

HA13455

Three-Phase Motor Driver with Switching Regulator

Description

The HA13455 three-phase brushless DC motor driver can provide an output current of up to 1.8 A from the switching regulator at up to 1.0 A per phase.

Features

- High-efficiency driver
- Switching regulator output can also be used for other applications.

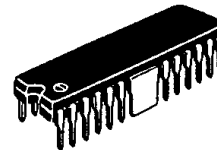
Functions

- 1.0-A three-phase output circuit
- Hall amplifier matrix
- Buffer amplifier
- Control amplifier
- FG amplifier
- 1.8-A switching regulator with output current regulator
- Overtemperature shutdown (OTSD)

Ordering Information

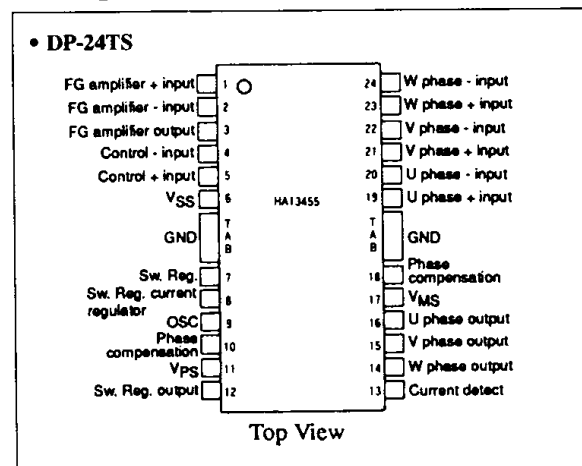
Type No.	Package
HA13455	DP-24TS

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(DP-24TS)

Pin Assignment



Logic Table

Control Voltage V _{CTL} (@ V _{ref} = 2.5 V)	Hall Amplifier input						Output			Notes
	U+	U-	V+	V-	W+	W-	U	V	W	
V _{CTL} ≥ 2.5 V	L	H	H	L	L	H	H	L	Open	1
	L	H	H	L	H	L	H	Open	L	
	L	H	L	H	H	L	Open	H	L	
	H	L	L	H	H	L	L	H	Open	
	H	L	L	H	L	H	L	Open	H	
	H	L	H	L	L	H	Open	L	H	
V _{CTL} < 2.5 V	H	L	H	L	H	L	Short	Short	Short	2
	L	H	L	H	L	H	Short	Short	Short	
V _{CTL} < 2.5 V	x	x	x	x	x	x	Open	Open	Open	3
x (Don't care)	Open	Open	Open	Open	Open	Open	Open	Open	Open	4

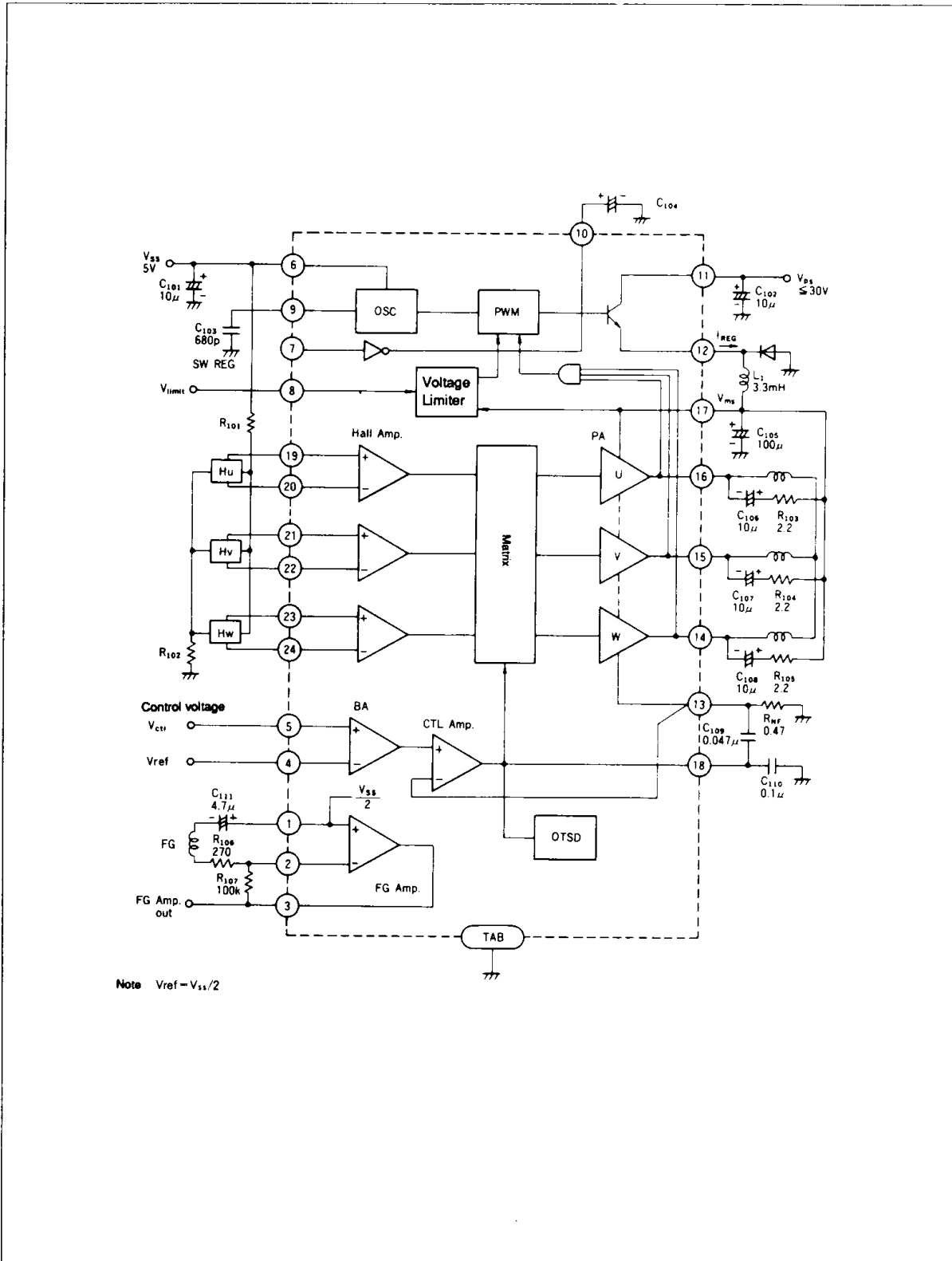
Notes:

1. Control mode
2. Operating in this mode may damage the device
3. Control mode release
4. Hall amplifier open protection mode



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Block Diagram



Note V_{ref} = V_{SS}/2



Absolute Maximum Ratings (Ta = 25°C)

Parameter	Symbol	Rating	Unit	Notes
Control block power supply voltage	V _{SS}	7	V	1
PA block power supply voltage	V _{MS}	30	V	2
REG block power supply voltage	V _{PS}	30	V	
Input voltage	V _{in}	0 to V _{SS}	V	3
PA output current	I _O	1.0	A	
REG output current	I _{REG}	1.8	A	
Power dissipation	P _T	2.5	W	4
Junction operating temperature	T _j	150	°C	5
Storage temperature	T _{stg}	-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. The recommended operating voltage range (V_{SS}) is 4.5 to 5.5 V
2. When V_{MS} ≤ V_{PS}
3. For pins 1, 2, 5, 8, and 19–24
4. For T_c = 100°C. Thermal resistance is as follows:
 $\theta_{j-c} \leq 25^\circ\text{C/W}$
 $\theta_{j-a} \leq 60^\circ\text{C/W}$
5. Operating junction temperature (T_{jop}) is -20 to +125°C.

Electrical Characteristics

(Ta = 25°C, V_{SS} = 5 V, V_{PS} = 18 V, V_{MS} = 12 V, V_{ref} = 2.5 V)

Parameter	Symbol	Min	Typ	Max	Unit	Test Conditions	Pins	Notes	
Control block	Quiescent current	I _{SS1}	—	—	14	mA	V _{SS} = 5.5 V, V _{CTL} = 0 V	6	
		I _{SS2}	—	65	100	mA	V _{SS} = 5.5 V, V _{CTL} = V _{SS} , R _L = Open		
Switching regulator	Quiescent current	I _{PS1}	—	—	1.0	mA	V _{PS} = 30 V, REG off	11	
		I _{PS2}	—	—	3	mA	V _{PS} = 30V, REG on		
Output block	Quiescent current	I _{MS1}	—	—	9	mA	V _{MS} = 30 V, V _{CTL} = 0 V	17	
		I _{MS2}	—	—	100	mA	V _{MS} = 30 V, V _{CTL} = V _{SS} , R _L = open		
Hall amplifier	Input current	I _{HI}	—	—	+10	μA	V _H = 2.2 V	19–24	
	Common mode input voltage	V _H	1.6	—	V _{SS} -2.3	V			
Buffer amplifier	Input current	I _{BI1}	—	—	+10 -200	μA	V _{CTL} = 0 V	5	
		I _{BI2}	—	—	±10	μA	V _{CTL} = 1 V to V _{SS}		
	Threshold voltage	V _{TH}	2.4	2.6	2.8	V	V ₁₃ = 10 mV		1
	Voltage gain	G _{CTL}	0.7	1.0	1.42	V/V		13	1
Motor driver output block	Leakage current	I _{CER1}	—	—	1.0	mA	V _{CE} = 30 V	14–16	
amplifier	Saturation voltage	V _{sat} H1	—	1.2	1.6	V	I _O = 0.5 A		2
		V _{sat} H2	—	1.6	2.5	V	I _O = 1.0 A		
		V _{sat} L1	—	0.5	0.75	V	I _O = 0.5 A		
		V _{sat} L2	—	1.0	2.0	V	I _O = 1.0 A		
	R _{NF} max voltage	V _{NF} max	0.55	0.75	0.95	V		13	



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Electrical Characteristics (cont)

Parameter	Symbol	Min	Typ	Max	Unit	Test Conditions	Pins	Notes
FG amplifier	Bias voltage	V_{FG}	2.3	2.5	2.7	V		1
	Input current	I_{FGI}	—	—	± 10	μA	$V_2 = 2.5 V$	2
	Output current	I_{FGO}	0.15	—	0.35	mA		3
	Output low voltage	V_{OL}	—	—	1.2	V		
	Output high voltage	V_{OH}	4.5	—	—	V		
OSC	Frequency	f_{osc}	35	50	70	kHz		9
	Low level voltage	V_{Hosc}	1.05	1.30	1.55	V		
	High level voltage	V_{Losc}	3.15	3.30	3.45	V		
	Duty cycle	D_{osc}	43	53	63	%		
Switching regulator output block	Leakage current	$I_{CER 2}$	—	—	1.0	mA	$V_{CE} = 30 V$	12
	Saturation voltage	$V_{sat R1}$	—	1.5	2.25	V	$I_{REG} = 1 A$	
$V_{sat R2}$		—	1.8	2.5	V	$I_{REG} = 1.8 A$		
Voltage regulator	Min voltage	$V_{REG min}$	7.2	8.0	8.8	V	$V_{ps} = 30 V$	17
	Max voltage	$V_{REG max}$	7.2	8.0	8.8	V/V	$V_{ps} = 30 V$, $V_B = 1.0 \text{ to } 3.0 V$	
OTSD	Operating temperature	T_{sd}	125	—	—	$^{\circ}C$		

Notes:

- See figure 1.
- V_{satH1} and V_{satH2} are the upper saturation mean voltages. V_{satL1} and V_{satL2} are the lower saturation mean voltages.

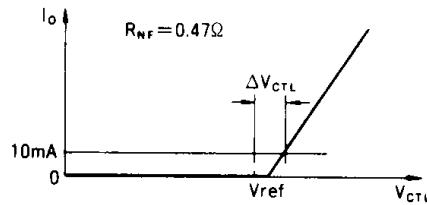


Figure 1 Buffer Amp Characteristics