# M56733AFP

3-PHASE BRUSHLESS MOTOR CONTROL

## DESCRIPTION

The M56733AFP is a semiconductor integrated circuit designed as a single chip controller for the FDD spindle motor. The IC is equipped with a power amplifier, hole amplifier, FG amplifier, oscillator, speed discriminator, and various types of protection circuits.

Equipped with MOD pin that enables 3-speed switching with a single pin, the M56733AFP is very convenient to make system compact.

## FEATURES

- Provided with digital servo enabling high precision, high stability and non-adjustment.
- 3-speed switching function with a pin ..... MOD
- Enable two systems ..... EN•$\overline{EN}$
- $I_O$ (peak)=1.0A
- Low capacitance of dumping capacitor

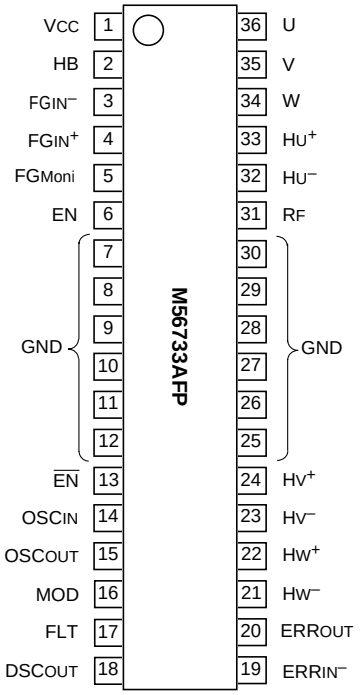
## APPLICATION

FDD spindle motor (5")

## RECOMMENDED OPERATING CONDITIONS

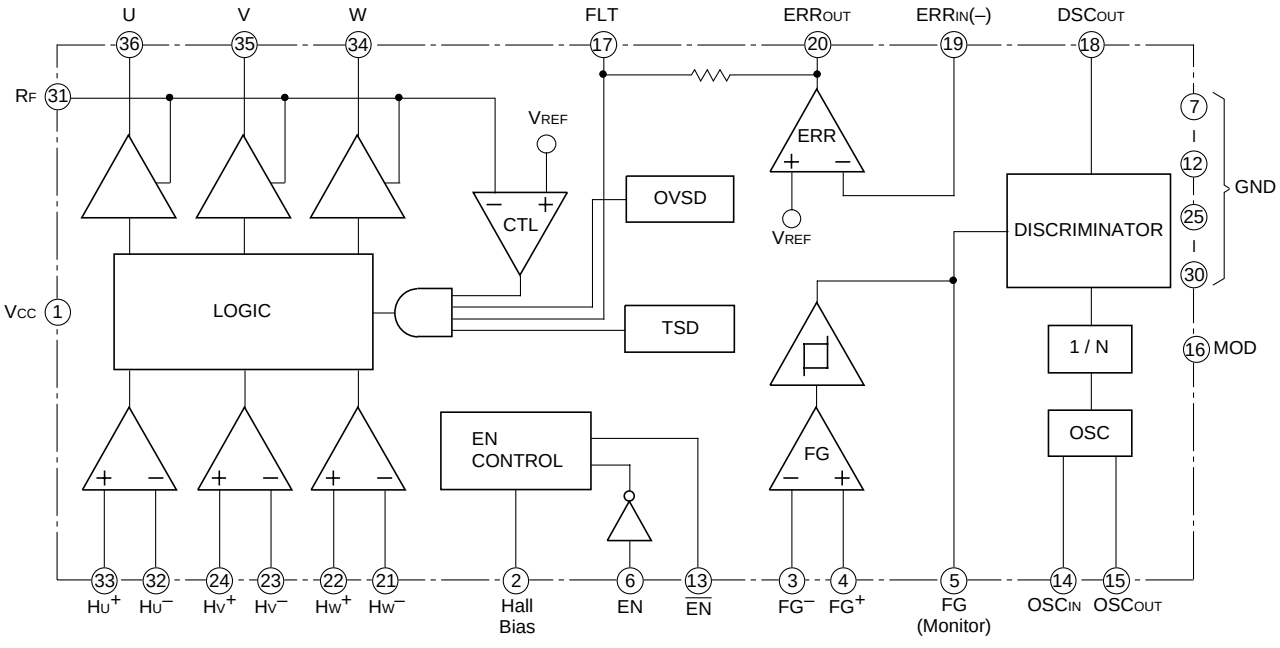
Supply voltage ..... 10.8 – 12.0 – 13.2 V
Oscillation frequency ..... 492 kHz
Maximum output current ..... 800 mA
FG amplifier input signal level ..... 5 mVp-p or more

## PIN CONFIGURATION (TOP VIEW)




Outline 36P2R-D

## BLOCK DIAGRAM

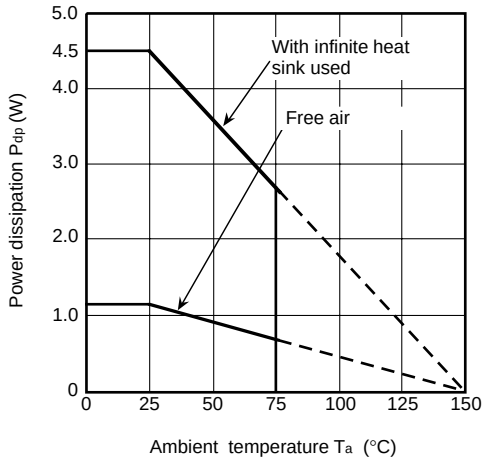


## ABSOLUTE MAXIMUM RATINGS (Ta=25˚C)

| Symbol | Parameter | Conditions | Ratings | Unit |
|---|---|---|---|---|
| $V_{CC}$ | Supply voltage | | 15 | V |
| Io | Output current | | 1.0 | A |
| $V_{HD}$ | Hole amplifier, differential input voltage | Between 21 and 22, between 23 and 24, between 32 and 33 (pin number) | 5 | V |
| $V_{IN}$ | Apply voltage at pin | 6,13,21 – 24,32,33 (pin number) | 0 – $V_{CC}$ | V |
| $f_{IN}$ | Clock frequency | | 1000 | kHz |
| $P_t$ | Power dissipation | Use of infinite heat sink | 4.5 | W |
| $K_\theta$ | Thermal derating | Use of infinite heat sink | 27.8 | °C/W |
| $T_j$ | Temperature at junction | | 150 | °C |
| $T_{opr}$ | Operating temperature | | -20 – 75 | °C |
| $T_{stg}$ | Storage temperature | | -40 – 125 | °C |

## TYPICAL CHARACTERISTICS

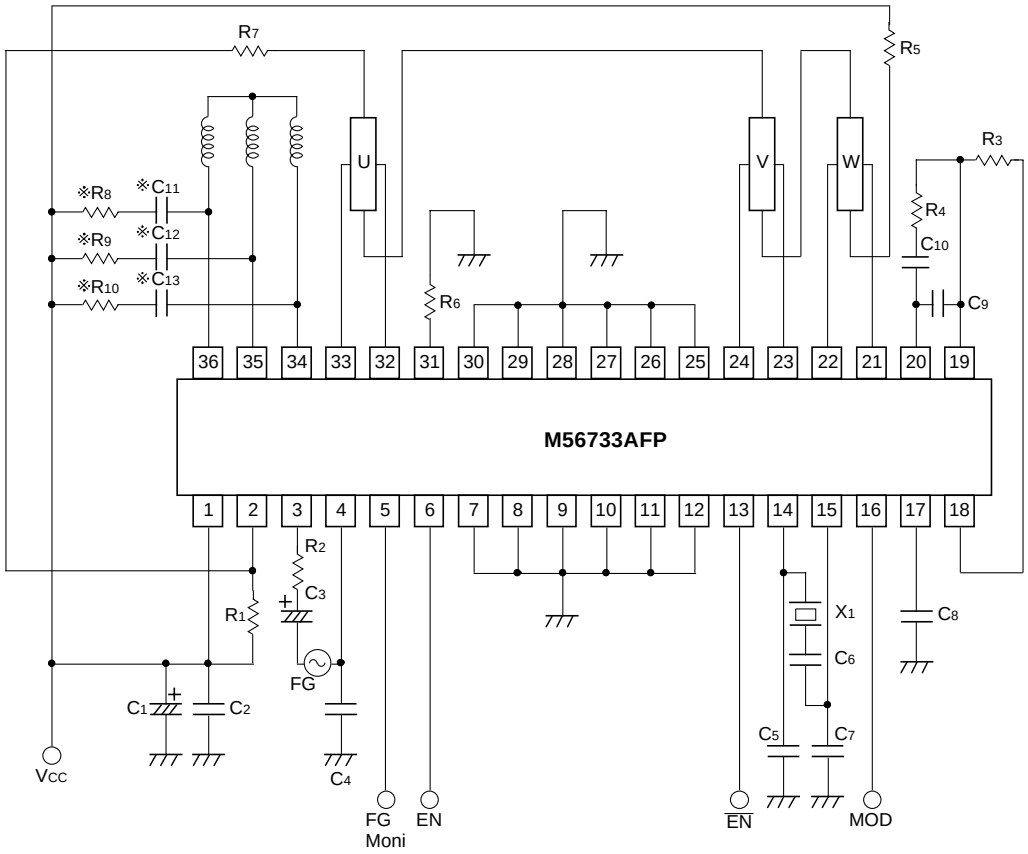
Thermal derating (Maximum rating)



**ELECTRICAL CHARACTERISTICS** (Ta=25˚C, $V_{CC}$=12V unless otherwise noted)

| Symbol | Parameter | Test conditions | Limits | | | Unit |
|---|---|---|---|---|---|---|
| | | | Min. | Type. | Max. | |
| $I_{CC}H$ | Circuit current | Except for injector current with circuit turned ON | 9 | 18 | 28 | mA |
| $I_{CC}L$ | Circuit current | With circuit turned OFF | – | – | 300 | µA |
| $I_{IN}HA$ | Hole amplifier input current | | – | 0.4 | 4.0 | µA |
| $V_N$ | Phase output center voltage | | 5.1 | 6.3 | 7.1 | V |
| $\Delta V_N$ | Center voltage difference between phases | | – | – | 0.2 | V |
| $V_{sat}$ | Output saturation voltage | $I_O$=0.7A, sum of upper and lower voltage | – | 2.8 | 3.2 | V |
| $V_{TH}$ | Control input reference voltage | Voltage at FLT pin when output starts | 1.05 | 1.20 | 1.35 | V |
| $G_V$ | Voltage gain between control input and output | Source side | 16.65 | 18.05 | 25.10 | dB |
| | | Sink side | 20.82 | 23.80 | 26.81 | |
| | | Source + Sink | 26.00 | 28.00 | 30.00 | |
| $\Delta G_V$ | Difference in voltage gain between phases | | – | – | 2 | dB |
| $V_{ref}$ | Error amplifier reference voltage | Measurement of mean level of discriminator output | 2.0 | 2.2 | 2.4 | V |
| $I_{IN}$•E | Error amplifier input current | | -0.2 | -0.02 | – | µA |
| Vo•E | Error amplifier output level | Hi | 2.2 | 2.5 | 3.1 | V |
| | | Lo | 0.6 | 0.8 | 1.05 | |
| $V_{CL}$ | Current limit reference voltage | Voltage at RF pin when the voltage at FLT pin is lower than 1.5V. | 0.36 | 0.40 | 0.44 | V |
| $V_{IN}$ | Function input threshold voltage | Hi 6,13pin | 2.5 | – | – | V |
| | | Lo 6,13pin | – | – | 1.0 | |
| $I_{IN}$ | Input current at function input pin | $V_{IN}$=12V 6pin | 500 | 700 | 1000 | µA |
| | | $V_{IN}$=0V 13pin | -150 | -100 | -70 | |
| $V_{inj}$ | Voltage at injector pin | $I_{inj}$=6mA | 0.6 | 0.9 | 1.5 | V |
| $V_O$DSC | Discriminator output level | Hi | 4.1 | 4.8 | 5.3 | V |
| | | Lo | 0.5 | 0.8 | 1.2 | |
| $\Delta T$ | Discriminator count error | + for deceleration side, - for acceleration side fosc=492kHz | -6 | 1 | 6 | µs |
| fosc | Oscillation frequency | fosc=492kHz | -0.2 | – | 0.2 | % |
| $I_{inj}$MAX | Maximum operating current of injector | fosc=492kHz | 25 | – | – | mA |
| $I_{inj}$MIN | Minimum operating current of injector | fosc=492kHz | – | – | 4 | mA |
| VOLFG | FG amplifier output low level (monitor) | IL=200µA | – | 0.1 | 0.2 | V |
| I1FG | Leak current at FG amplifier output pin (monitor) | 12V applied | – | – | 1.0 | µA |
| $I_{IN}$MOD | Input current at MOD pin | 12V applied | 435 | 565 | 800 | µA |
| | | 0V applied | -75 | -98 | -140 | |

## APPLICATION CIRCUIT EXAMPLE




<Constants>

| | |
|---|---|
| | C1=33µF |
| | C2=0.47µF |
| | C3=10µF |
| R1=5.1kΩ | C4=0.01µF |
| R2=510Ω | C5=165pF |
| R3=47kΩ | C6=56pF |
| R4=180kΩ | C7=165pF |
| R5=1.2kΩ | C8=1µF |
| R6=0.5Ω | C9=0.01µF |
| R7=1.2kΩ | C10=0.1µF |
| R8=4.7Ω | C11=0.1µF |
| R9=4.7Ω | C12=0.1µF |
| R10=4.7Ω | C13=0.1µF |

X1=492kHz
(Oscillator)

Notes: 1. Sets items with ※when measures for such as oscillation require to be taken.
2. $R_1$ is to be used for injection current boost. Set $R_1$, if necessary.
3. Set $R_2$ when gain adjustments are required.

4. Enable function

| EN / $\overline{EN}$ | LO | Hi |
|---|---|---|
| Lo | DISABLE | ENABLE |
| Hi | DISABLE | DISABLE |

5. Mode function

| Mode pin | FG synchronous frequency |
|---|---|
| Lo (MOD ≤ 0.8V) | fosc/1640Hz |
| M (Open status) | fosc/820Hz |
| Hi (MOD ≥ 2.6V) | fosc/(4100/3) Hz |