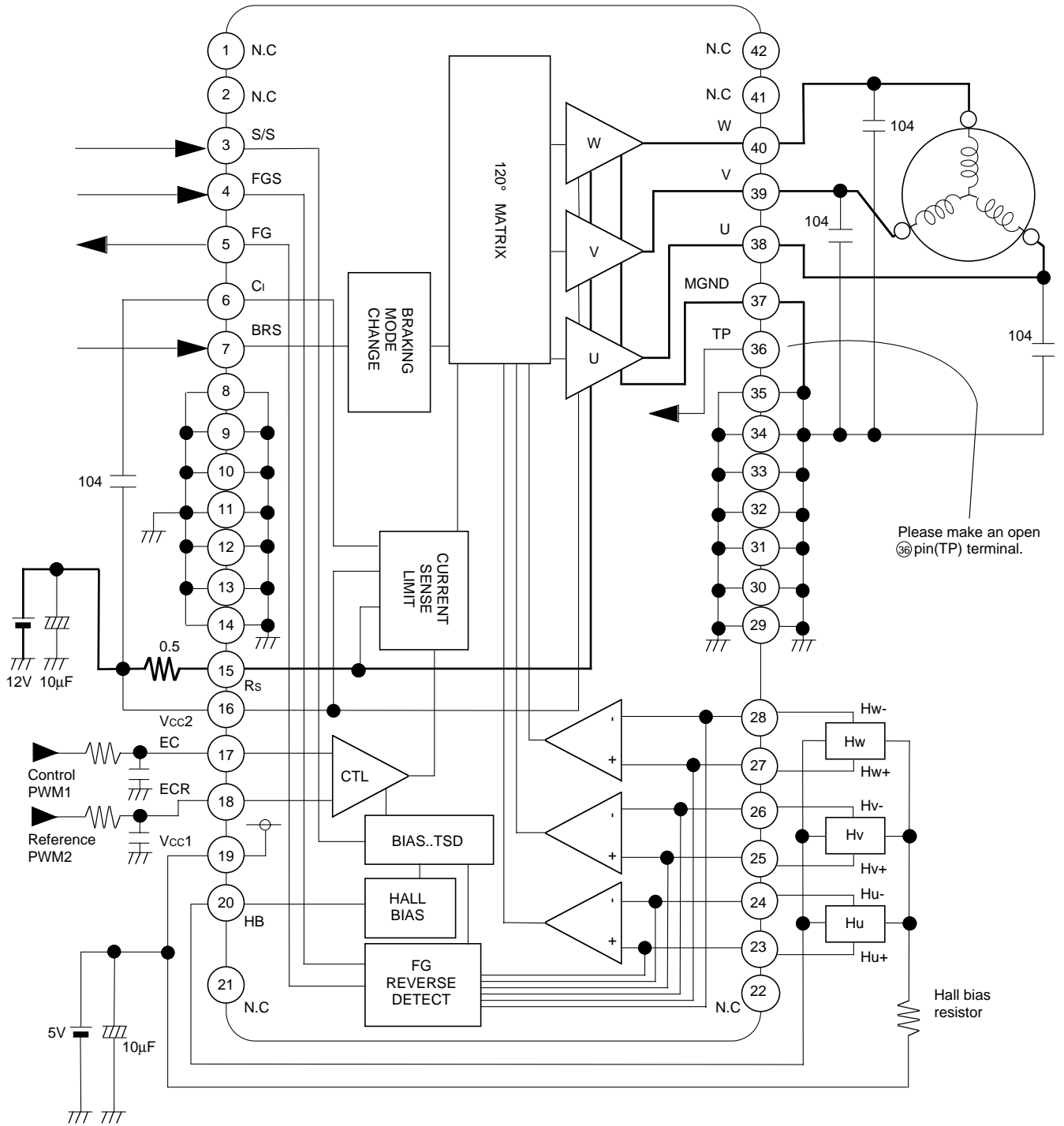
Figure 7.

It is possible to select three kinds of mode [the reverse braking, the short braking and the free run] in reverse torque by logic control using the BRS terminal.

Figure 7 shows the function table of the braking mode select.

It is the reverse braking when BRS is LOW, the short braking when BRS is HIGH and the free run when BRS is OPEN.

APPLICATION CIRCUIT



AREA OF SAFTY OPERATION

