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, $\overline{EN}$
- $I_{O\ (peak)}$ = 1.0 A
- Low-capacitance damping capacitor

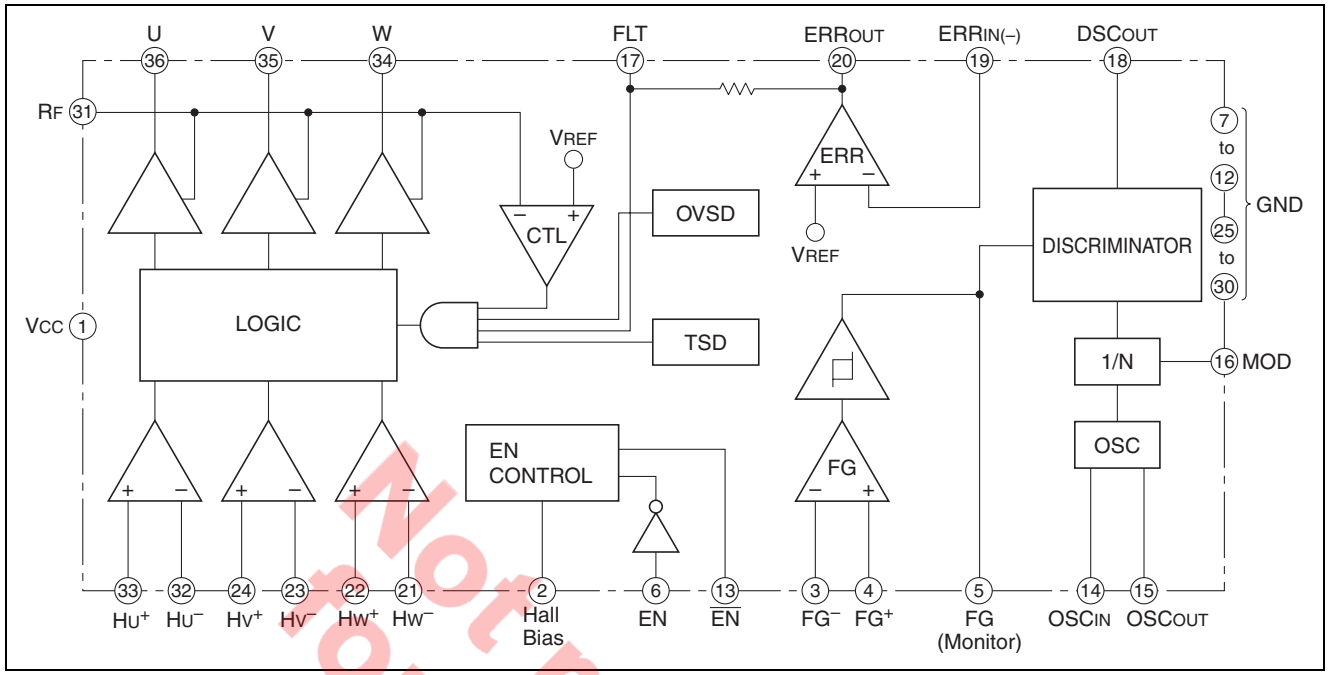
Applications

- FDD spindle motors (5 inches)

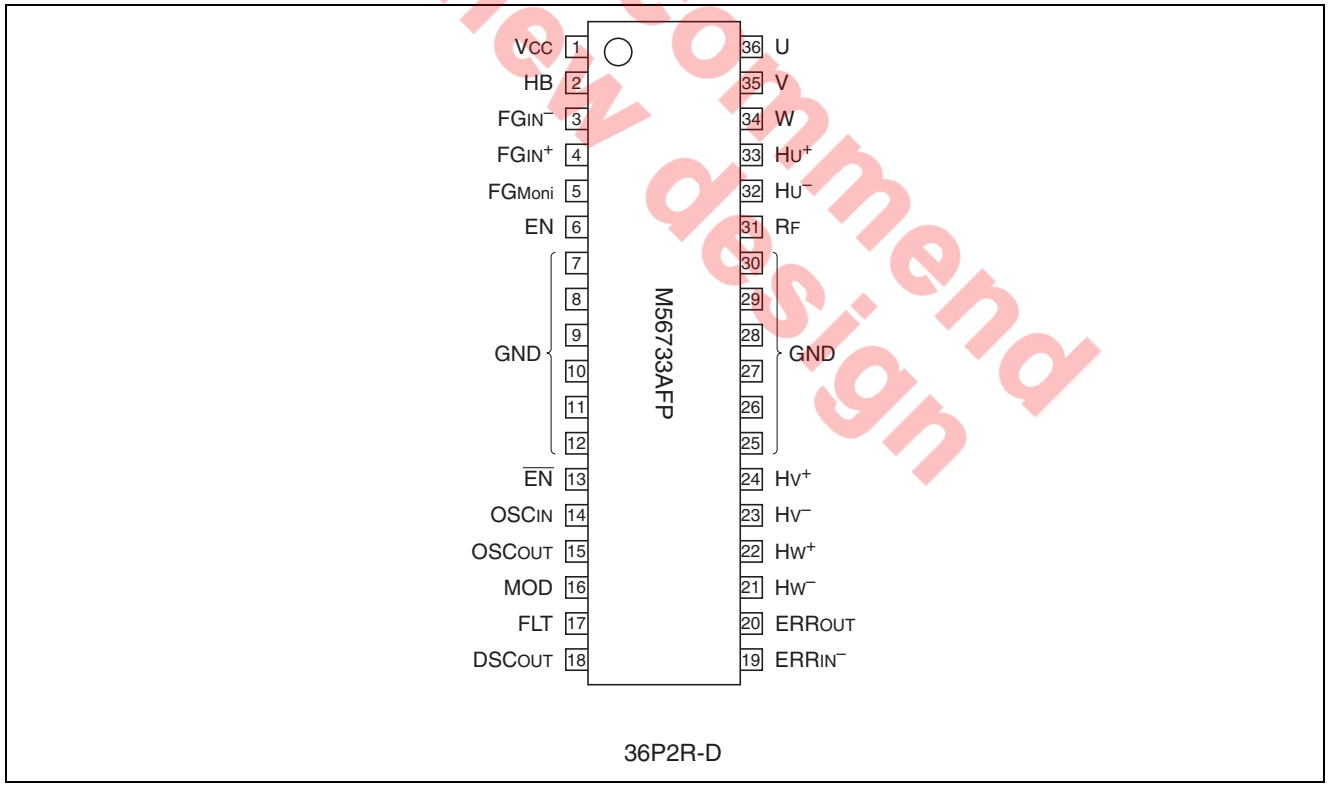
Recommended Operating Conditions

- 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

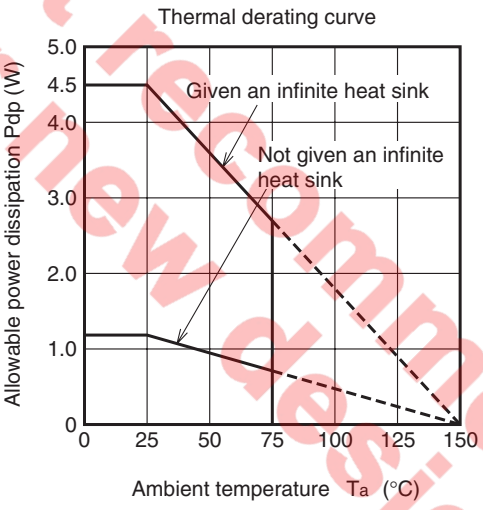


Absolute Maximum Ratings

(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 3	5	V
V_{IN}	Voltage applied to pins	6, 13, 21 to 24, 32, 33 (pin numbers)	0 to Vcc	V
f_{IN}	Clock frequency		1000	kHz
Pt	Allowable dissipation	Infinite heat sink	4.5	A
Kθ	Thermal derating range	Infinite heat sink	27.8	°C/W
Tj	Junction temperature		150	°C
Topr	Ambient operating temperature		–20 to 75	°C
Tstg	Storage temperature		–40 to 125	°C

Characteristic curves

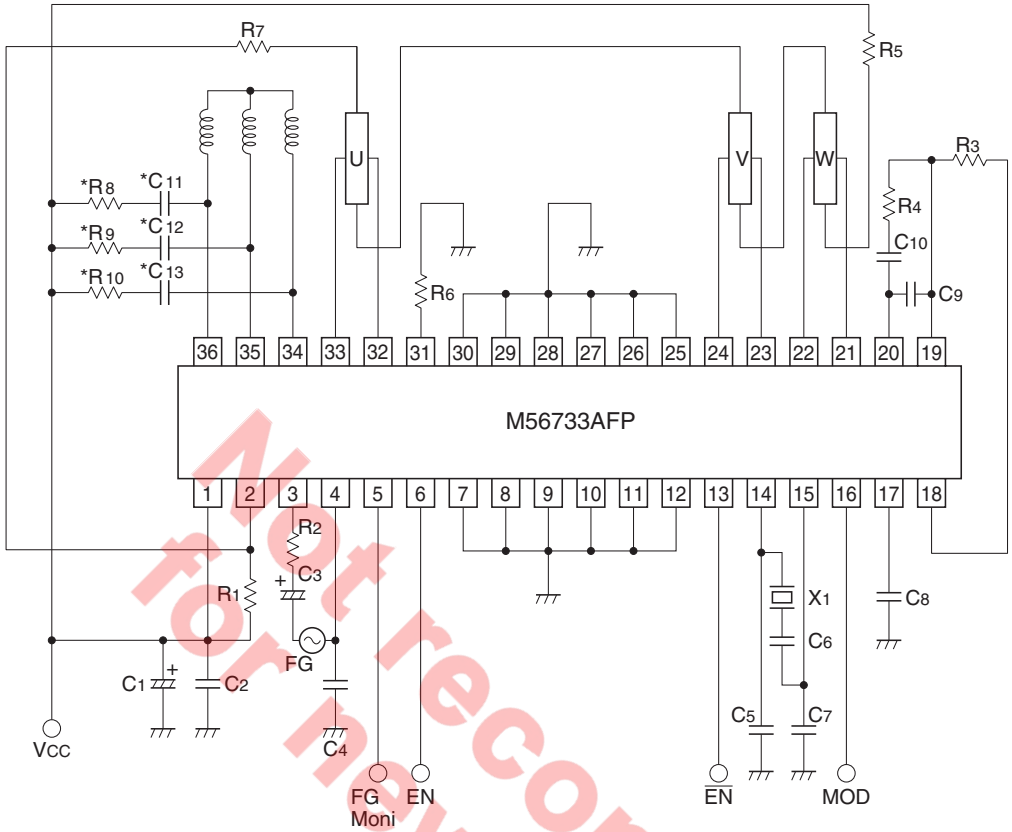


Electrical Characteristics

(unless otherwise noted, Ta = 25°C, V_{CC} = 5.0 V,)

Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
$I_{CC}H$	Circuit Current	When the circuit is switched on. Excludes the injector current.	9	18	28	mA
$I_{CC}L$	Circuit Current	When only the minimal circuit is switched on.	—	—	300	µA
$I_{IN}HA$	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
Vsat	Saturation output voltage	Io = 0.7 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
Vref	Error amplifier reference voltage	Intermediate level of discriminator output is measured	2.0	2.2	2.4	V
I_{IN}•E	Error amplifier input current		–0.2	–0.02		µA
V_O•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 V, pin 6	500	700	1000	V
		V_{IN} 0 V, pin 13	–150	–100	–70	V
Vinj	Injector pin voltage		0.6	0.9	1.5	V
VoDSC	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 fosc = 492 kHz	–6	1	6	µA
fosc	Oscillation frequency	fosc = 492 kHz	–0.2	—	0.2	%
IinjMAX	Injector max. operating current	fosc = 492 kHz	25	—	—	mA
IinjMIN	Injector min. operating current	fosc = 492 kHz	—	—	4	mA
VOLFG	FG amplifier output low level (monitor)	IL = 200 µA	—	0.1	0.2	V
I1FG	FG amplifier output pin leakage current (monitor)	When 12 V is applied	—	—	1.0	µA
I_{IN}MOD	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)

X_1=492kHz (Oscillator)

R_1=5.1k	C_1=33 F
R_2=510	C_2=0.47 F
R_3=47k	C_3=10 F
R_4=180k	C_4=0.01 F
R_5=1.2k	C_5=165pF
R_6=0.5	C_6=56pF
R_7=1.2k	C_7=165pF
R_8=4.7	C_8=1 F
R_9=4.7	C_9=0.01 F
R_{10}=4.7	C_{10}=0.1 F
	C_{11}=0.1 F
	C_{12}=0.1 F
	C_{13}=0.1 F

Notes:
1. Values for elements marked * (asterisk) must be selected to prevent oscillation.
2. R_1 is used to boost the injection current. Select a suitable value.
3. Select an element of suitable value as required to adjust the gain.

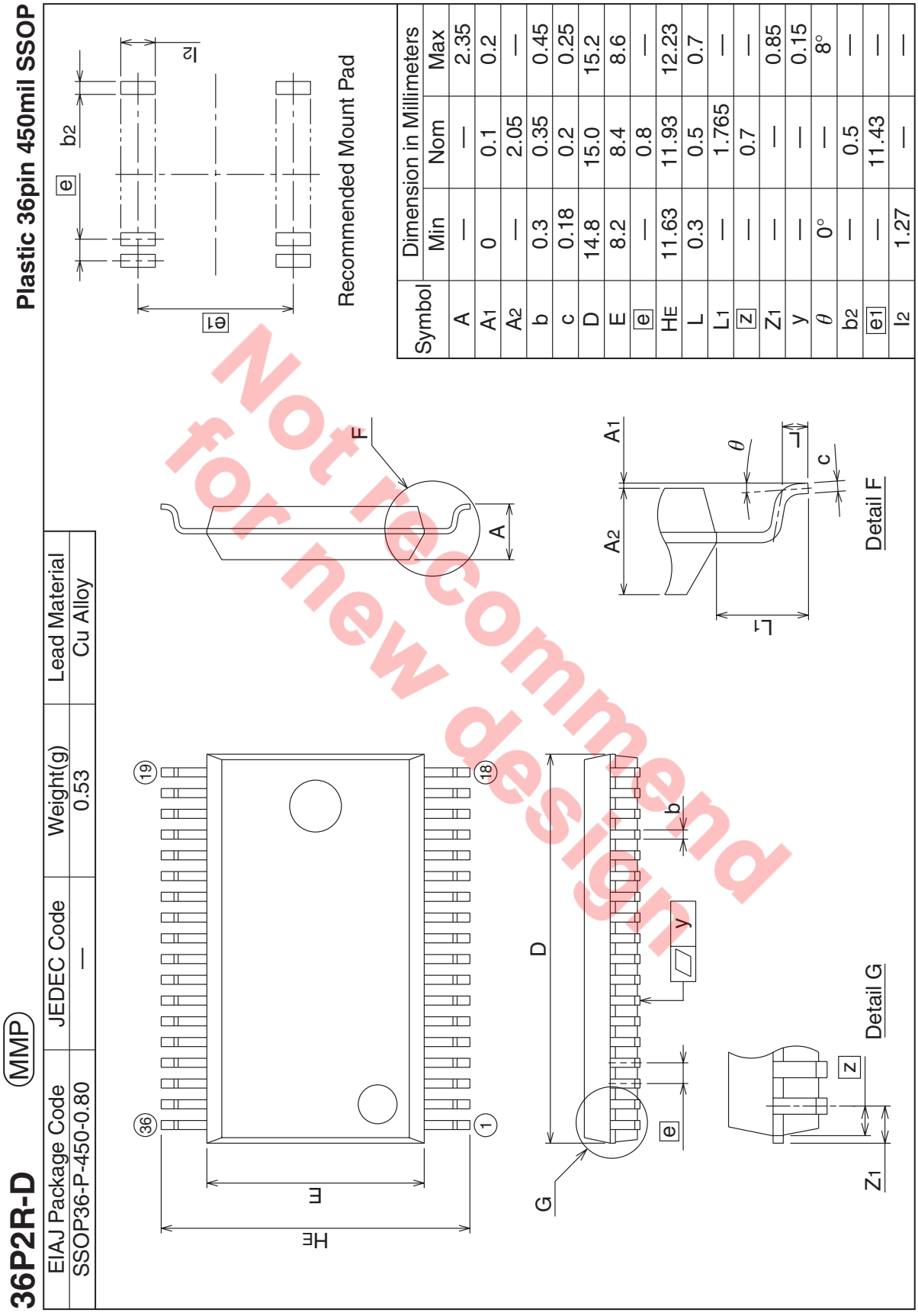
4. Enable function

EN / $\overline{EN}$	Lo	Hi
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



Symbol	Dimension in Millimeters		
	Min	Nom	Max
A	—	—	2.35
A_1	0	0.1	0.2
A_2	—	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	—
H_E	11.63	11.93	12.23
L	0.3	0.5	0.7
L_1	—	1.765	—
Z	—	0.7	—
Z_1	—	—	0.85
y	—	—	0.15
θ	0°	—	8°
b_2	—	0.5	—
e_1	—	11.43	—
l_2	1.27	—	—

Renesas Technology Corp. Sales Strategic Planning Div. Nippon Bldg., 2-6-2, Ohte-machi, Chiyoda-ku, Tokyo 100-0004, Japan

RENESAS SALES OFFICES

http://www.renesas.com

Renesas Technology America, Inc.
450 Holger Way, San Jose, CA 95134-1368, U.S.A
Tel: <1> (408) 382-7500 Fax: <1> (408) 382-7501

Renesas Technology Europe Limited.
Dukes Meadow, Millboard Road, Bourne End, Buckinghamshire, SL8 5FH, United Kingdom
Tel: <44> (1628) 585 100, Fax: <44> (1628) 585 900

Renesas Technology Europe GmbH
Dornacher Str. 3, D-85622 Feldkirchen, Germany
Tel: <49> (89) 380 70 0, Fax: <49> (89) 929 30 11

Renesas Technology Hong Kong Ltd.
7/F., North Tower, World Finance Centre, Harbour City, Canton Road, Hong Kong
Tel: <852> 2265-6688, Fax: <852> 2375-6836

Renesas Technology Taiwan Co., Ltd.
FL 10, #99, Fu-Hsing N. Rd., Taipei, Taiwan
Tel: <886> (2) 2715-2888, Fax: <886> (2) 2713-2999

Renesas Technology (Shanghai) Co., Ltd.
26/F., Ruijin Building, No.205 Maoming Road (S), Shanghai 200020, China
Tel: <86> (21) 6472-1001, Fax: <86> (21) 6415-2952

Renesas Technology Singapore Pte. Ltd.
1, Harbour Front Avenue, #06-10, Keppel Bay Tower, Singapore 098632
Tel: <65> 6213-0200, Fax: <65> 6278-8001

Colophon 1.0