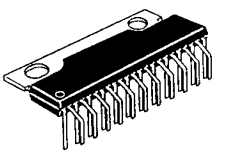
HA13403, HA13403V, HA13403MP

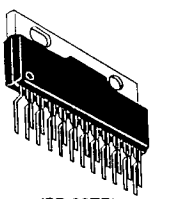
Three-Phase Brushless Motor Driver

• **HA13403**



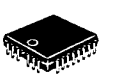
(SP-23TA)

• **HA13403V**



(SP-23TB)

• **HA13403MP**



(MP-28)

Description

The HA13403 is a monolithic power IC developed for use as a three-phase brushless DC motor driver.

With a maximum output current of 1.5 A/phase and power supply voltage of 26 V, this device is ideal as a driver for VTR cylinder or capstan motors.

Features

- High output current and low output saturation voltage
- Separate power supplies for the control and output blocks permit each to be used over a wide range of voltages

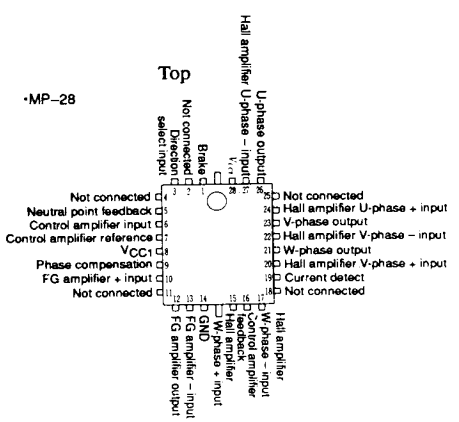
	HA13403/V	HA13403MP
Control block	4.5 to 13 V	4.5 to 5.5 V
Output block	V_{CC1} to 24 V	V_{CC1} to 15 V

- Includes FG amplifier
- Includes brake circuit

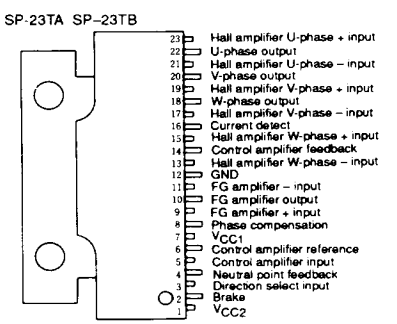
Ordering Information

Type No.	Package
HA13403	SP-23TA
HA13403V	SP-23TB
HA13403MP	MP-28

Pin Assignment

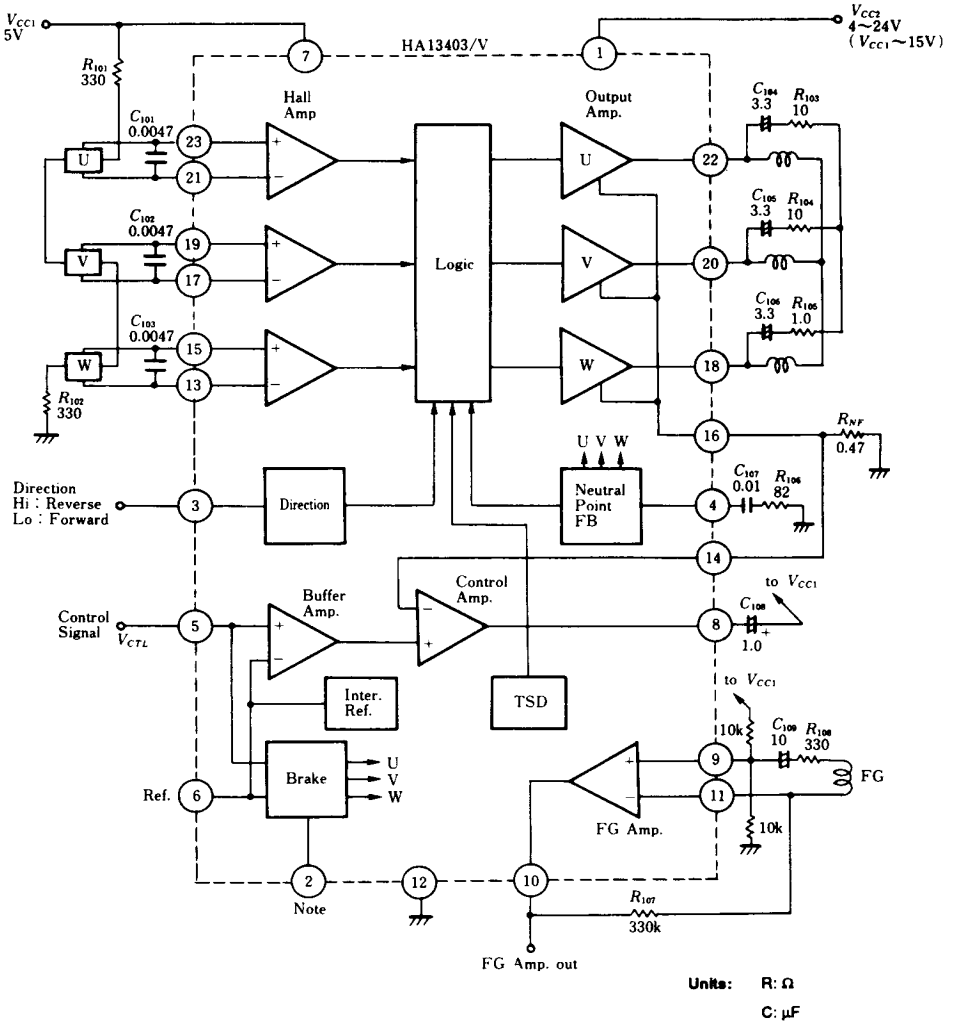


Top View



Top View

Block Diagram



Note: The brake circuit is disabled if pins 1 and 2 are shorted.

Absolute Maximum Ratings (Ta = 25°C)

Parameter	Symbol	Rating HA13403/V	Rating HA13403MP	Unit
Control block power supply voltage	V_{CC1}	13	13	V
Output block power supply voltage	V_{CC2}	26	20	V
Output current	I_O	1.5	1.0	A
Hall amplifier input voltage	V_H	0 to V_{CC1}	0 to V_{CC1}	V
Direction select input voltage	V_D	0 to V_{CC1}	0 to V_{CC1}	V
Control input voltage	V_{CTL}	0 to V_{CC1}	0 to V_{CC1}	V
Power dissipation	P_T	10	1.0	W
Junction temperature	T_j	150	150	°C
Operating temperature	T_{opr}	−20 to +70	−20 to +70	°C
Sto rage temperature	T_{stg}	−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.

Note:

1. Depends on derating. Thermal resistance is as follows:
   Junction—TAB $\theta_{jc} \leq 5$°C/W (HA13403/V)
   Junction—air $\theta_{ja} \leq 40$°C/W (HA13403/V)
   Junction—air $\theta_{ja} \leq 80$°C/W (HA13403MP mounted on an aluminum baseplate)

Electrical Characteristics (V_{CC1} = 5 V, V_{CC2} = 15 V, Ta = 25°C)

Parameter	Symbol	Min	Typ	Max	Unit	Test Conditions		Pin SP-23TA	Pin MP-28	Notes
Quiescent current	I_{CC1}	6	8	7	mA	$V_{CTL} = V_{CC1}/2$	V_{CC1} = 5 V	7	12	
		9	12.4	20	mA		V_{CC1} = 12 V			
	I_{CC2}	3.1	4.2	6.5	mA	$V_{CTL} = V_{CC1}$		1	28	
TSD operating temperature	T_{sd}	125	—	—	°C					
Hall amplifier input current	I_{BH}	—	1.3	10	µA	$V_H = V_{CC1}$		13, 15	15, 17	
Hall amplifier common mode input voltage	V_H	1.5	—	3.5	V		V_{CC1} = 5 V	17, 19	20, 22	
		2	—	9	V		V_{CC2} = 12 V	21, 23	24, 27	
Logic sensitivity	U_W	—	—	±10	mV	I_O = 50 mA				1
Output TRS breakdown voltage	BV_{CER}	26 (20)	—	—	V	I_C = 50 mA		18	21	6
Output amplifier leakage current	I_{CER}	—	—	1.0	mA	V_{CE} = 20 V		20	23	
Output saturation voltage	V_{CE} (Sat)	—	2.1	2.8	V	$V_{CTL} = V_{CC1}$	I_O = 1 A	22	26	2
		—	3.3	4.7	V		I_O = 1.5 A			
		—	1.1	1.5	V		I_O = 0.3 A, V_{CC2} = 4 V			
		—	—	1.2	V	$V_{CTL} = V_{CC1}$, I_O = 1 A				3
Reference voltage	V_{REF}	2.25	2.5	2.75	V		V_{CC1} = 5 V	6	7	
		5.4	6.0	6.6	V		V_{CC1} = 12 V			
Threshold voltage	V_{TH}	0.08	0.14	0.27	V	I_O = 20 mA	V_{CC1} = 5 V	5	6	4
		0.09	0.17	0.31	V		V_{CC1} = 12 V			
Control input current	I_{CTL}	—	10	30	µA	$V_{CTL} = V_{CC1}$	V_{CC1} = 5 V			
		—	80	240	µA		V_{CC1} = 12 V			
		—	—	15	µA	$V_{CTL} = V_{CC}$	V_{CC1} = 12 V			
		−15	—	—	µA	V_{CTL} = 0 V	V_{CC1} = 12 V			

Parameter	Symbol	Min	Typ	Max	Unit	Test Conditions		Pin SP-23TA	Pin MP-28	Notes
Control amplifier voltage gain	G_{CTL}	–8	–6	–4	dB	I_O = 50 mA		16	19	
		–9.7	–7.7	–5.7	dB	I_O = 200 mA				
Forward mode voltage range	V_{D-F}	0	—	1.5	V		V_{CC1} = 5 V	3	3	
		0	—	2.2	V		V_{CC1} = 12 V			
Reverse mode voltage range	V_{D-R}	3.5	—	5	V		V_{CC1} = 5 V	3	3	
		4.2	—	12	V		V_{CC1} = 12 V			
Forward mode input current	V_{D-F}	–0.28	–0.18	–0.12	mA	V_D = 0 V	V_{CC1} = 5 V	3	3	
		–0.40	–0.25	–0.16	mA		V_{CC1} = 12 V			
Reverse mode input current	V_{D-R}	0.12	0.18	0.28	mA	$V_D = V_{CC1}$	V_{CC1} = 5 V			
		0.4	0.9	1.4	mA		V_{CC1} = 12 V			
Brake mode voltage	V_{BRK}	1.0	—	1.5	V		V_{CC1} = 5 V	5	6	5
		1.0	—	5	V		V_{CC1} = 12 V			
Brake release voltage		—	—	0.5	V					
FG amplifier output bias current		–0.5	–0.25	–0.12	mA		V_{CC1} = 5 V	10	12	
		–0.8	–0.4	–0.2	mA		V_{CC1} = 12 V			
FG amplifier output voltage		2.3	2.8	3.5	V					

Notes:

1. Minimum input voltage necessary for 80% or more of I_O = 50 mA to flow at original phase.
2. Sum of the upper and lower saturation voltages.
3. Lower saturation voltage when brake circuit is in operation.
4. Difference in voltage from pin 6.
5. See figure 1.
6. Values in parentheses are for the HA13403MP.

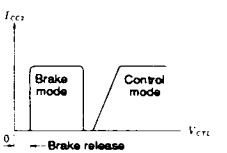


Figure 1

Timing Chart