

# 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.

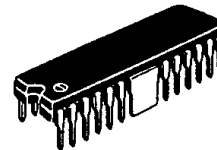
### Functions

- 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

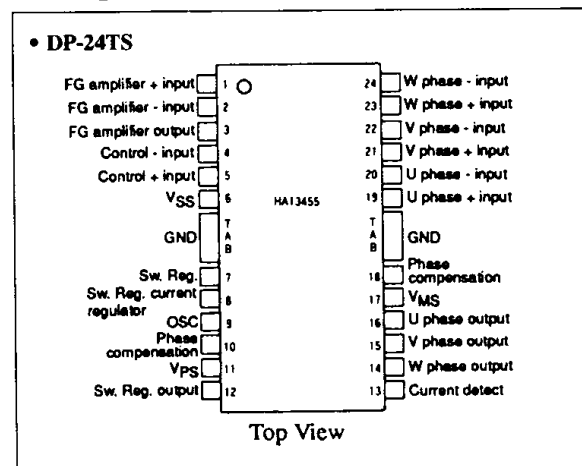
Type No.	Package
HA13455	DP-24TS

HA13455



(DP-24TS)

### Pin Assignment



### Logic Table

Control Voltage V <sub>CTL</sub> (@ V <sub>ref</sub> = 2.5 V)	Hall Amplifier input						Output			Notes
	U+	U-	V+	V-	W+	W-	U	V	W	
V <sub>CTL</sub> ≥ 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 <sub>CTL</sub> < 2.5 V	H	L	H	L	H	L	Short	Short	Short	2
	L	H	L	H	L	H	Short	Short	Short	
V <sub>CTL</sub> < 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

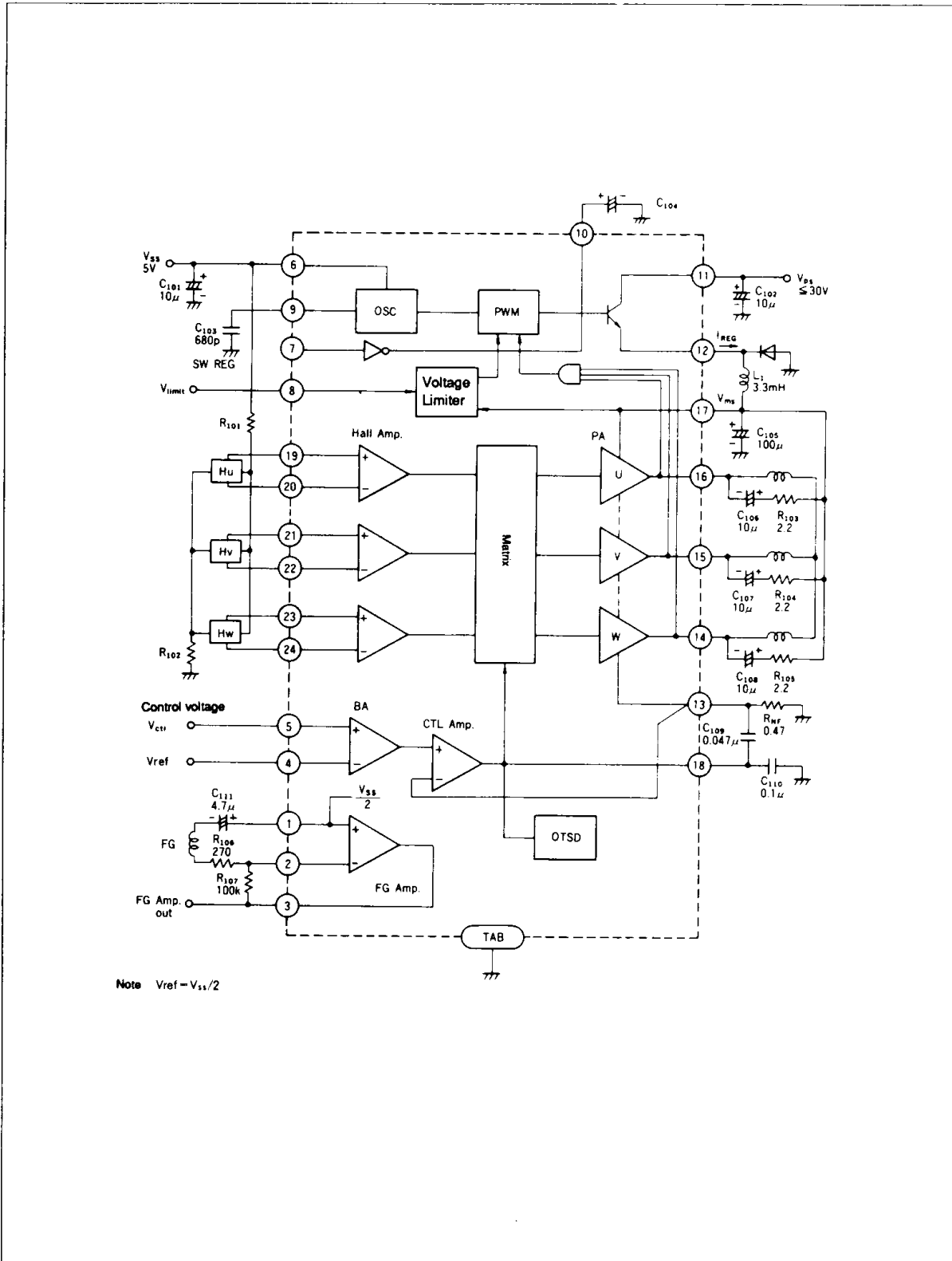
### Notes:

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



**Absolute Maximum Ratings** (Ta = 25°C)

Parameter	Symbol	Rating	Unit	Notes
Control block power supply voltage	V <sub>SS</sub>	7	V	1
PA block power supply voltage	V <sub>MS</sub>	30	V	2
REG block power supply voltage	V <sub>PS</sub>	30	V	
Input voltage	V <sub>in</sub>	0 to V <sub>SS</sub>	V	3
PA output current	I <sub>O</sub>	1.0	A	
REG output current	I <sub>REG</sub>	1.8	A	
Power dissipation	P <sub>T</sub>	2.5	W	4
Junction operating temperature	T <sub>j</sub>	150	°C	5
Storage temperature	T <sub>stg</sub>	-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<sub>SS</sub>) is 4.5 to 5.5 V
2. When V<sub>MS</sub> ≤ V<sub>PS</sub>
3. For pins 1, 2, 5, 8, and 19–24
4. For T<sub>c</sub> = 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<sub>jop</sub>) is -20 to +125°C.

**Electrical Characteristics**

(Ta = 25°C, V<sub>SS</sub> = 5 V, V<sub>PS</sub> = 18 V, V<sub>MS</sub> = 12 V, V<sub>ref</sub> = 2.5 V)

Parameter	Symbol	Min	Typ	Max	Unit	Test Conditions	Pins	Notes
Control block	Quiescent current	I <sub>SS1</sub>	—	—	14	mA	V <sub>SS</sub> = 5.5 V, V <sub>CTL</sub> = 0 V	6
		I <sub>SS2</sub>	—	65	100	mA	V <sub>SS</sub> = 5.5 V, V <sub>CTL</sub> = V <sub>SS</sub> , R <sub>L</sub> = Open	
Switching regulator	Quiescent current	I <sub>PS1</sub>	—	—	1.0	mA	V <sub>PS</sub> = 30 V, REG off	11
		I <sub>PS2</sub>	—	—	3	mA	V <sub>PS</sub> = 30V, REG on	
Output block	Quiescent current	I <sub>MS1</sub>	—	—	9	mA	V <sub>MS</sub> = 30 V, V <sub>CTL</sub> = 0 V	17
		I <sub>MS2</sub>	—	—	100	mA	V <sub>MS</sub> = 30 V, V <sub>CTL</sub> = V <sub>SS</sub> , R <sub>L</sub> = open	
Hall amplifier	Input current	I <sub>HI</sub>	—	—	+10	μA	V <sub>H</sub> = 2.2 V	19–24
	Common mode input voltage	V <sub>H</sub>	1.6	—	V <sub>SS</sub> -2.3	V		
Buffer amplifier	Input current	I <sub>BI1</sub>	—	—	+10 -200	μA	V <sub>CTL</sub> = 0 V	5
		I <sub>BI2</sub>	—	—	±10	μA	V <sub>CTL</sub> = 1 V to V <sub>SS</sub>	
	Threshold voltage	V <sub>TH</sub>	2.4	2.6	2.8	V	V <sub>I3</sub> = 10 mV	1
	Voltage gain	G <sub>CTL</sub>	0.7	1.0	1.42	V/V		13 1
Motor driver output block	Leakage current	I <sub>CER1</sub>	—	—	1.0	mA	V <sub>CE</sub> = 30 V	14–16
amplifier	Saturation voltage	V <sub>sat</sub> H1	—	1.2	1.6	V	I <sub>O</sub> = 0.5 A	2
		V <sub>sat</sub> H2	—	1.6	2.5	V	I <sub>O</sub> = 1.0 A	
		V <sub>sat</sub> L1	—	0.5	0.75	V	I <sub>O</sub> = 0.5 A	
		V <sub>sat</sub> L2	—	1.0	2.0	V	I <sub>O</sub> = 1.0 A	
	R <sub>NF</sub> max voltage	V <sub>NF</sub> 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	$I_{FGI}$	—	—	$\pm 10$	$\mu A$	$V_2 = 2.5 V$	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.

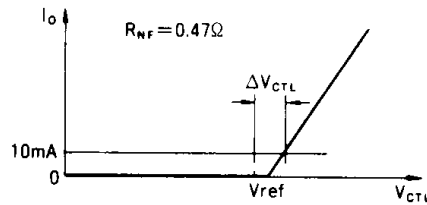


Figure 1 Buffer Amp Characteristics