

M56733AFP

3-Phase Brushless Motor Driver

REJ03F0081-0100Z

Rev.1.0

Sep.22.2003

Description

The M56733AFP is a semiconductor integrated circuit designed as a single-chip controller for FDD spindle motors. It incorporates a power amplifier, Hall amplifier, FG amplifier, oscillator, and speed discriminator, along with various protective circuits. Control of switching between three speeds by the single MOD pin gives this IC the edge for use in compact systems.

Features

- Digital servo provides high precision, good stability, and freedom from the need for adjustment.
- A single pin controls switching between three speed. ●● MOD
- Two enable signals. ●● EN, $\overline{\text{EN}}$
- $I_{O(\text{peak})} = 1.0 \text{ A}$
- Low-capacitance damping capacitor

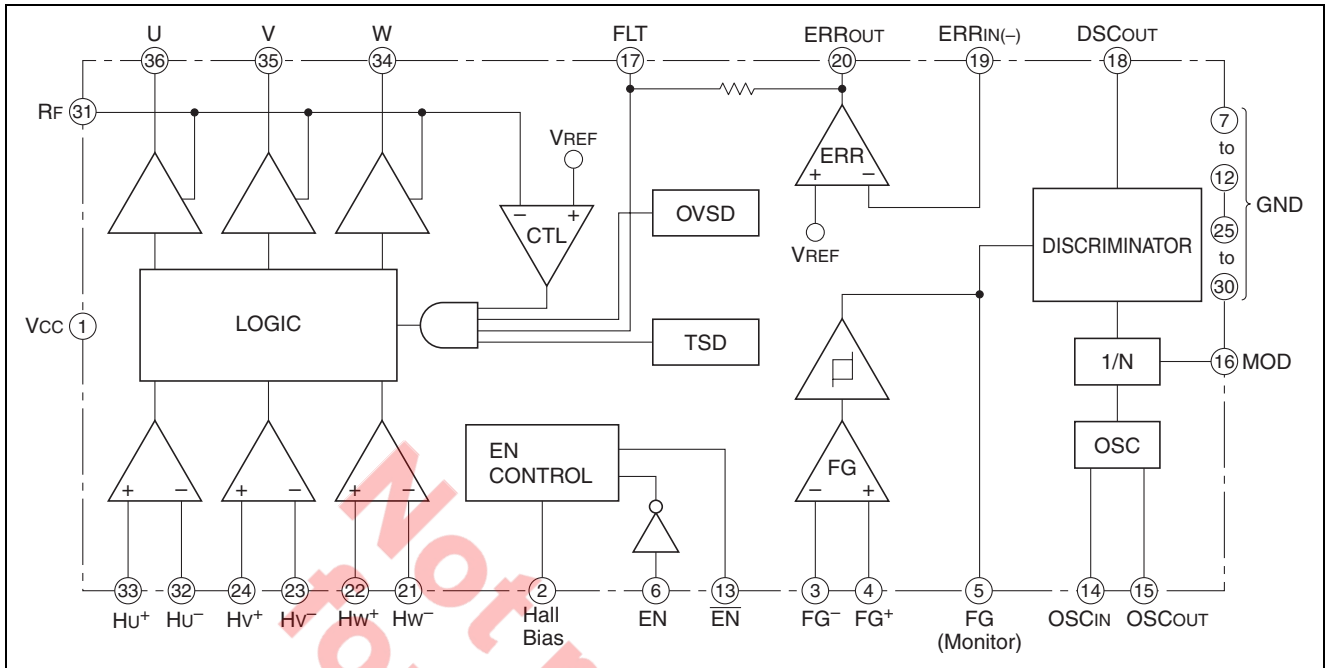
Applications

- FDD spindle motors (5 inches)

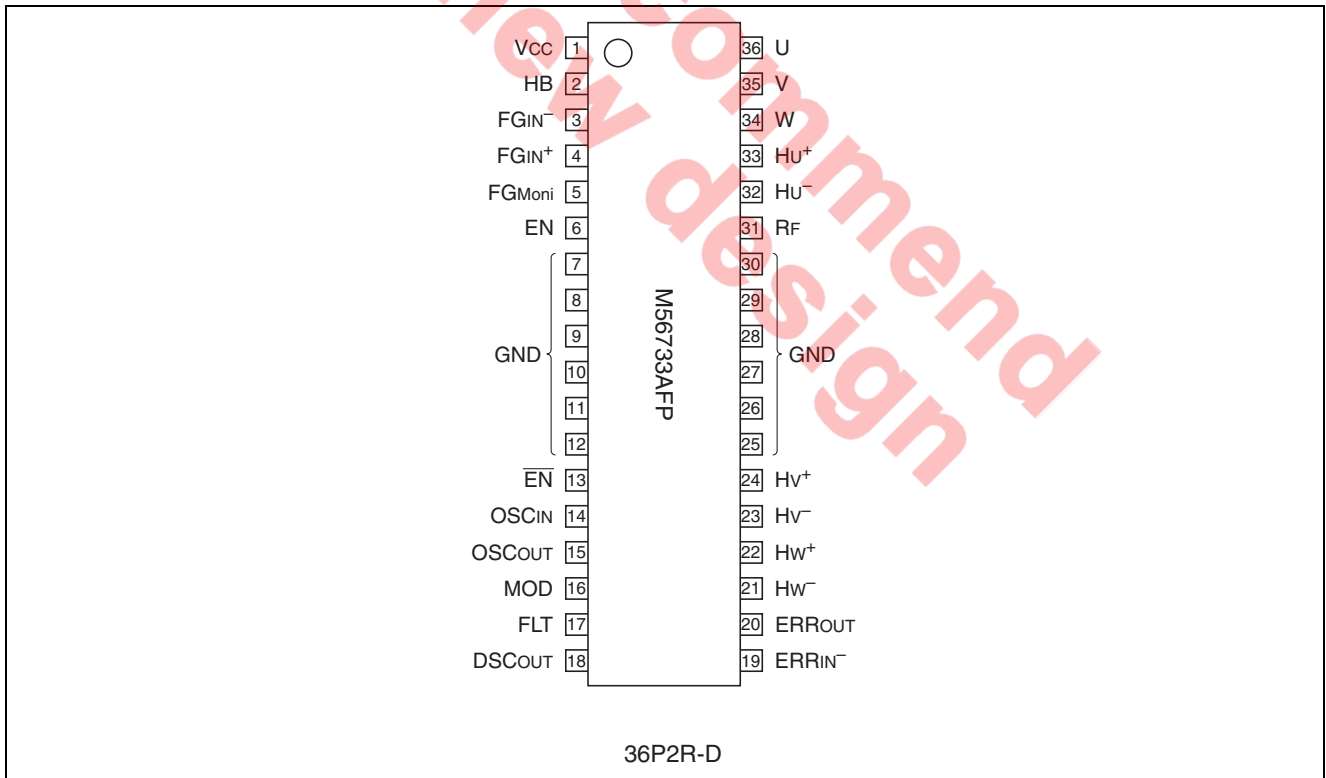
Recommended Operating Conditions

- Power-supply voltage: 10.8 (min.) to 13.2 (max.), 12.0 (typ.)
- Oscillation frequency: 492 kHz
- Maximum output current: 800 mA
- FG amplifier input signal level: 5 mVp-p or more

Block Diagram



Pin Configuration

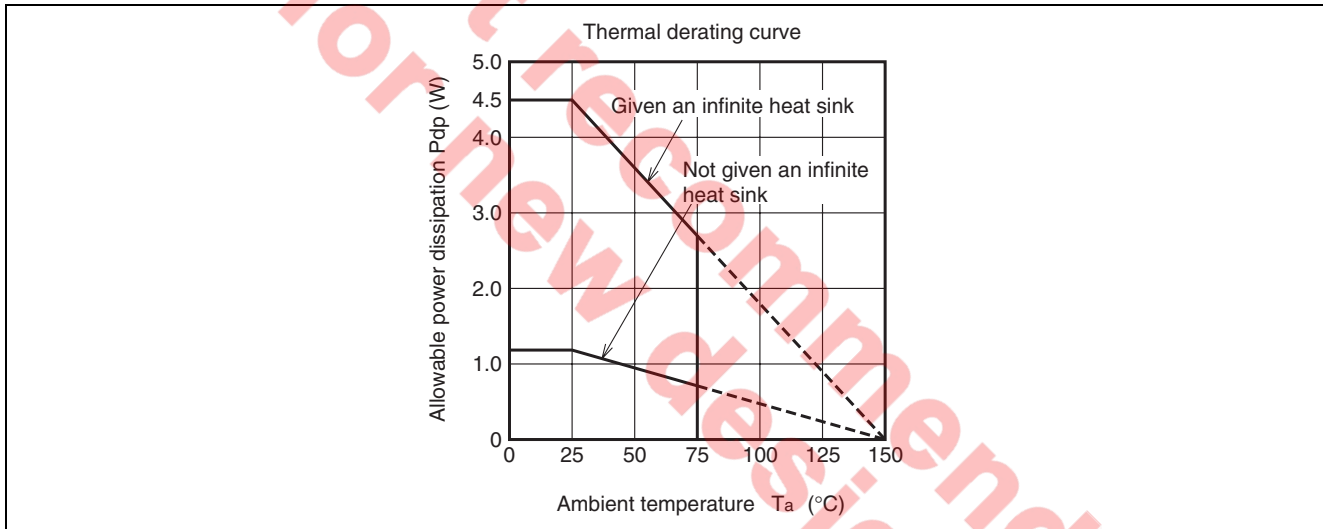


Absolute Maximum Ratings

(Ta = 25°C)

Symbol	Parameter	Test conditions	Ratings	Unit
V _{CC}	Power-supply voltage		15	V
I _o	Output current		1.0	A
V _{HD}	Hall amplifier differential input voltages	Between pins 21 and 22, 23 and 24, and 32 and 33	5	V
V _{IN}	Voltage applied to pins	6, 13, 21 to 24, 32, 33 (pin numbers)	0 to V _{CC}	V
f _{IN}	Clock frequency		1000	kHz
P _t	Allowable dissipation	Infinite heat sink	4.5	A
K _θ	Thermal derating range	Infinite heat sink	27.8	°C/W
T _j	Junction temperature		150	°C
T _{opr}	Ambient operating temperature		-20 to 75	°C
T _{stg}	Storage temperature		-40 to 125	°C

Characteristic curves

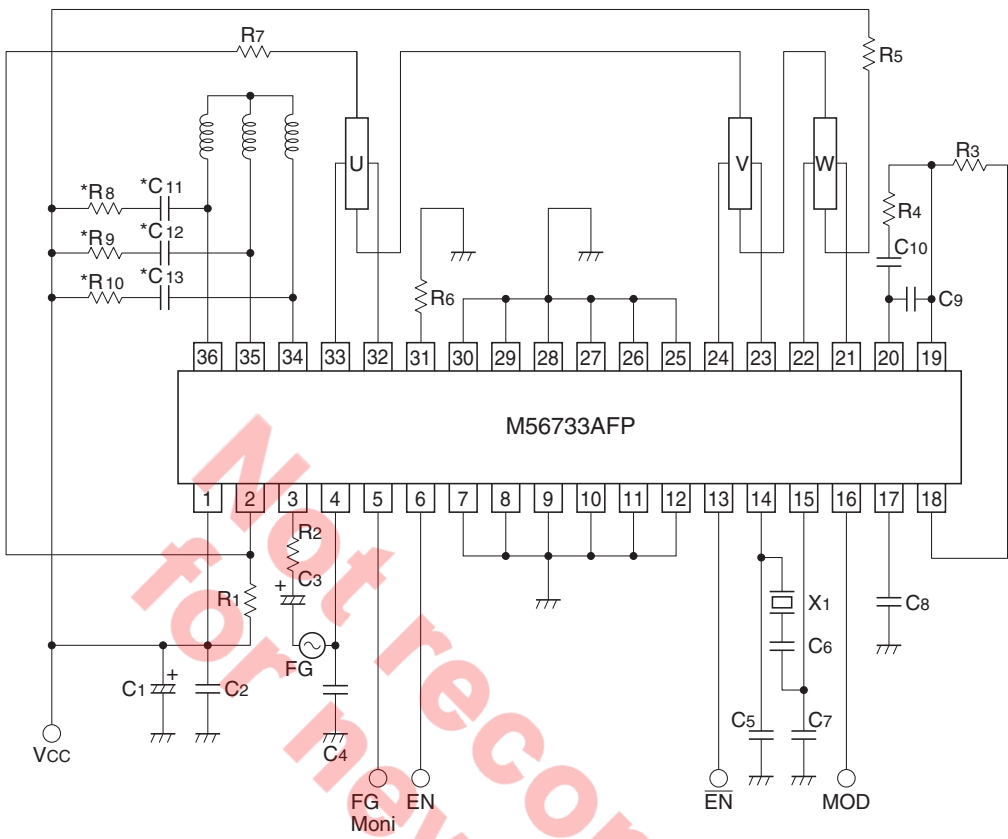


Electrical Characteristics

(unless otherwise noted, $T_a = 25^\circ\text{C}$, $V_{CC} = 5.0\text{ V}$.)

Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
I_{CCH}	Circuit Current	When the circuit is switched on. Excludes the injector current.	9	18	28	mA
I_{CCL}	Circuit Current	When only the minimal circuit is switched on.	—	—	300	μA
I_{INHA}	Current input to the Hall amplifier		—	0.4	4.0	μA
V_N	Voltage when the output is at the mid-phase point		5.1	6.3	7.1	V
ΔV_N	Difference of voltage when the output is at the mid-phase point		—	—	0.2	V
V_{sat}	Saturation output voltage	$I_o = 0.7\text{ A}$, sum of upper and lower transistors	—	2.8	3.2	V
V_{TH}	Control-input reference voltage	FLT-pin voltage for which motor rotates	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	dB
		Source and sink sides	26.00	28.00	30.00	dB
ΔG_V	Difference of voltage-gain between phases		—	—	2	dB
V_{ref}	Error amplifier reference voltage	Intermediate level of discriminator output is measured	2.0	2.2	2.4	V
$I_{IN \bullet E}$	Error amplifier input current		-0.2	-0.02		μA
$V_{O \bullet E}$	Error amplifier output level	High	2.2	2.5	3.1	V
		Low	0.6	0.8	1.05	V
V_{CL}	Current-limiting reference voltage	The RF pin voltage when voltage on the FLT pin falls below 1.5 V. No load.	0.36	0.40	0.44	V
V_{IN}	Function- input threshold voltage	High Pins 6 and 13	2.5	—	—	V
		Low	—	—	0.1	V
I_{IN}	Current input to the function-input pins	$V_{IN} = 12\text{ V}$, pin 6	500	700	1000	V
		$V_{IN} = 0\text{ V}$, pin 13	-150	-100	-70	V
V_{inj}	Injector pin voltage		0.6	0.9	1.5	V
V_{oDSC}	Discriminator output level	High	4.1	4.8	5.3	V
		Low	0.5	0.8	1.2	V
ΔT	Discriminator count error	+ : Deceleration side - : Acceleration side $f_{osc} = 492\text{ kHz}$	-6	1	6	μA
f_{osc}	Oscillation frequency	$f_{osc} = 492\text{ kHz}$	-0.2	—	0.2	%
I_{injMAX}	Injector max. operating current	$f_{osc} = 492\text{ kHz}$	25	—	—	mA
I_{injMIN}	Injector min. operating current	$f_{osc} = 492\text{ kHz}$	—	—	4	mA
V_{OLFG}	FG amplifier output low level (monitor)	$I_L = 200\text{ }\mu\text{A}$	—	0.1	0.2	V
I_{IFG}	FG amplifier output pin leakage current (monitor)	When 12 V is applied	—	—	1.0	μA
I_{INMOD}	Current input to the MOD pin	When 12 V is applied	435	565	800	μA
		When 0 V is applied	-75	-98	-140	μA

Application Example



(Individual values)

- C₁=33 F
- C₂=0.47 F
- C₃=10 F
- C₄=0.01 F
- C₅=165pF
- C₆=56pF
- C₇=165pF
- C₈=1 F
- C₉=0.01 F
- C₁₀=0.1 F
- C₁₁=0.1 F
- C₁₂=0.1 F
- C₁₃=0.1 F
- R₁=5.1k
- R₂=510
- R₃=47k
- R₄=180k
- R₅=1.2k
- R₆=0.5
- R₇=1.2k
- R₈=4.7
- R₉=4.7
- R₁₀=4.7
- X₁=492kHz (Oscillator)

Notes:

1. Values for elements marked * (asterisk) must be selected to prevent oscillation.
2. R₁ is used to boost the injection current. Select a suitable value.
3. Select an element of suitable value as required to adjust the gain.

4. Enable function

	EN	Lo	Hi
EN			
Lo		DISABLE	ENABLE
Hi		DISABLE	DISABLE

5. Mode function

Mode pin	FG synchronization frequency
Lo (MOD ≤ 0.8V)	fosc/1640Hz
M (Open)	fosc/820Hz
Hi (MOD V 2.6V)	fosc/ (4100/3) Hz

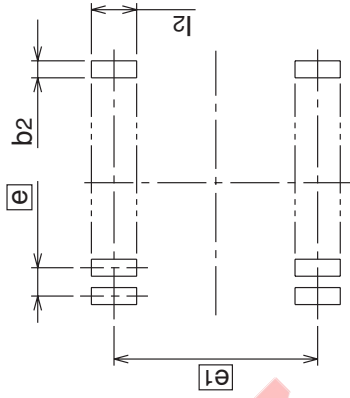
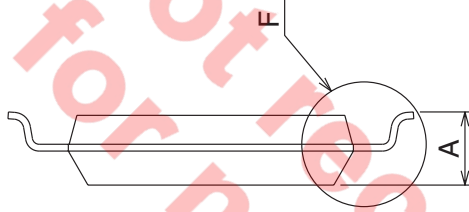
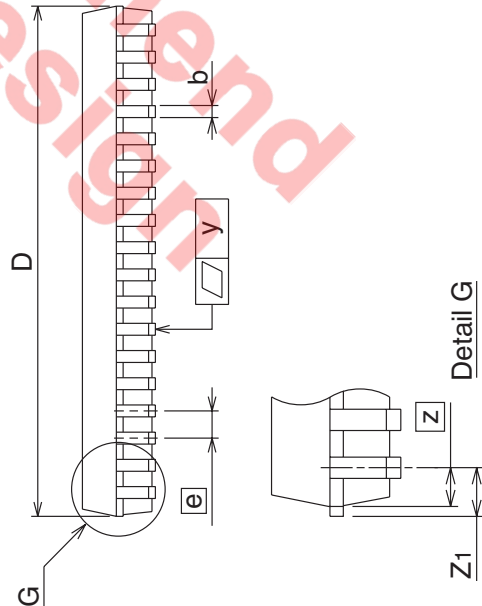
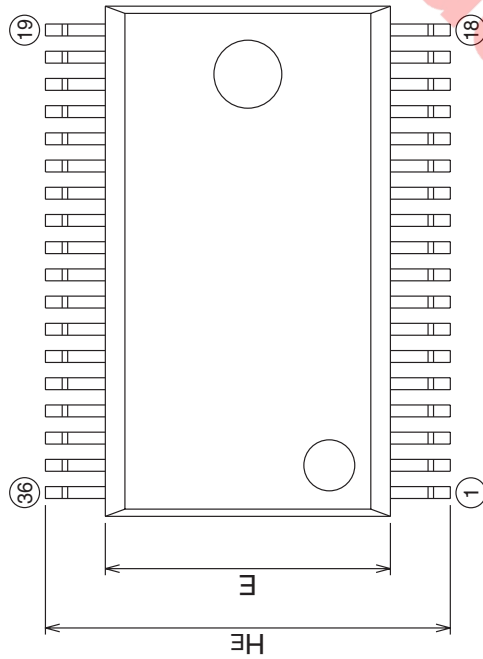
Package Dimensions

36P2R-D

(MMP)

Plastic 36pin 450mil SSOP

EIAJ Package Code SSOP36-P-450-0.80	JEDEC Code —	Weight(g) 0.53	Lead Material Cu Alloy
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Recommended Mount Pad

Symbol	Dimension in Millimeters		
	Min	Norm	Max
A	—	—	2.35
A1	0	0.1	0.2
A2	—	2.05	—
b	0.3	0.35	0.45
c	0.18	0.2	0.25
D	14.8	15.0	15.2
E	8.2	8.4	8.6
e	—	0.8	—
HE	11.63	11.93	12.23
L	0.3	0.5	0.7
L1	—	1.765	—
Z	—	0.7	—
Z1	—	—	0.85
y	—	—	0.15
theta	0°	—	8°
b2	—	0.5	—
e1	—	11.43	—
l2	1.27	—	—

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