

# HA13490P, HA13490MP, HA13490FP

## Voice Coil Motor Driver

### Description

HA13490/FP/MP are VCM drive IC for HDD and have following functions and features.

### Functions

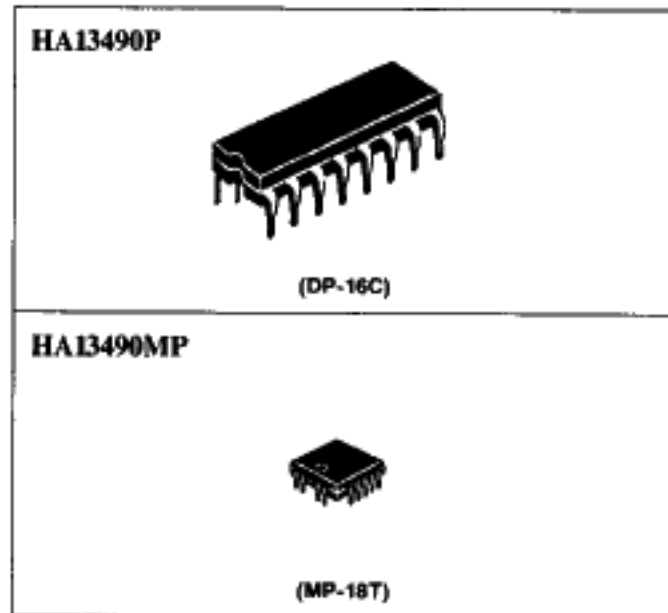
- Input buffer amp
- 1.2 A peak BTL output amp
- Retract input
- Chip enable input
- Independent OP amp
- OTSD (Over Temperature Shut Down)

### Features

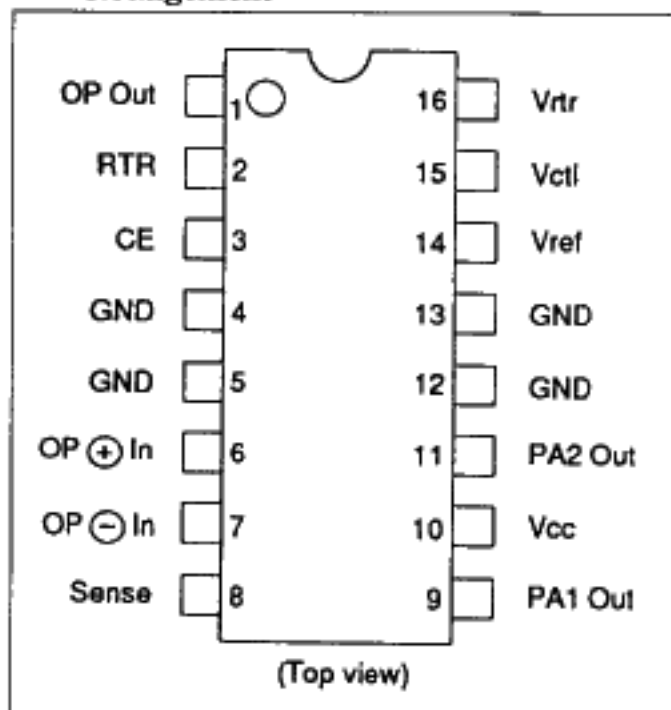
- Wide operating voltage range
- No cross-over distortion
- Small external components
- Low saturation voltage
- 3 types package line up

### Ordering Information

Type No.	Package
HA13490P	300 mil 16 pin plastic DIP (DP-16C)
HA13490MP	18 pin plastic QFI (MP-18T)
HA13490FP	16 pin plastic SOP (FP-16T)

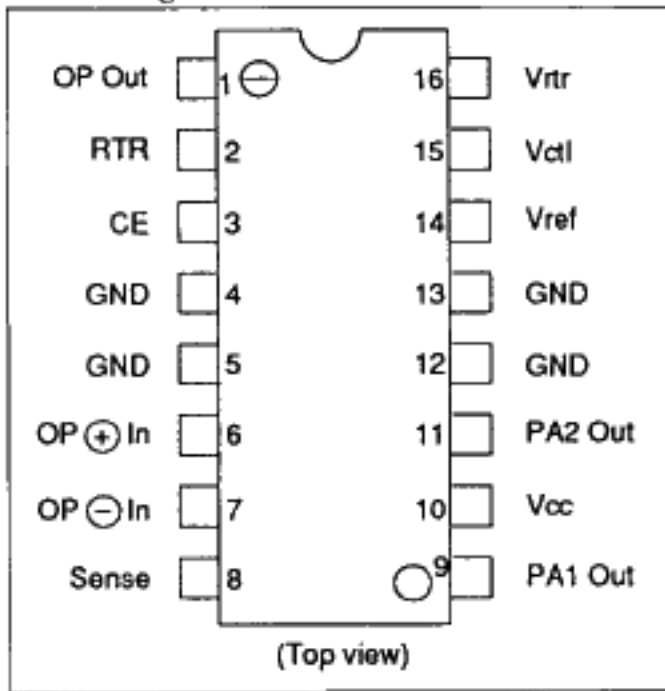


### Pin Arrangement

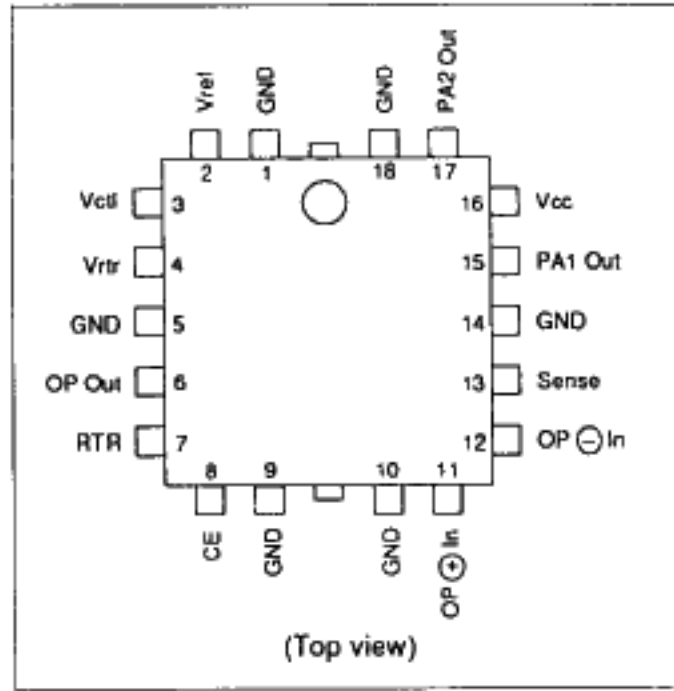


HA13490P

Pin Arrangement

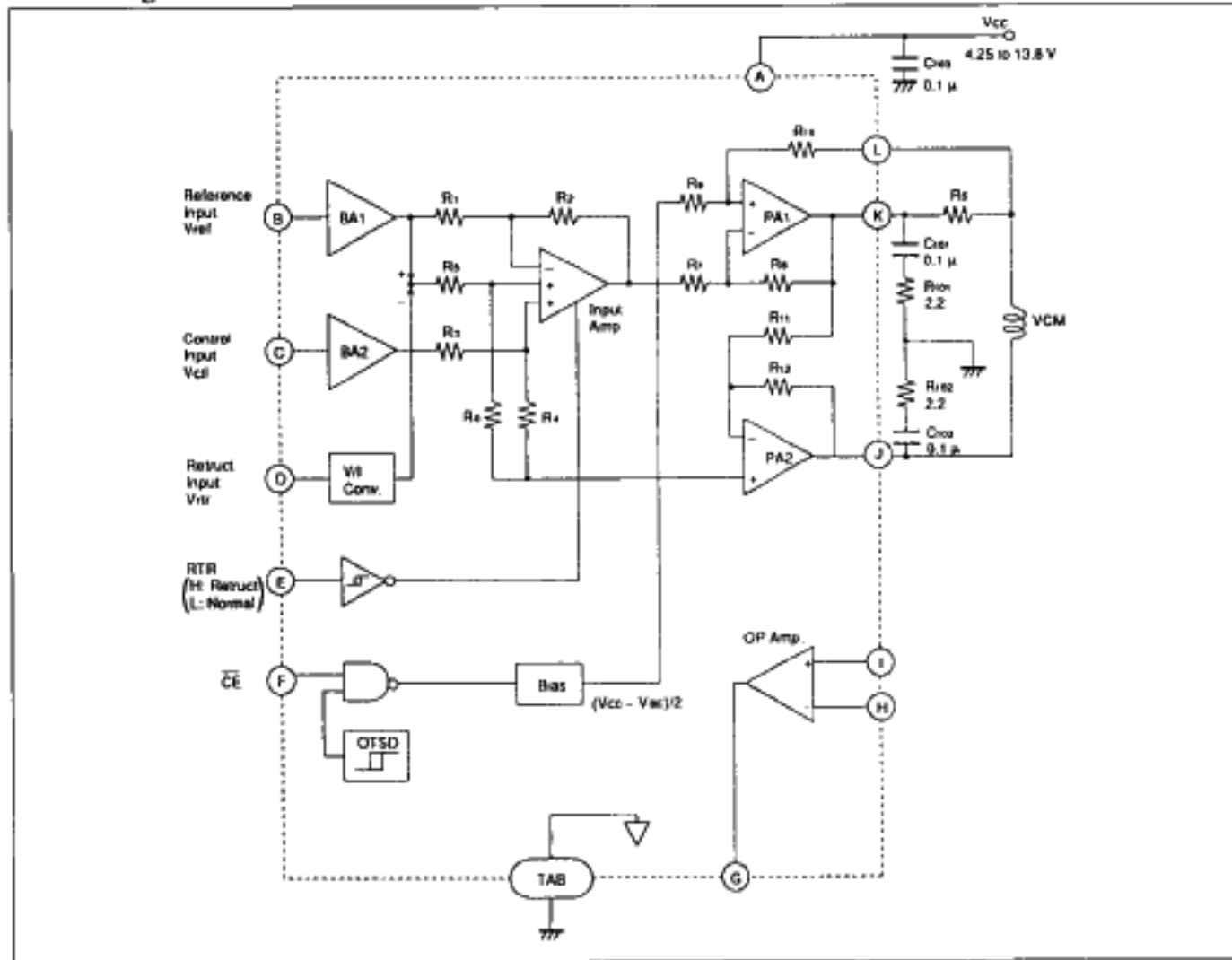


HA13490FP



HA13490MP

Block Diagram



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**Table 1 External Components**

Parts No.	Recommended Value	Purpose	Note
R <sub>101</sub> , R <sub>102</sub>	2.2 Ω	Stability	
R <sub>s</sub>	2.0 Ω	Current sense	1
C <sub>101</sub> , C <sub>102</sub>	0.1 μF	Stability	2
C <sub>103</sub>	≥0.1 μF	Power supply bypass	

Note: Use a reactance free resistance.

The relation between output current and input voltage can be described as follows.

When RTR is L

$$I_o = -g_m(V_{ct1} - V_{ref})$$

When RTR is H

$$I_o = -g_m V_{tr}$$

Where  $g_m$  and  $g_{mr}$  are internal constant (see electrical characteristics) and output current "+" means source current from PA1 and "-" means sink current.

**Table 2 Absolute Maximum Ratings (T<sub>a</sub> = 25 °C)**

Item	Symbol	HA13490	HA13490MP	HA13490FP	Unit	Note
Supply voltage	V <sub>cc</sub>	15	15	15	V	1
Input voltage	V <sub>in</sub>	0 to V <sub>cc</sub>	0 to V <sub>cc</sub>	0 to V <sub>cc</sub>	V	2
Peak output current	I <sub>opeak</sub>	1.2	1.2	1.2	A <sub>p</sub>	3
DC output current	I <sub>o</sub>	0.8	0.8	0.8	A	
Power dissipation	P <sub>T</sub>	2(T <sub>pin</sub> =120 °C)	2(T <sub>pin</sub> =100 °C)	2(T <sub>pin</sub> =70 °C)	W	4
Junction temperature	T <sub>j</sub>	150	150	150	°C	1
Storage temperature	T <sub>stg</sub>	-55 to +125	-55 to +125	-55 to +125	°C	

The absolute maximum ratings are limiting values, to be applied individually, beyond which the device may be permanently damaged. Functional operation under any of these conditions is not guaranteed. Exposing a circuit to its absolute maximum rating for extended periods of time may affect the device's reliability.

Notes: 1. Recommended operating range is as follows.

$$V_{cc} = 4.25 \text{ to } 13.8 \text{ V}$$

$$T_{jopr} = 0 \text{ to } 125 \text{ °C}$$

2. Apply to CE, RTF, V<sub>ref</sub>, V<sub>ct1</sub> and V<sub>tr</sub> input.

3. t ≤ 20 ms

4. Package thermal data

Item	HA13490	HA13490MP	HA13490FP	Unit
θ <sub>j-pin</sub>	15	25	40	°C/W
θ <sub>j-a</sub>	60	80	100	°C/W



Table 4 Electrical Characteristics (Ta = 25 °C, Vcc = 12 V)

Item	Symbol	Min	Typ	Max	Unit	Test Condition	Appli- cation Terminal	Note	
Quiescent current	I <sub>CCO</sub>	—	0.15	0.4	mA	V <sub>CC</sub> = 13.8 V	CE=H	A	
	I <sub>CC</sub>	—	7.5	15	mA	I <sub>O</sub> =0	CE=L		
CE & RTR	Input low voltage	V <sub>IL</sub>	—	—	0.8	V		E, F	
	Input high voltage	V <sub>IH</sub>	2.0	—	—	V			
	Input current	I <sub>I</sub>	—	—	±2.5	μA	V <sub>in</sub> =0 to V <sub>CC</sub>		
BA1 & BA2	Input current	I <sub>CTL</sub>	—	—	±2.5	μA	V <sub>ref</sub> =6 V, V <sub>ctl</sub> =0 to 12 V	B, C	
	Input offset current	ΔI <sub>CTL</sub>	—	—	±0.5	μA			
	Input offset voltage	V <sub>IO1</sub>	—	—	±10	mV	V <sub>ref</sub> =6 V	B, C	1
	Common mode voltage range	V <sub>CM1</sub>	$\frac{1}{3}V_{CC}$	—	$\frac{2}{3}V_{CC}$	V		B, C	
PA1 & PA2	Quiescent voltage	V <sub>O</sub>	5.3	5.65	6.0	V		K, J	
	Leak current	I <sub>CER</sub>	—	—	4.0	mA	V <sub>CE</sub> =15 V		
	Output total Saturation voltage	V <sub>SAT</sub>	—	1.8	2.4	V	I <sub>O</sub> =0.8 A	K, J	
			—	1.2	1.4	V	I <sub>O</sub> =0.1 A		
BA to PA	V/I transfer gain	g <sub>m</sub>	—	0.5	—	A/V	R <sub>S</sub> =2 Ω	K, L	1
	Gain bandwidth	B	—	75	—	kHz	g <sub>m</sub> =-3 dB	K, L	2
	Phase shift	Δφ	—	8	—	deg.	f=10 kHz		
	Total harmonic distortion	D	—	—	2	%	f=1 kHz, I <sub>O</sub> =0.1 Arms		
V <sub>tr</sub> to PA	Offset voltage	V <sub>IO2</sub>	—	—	±20	mV		D	3
	Retract gain	g <sub>mr</sub>	—	0.1	—	A/V	R <sub>S</sub> =2 Ω	L	

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## Electrical Characteristics(Ta = 25 °C) (cont)

OP amp	Input current	$I_{op}$	—	—	$\pm 1.0$	$\mu A$	H, I
	Input offset current	$\Delta I_{op}$	—	—	$\pm 0.1$	$\mu A$	
	Input offset voltage	$V_{io3}$	—	—	$\pm 5$	mV	
	Common mode voltage range	$V_{cms}$	2	—	10	V	
	Openloop voltage gain	$G_{ol}$	—	60	—	dB	f=1 kHz G
	Gain bandwidth	$B_3$	—	1000	—	kHz	$G_{ol}=0$ dB
	Output low voltage	$V_{OL}$	—	—	1.0	V	$I_{OL}=1$ mA
Output high voltage	$V_{OH}$	$V_{CC}$ -1.0	—	—	V	$I_{OH}=1$ mA	
OTSD	Shutdown temperature	$T_{sd}$	—	150	—	°C	
	Hysteresis	$T_{hys}$	—	25	—	°C	

- Notes: 1. See figure 1.  
The  $g_m(V/I)$  transfer gain can be calculated as.  
 $g_m = \Delta I_o / \Delta V_{ctl}$  (A/V)
2. Test conditions are follows.  
 $R_s = 2 \Omega$   
 $R_L = 10.5 \Omega$  (Non inductive)
3. See figure 2.  
The  $g_m(R)$  (Retract gain) can be calculated as

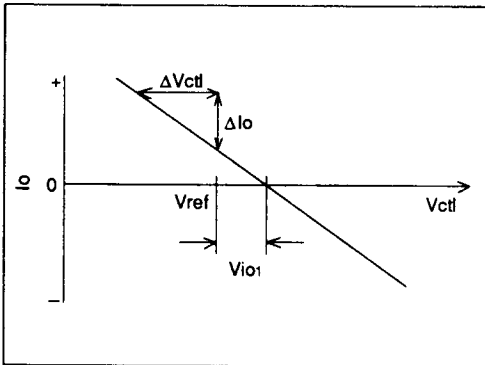


Figure 1  $I_o$  vs.  $V_{ctl}$

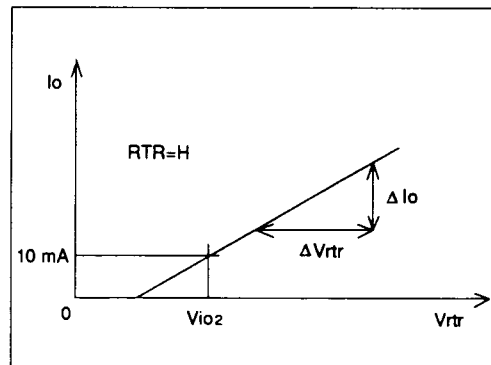


Figure 2  $I_o$  vs.  $V_{rtr}$