HA13529FP

Voice Coil Motor Driver

The HA13529FP is VCM driver for 12 V HDD and have following functions and features.

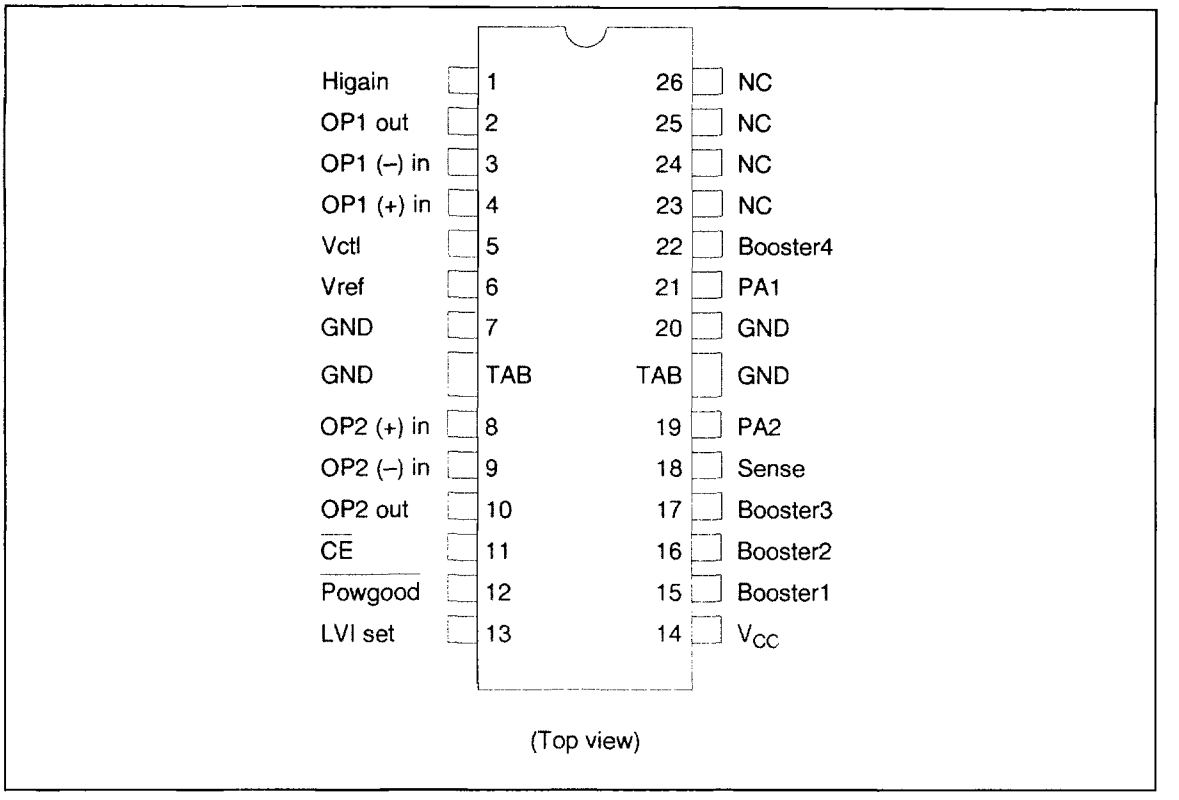
Functions

- Input amp
- 1.2 A BTL output amp
- OP amp
- OTSD & LVI

Features

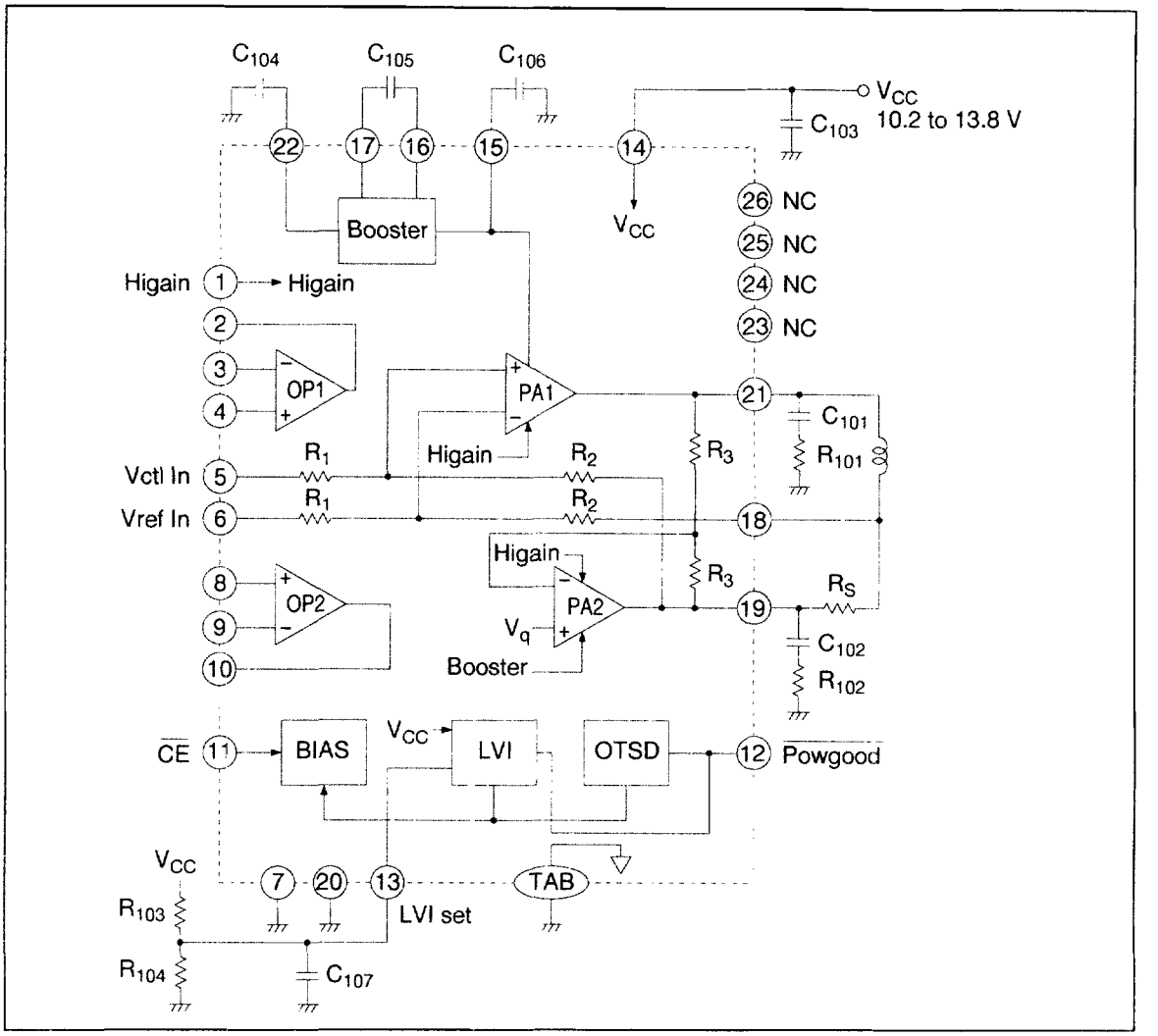
- Low saturation voltage
- No cross-over distortion
- Few external components

Pin Arrangement



(Top view)

Block Diagram



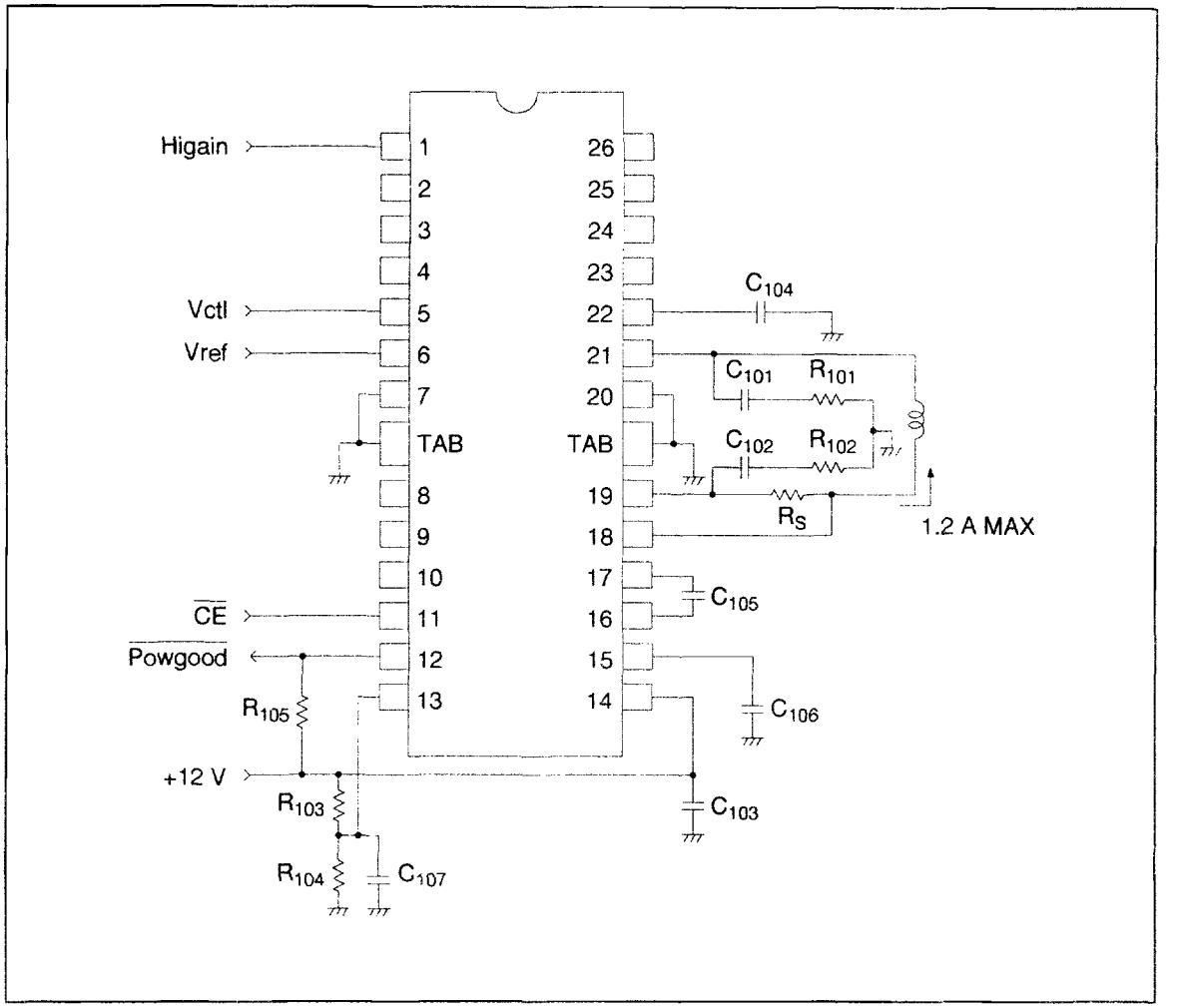
Truth Table

Input			Output	
$\overline{CE}$	V_{CC}	Higain	PA1 & PA2	$\overline{Powgood}$
H or Z*[1]	0 to 12 V	X	Disable	Z
L	0 to 7 V	X	Disable	Z
	≤ Vsd *[2]	X	Disable	Z
	> Vsd *[2]	H or Z	High gain*[2]	L
		L	Low gain*[2]	L

Notes: 1. Z = High impedance
2. See electrical characteristics

H = High voltage level
L = Low voltage level
X = Irrelevant

Applications



External Component

Parts No.	Recommended Value	Purpose	Notes
R_{101}, R_{102}	2.2 Ω	For power amplifire output stabilization	
R_{103}, R_{104}	—	LVI voltage setting	1
R_{105}	10 kΩ	$\overline{\text{Powgood}}$ pull up	
R_S	1.0 Ω	Power amplifire output current detection	2
C_{101}, C_{102}	≥ 0.1 μF	For power amplifire output stabilization	
C_{103}	≥ 0.1 μF	Power supply by pass	
C_{104}	820 pF	For booster	
C_{105}, C_{106}	0.1 μF, 1.0 μF	For booster	
C_{107}	≥ 0.01 μF	For LVI	

Notes: 1. The LVI operating voltage Vsd and Hysteresis Vhys are determined as follows.

$$Vsd = \left(1 + \frac{R_{103}}{R_{104}}\right) \cdot 1.2\ (V) \qquad (Vsd \geq 8.5\ V)$$

$$Vhys = \left(1 + \frac{R_{103}}{R_{104}}\right) \cdot 0.1\ (V)$$

2. The relationship between output current I_O and input voltage Vctl is determined as follows.

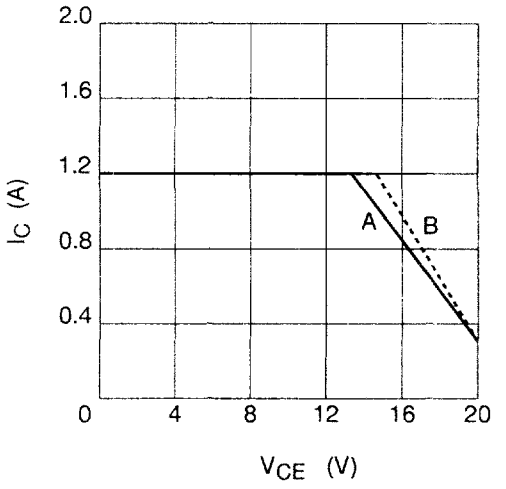
$$I_O = \frac{(Vctl - Vref)\ Gctl}{R_S}$$

Where,
Gctl : gm • R_S' (See electrical characteristics)
Vref : Reference voltage for PA1

Absolute Maximum Ratings (Ta = 25°C)

Item	Symbol	Rating	Unit	Notes
Power supply voltage	V_{CC}	15	V	1
Peak output current	I_{Opeak}	1.2	A	2
DC output current	I_O	0.8	A	
Input voltage	Vin	V_{CC}	V	
Power dissipation	P_T	6.0 (Tc = 100°C)	W	3
Junction temperature	Tj	150	°C	4
Storage temperature range	Tstg	–55 to +125	°C	

Notes: 1. Operating voltage range is 10.2 V to 13.8 V.
2. ASO of each output transistor is shown below. Operating locus must be with in the ASO.



	t_{on} (ms)	t_{off} (ms)
A	10	10
B	5	1.5

30 pulse

$I_{Opeak} \leq 100$ ms

3. Permitted value at Tc = 100°C. Thermal resistance is shown below.
   θj – c ≤ 8°C/W
   θj – a ≤ 15°C/W (Using Fe board), θj – a ≤ 62°C/W (When a glass epoxy printed circuit board is used with a wiring density of 20 %)
4. Operating junction temperature range is 0 to +125°C.

Electrical Characteristics (Ta = 25°C, V_{CC} = 12 V)

Item		Symbol	Min	Typ	Max	Units	Test Conditions	Applicable Terminal	Note
Quiescent current		I_{CC0}	—	0.6	1.0	mA	$\overline{CE}$ = Z	14	
		I_{CC1}	—	16	24	mA	$\overline{CE}$ = L		
$\overline{CE}$ & Higain	Input current	Iin (CE)	—	±30	±100	μA	$\overline{CE}$ = 0 to 5V	11	
			0	—	1000	μA	$\overline{CE}$ = 5V to V_{CC}		
		Iin (Hig)	—	—	±2	μA	Higain = 0 to V_{CC}	1	
	Input high voltage	Vih1	2.0	—	—	V		1, 11	
	Input low voltage	Vil1	—	—	0.8	V			
PA1 & PA2	Input resistance	Rin (H)	15	20	25	kΩ	Higain = H	5, 6	
		Rin (L)	30	40	50	kΩ	Higain = L		
	Input commom mode voltage range	V_{CM} (H)	0.7	—	7.0	V	Higain = H		
		V_{CM} (L)	0.7	—	7.0	V	Higain = L		
	Output quiescent voltage	Vq	5.8	6.10	6.4	V	Vctl, Vref open R_L = 10.5 Ω R_S' = 1.0 Ω	19, 21	
	Output offset voltage (PA2-Sense)	Vofs(H)	—	—	±5	mV	Higain = H R_L = 10.5 Ω R_S' = 1.0 Ω Vctl = Vref = 6.1 V		
		Vofs(L)	—	—	±3	mV	Higain = L R_L = 10.5 Ω R_S' = 1.0 Ω Vctl = Vref = 6.1 V		
	Total output saturation voltage	Vsat1	—	1.1	1.5	V	I_O = 0.7 A		1
		Vsat2	—	0.6	0.85	V	I_O = 0.2 A		
	Output leak current	I_{CER}	-2	—	100	μA	V_{CE} = 15 V		2
	Transfer gain	gm (H)	1.805	1.90	2.09	A/V	Higain = H R_S' = 1.0 Ω	18	
		gm (L)	0.44	0.49	0.54	A/V	Higain = L R_S' = 1.0 Ω		
	Gain bandwidth	B (H)	—	35	—	kHz	Higain = H R_L = 10.5 Ω R_S' = 1.0 Ω		2
		B (L)	—	60	—	kHz	Higain = L R_L = 10.5 Ω R_S' = 1.0 Ω		

Electrical Characteristics (Ta = 25°C, V_{CC} = 12 V) (cont)

Item		Symbol	Min	Typ	Max	Units	Test Conditions	Applicable Terminal	Note
OP1 & OP2	Input current	Iinop	—	—	±100	nA		3, 4, 8, 9	
	Input offset voltage	Vosop	—	—	±7	mV			
	Input common mode voltage range	Vcmop	0	—	V_{CC} −1.8	V			
	Output high voltage	V_{OHOP}	6.0	—	—	V	Iout = 1.0 mA	2, 10	
	Output low voltage	V_{OLOP}	—	—	1.0	V	Iout = 1.0 mA		
	Open loop gain	Gop	40	51	—	dB	f = 1 kHz (Note)		2
	Gain bandwidth	Bop	100	350	—	kHz	Gop = 0 dB		
Powgood	Output leak current	Ileak	—	—	±10	μA	V_{OH} = 15 V	12	
	Output low voltage	V_{OL}	—	—	0.4	V	I_{OL} = 2 mA		
LVI	Operating voltage	Vsd	8.6	9.3	10.0	V	R_{103} = 68 kΩ R_{104} = 10 kΩ	14	
	Hysteresis	Vhys	0.4	0.8	1.2	V	R_{103} = 68 kΩ R_{104} = 10 kΩ		
OTSD	Operating temperature	Tsd	125	150	—	°C			2
	Hysteresis	Thys	—	25	—	°C			

Notes: 1. Output saturation voltage is determined as total high and low output saturation voltage.
2. Value for guide only. At the delivery, this characteristic is not tested.

Total output saturation voltage Vsat is shown below.(Reference data)
The LVI circuit has the hysteresis, and it is shown below.