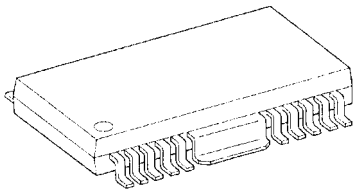
TOSHIBA BIPOLAR LINEAR INTEGRATED CIRCUIT SILICON MONOLITHIC

TA8470AF

3 PHASE FULL WAVE BRUSHLESS DC MOTOR DRIVER IC

TA8470AF is a low-noise type 3 Phase Bi-direction Motor Driver IC, developed as a 3 Phase Hall motor driver for VTRs (capstan, cylinder), etc.



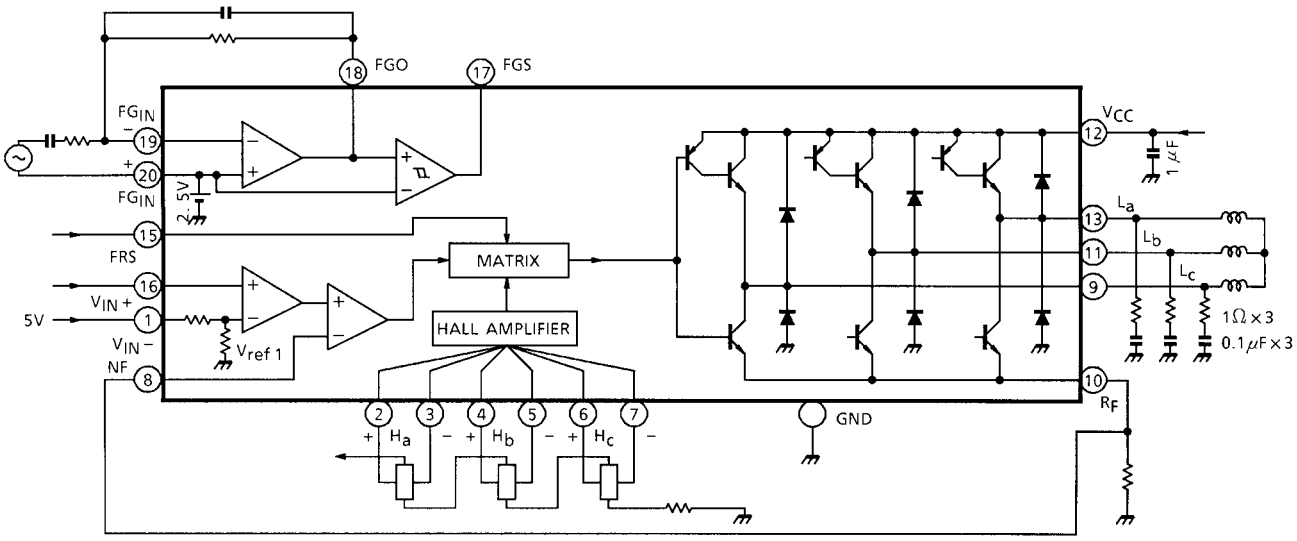
HSOP20-P-450-1.00

Weight : 0.79 g (Typ.)

FEATURES

- Operating Voltage Range : V_{CC} = 7~17 V
- Output Current : I_O (MAX.) = 1.2 A
- Three Phase Bi-direction, current control mode
- Low Noise (Quasi Sinusoidal Drive)
- Built-in FG Amplifier
- Low Output Impedance with B Class Push-Pull Driver, Capable of Short Brakes (Dumping Brakes)
- Position Detecting Circuit (Hall Input) with High Sensitivity : V_H = 50 mV_{p-p}
- Enclosed in Space-saving Power Flat Package
- Built-in Thermal Shutdown Circuit

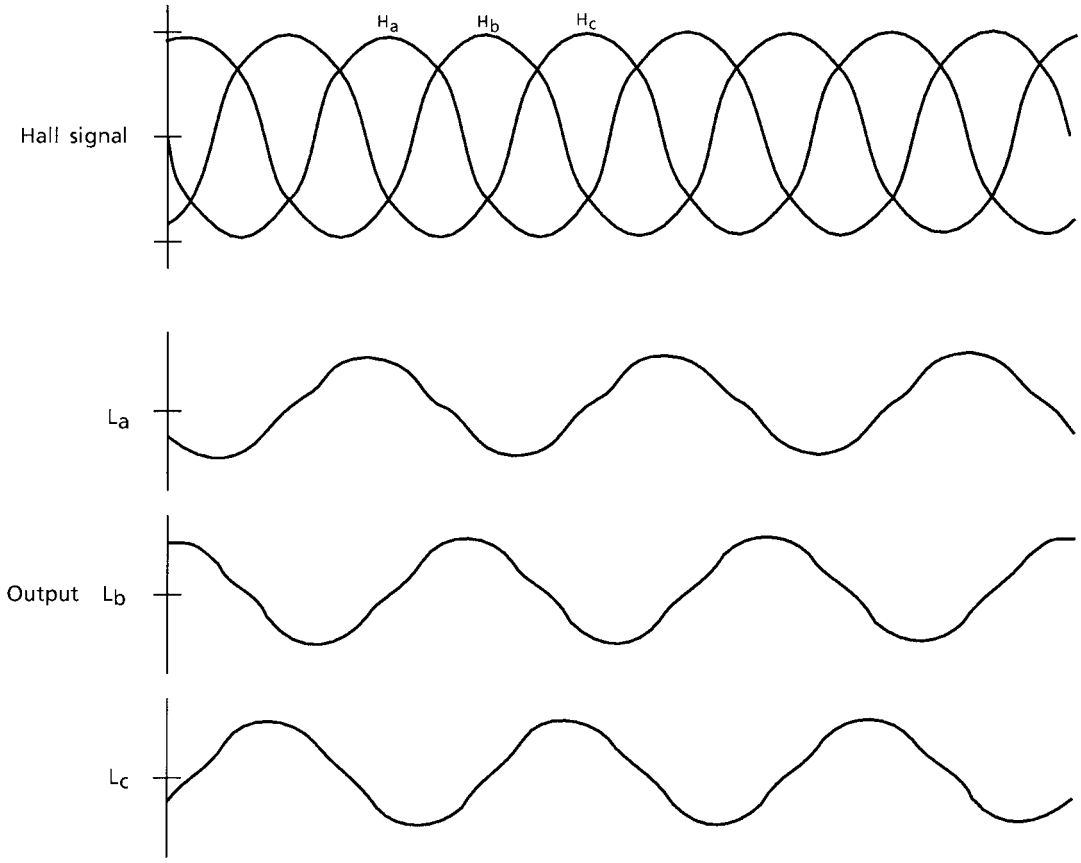
BLOCK DIAGRAM



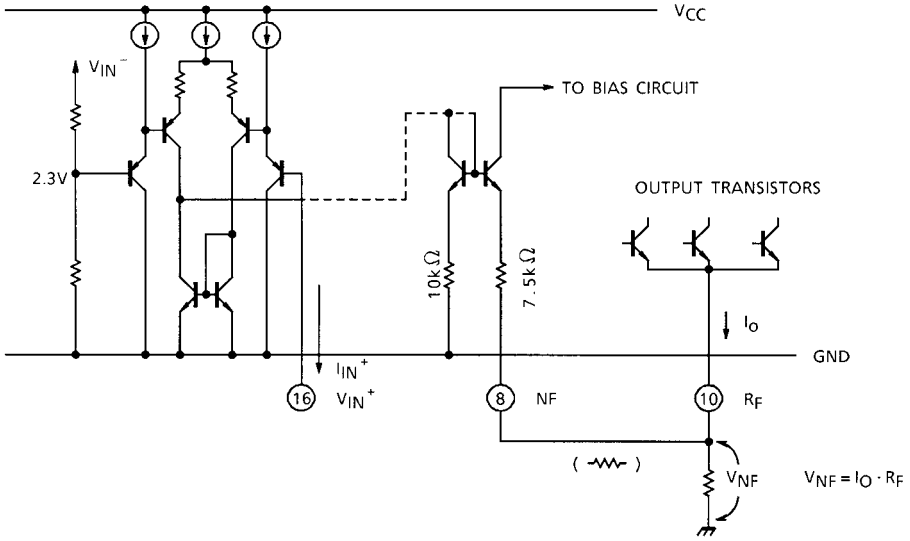
FUNCTION (V_{IN}^- = 5 V)

MODE	FRS	V_{IN}	OUTPUT
CW	L	V_{IN}^+ > 2.3 V	$L_a = H_a - H_b$ $L_b = H_b - H_c$ $L_c = H_c - H_a$
CCW	H	V_{IN}^+ > 2.3 V	$L_a = -(H_a - H_b)$ $L_b = -(H_b - H_c)$ $L_c = -(H_c - H_a)$
Standby	M	—	Mid-point potentia (Note)
Brake	—	V_{IN}^+ < 2.3 V	Mid-point potentia (Note)

Note: Low-impedance Mode

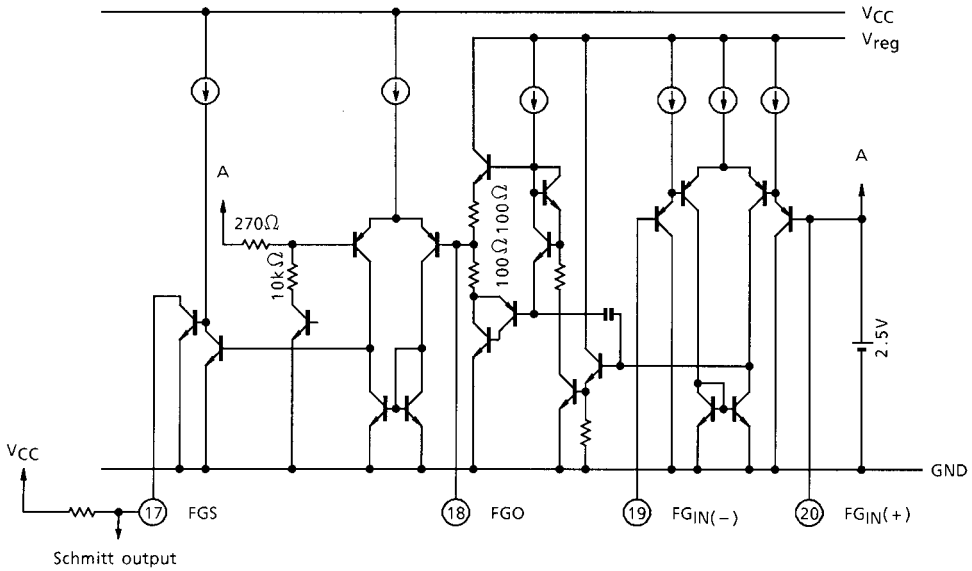

Ha
Hb
Hc
Hall signal
La
Output
Lb
Lc

1. Control input circuit

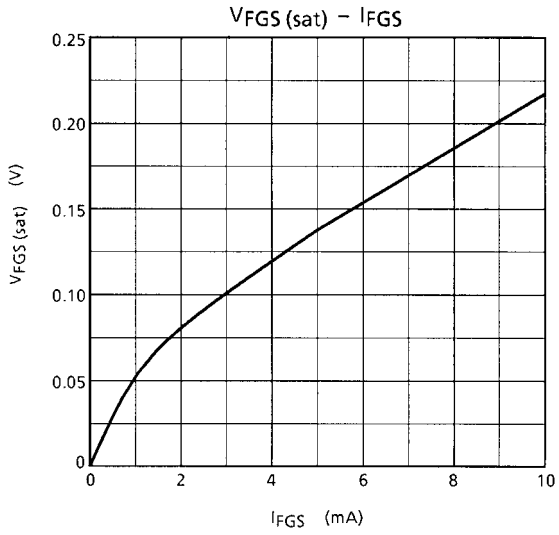


In the case of output current feedback to the motor, connect feedback resistance to R_F pin (10) and feed it back to N_F pin (8).
The feedback amount can be adjusted by connecting a resistor between pin (10) and (8) pin.

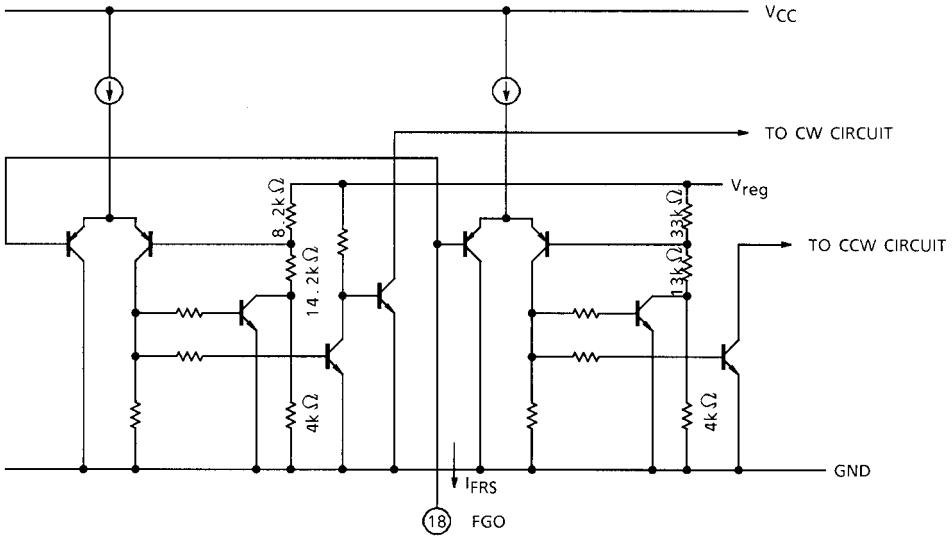
2. FG amplifier and schmitt circuit



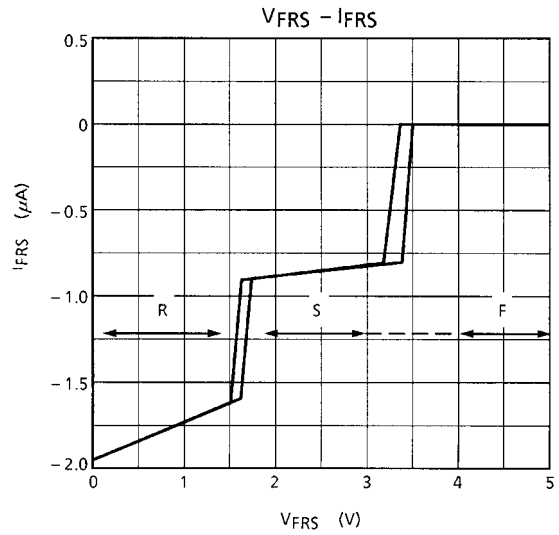
The FG amplifier is stored with internal reference voltage (2.5 V), making it possible to directly input the FG signal from pattern FG. The Schmitt circuit stored within can output wave-shaped FG signals.
FGO is in push-pull mode with low impedance.



3. FRS section



Voltage applied to FRS pin (15) makes it possible to select forward, reverse, and stop modes. For the relationships between FRS, control input, and output, refer to the item on these functions.
The relationship between input voltage (V_{FRS}) and input current (I_{FRS}) to the DRS pin (15) is shown as a feature in the following graph :



MAXIMUM RATINGS (Ta = 25°C)

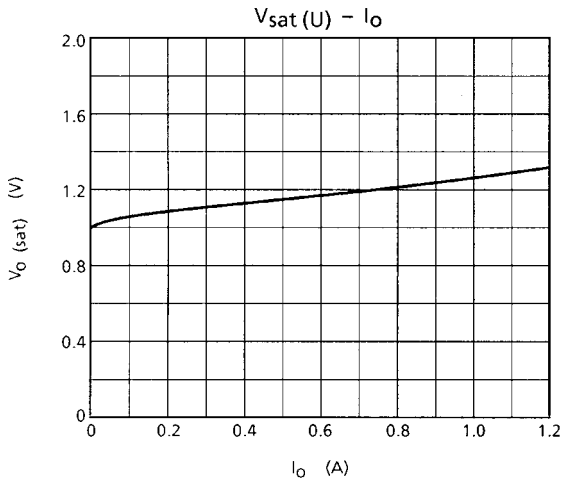
CHARACTERISTIC	SYMBOL	RATING	UNIT
Supply Voltage	V_{CC}	18	V
Output Current	I_O	1.2	A
FG Output Current	I_{FGO}	12	mA
	I_{FGS}	14	
Power Dissipation	P_D	1.0 (Note 1)	W
		3.2 (Note 2)	
		5.8 (Note 3)	
Operating Temperature	T_{opr}	−30~75	°C
Storage Temperature	T_{stg}	−55~150	°C

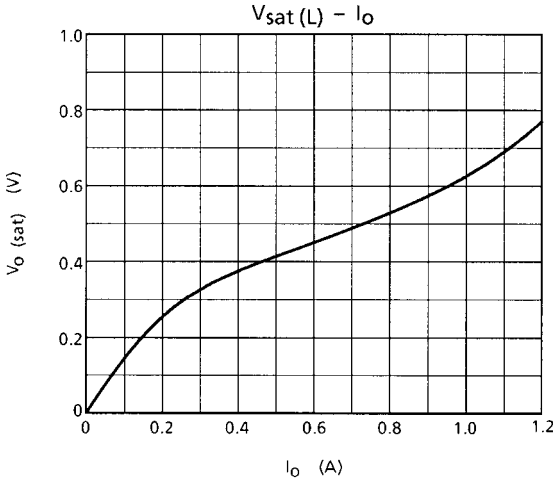
Note 1: Without heat sink
Note 2: 50 × 50 × 1 mm Fe board mounting
Note 3: Infinite heat sink mounting

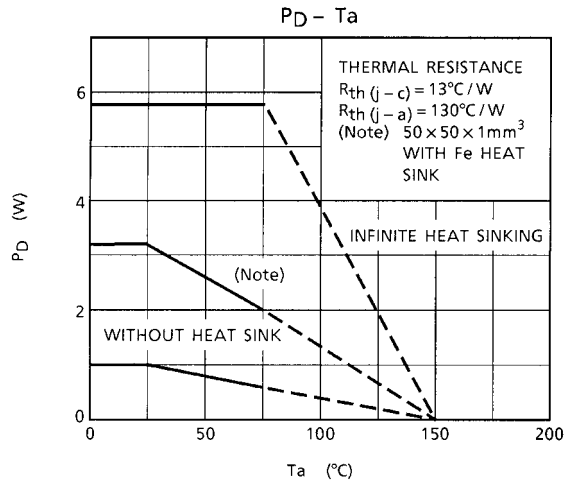
ELECTRICAL CHARACTERISTICS (V_{CC} = 12 V, $V_{IN}-$ = 5 V, Ta = 25°C)

CHARACTERISTIC			SYMBOL	TEST CIR-CUIT	TEST CONDITION	MIN	TYP.	MAX	UNIT
Supply Current			$I_{CC\ 1}$	1	Output Open, FRS = 2.5 V	—	12.5	28	mA
			$I_{CC\ 2}$	1	Output Open, FRS = GND	—	14	28	
			$I_{CC\ 3}$	1	Output Open, FRS = 5 V	—	14	28	
Speed Control Circuit	Input Voltage Range		V_{CIN}	2		GND	—	V_{CC} −2.5	V
	Control Output Voltage Gain		G_{VCO}	2	V_H = 25 mV_{p-p}	7.5	13	18	dB
	Input Current		I_{CIN}	2	V_{IN}^+ = GND (Sink Current)	—	0.2	5	μA
	Internal Reference Voltage 1		$V_{ref\ 1}$	—		2.15	2.30	2.45	V
Position Detecting Circuit	Common Mode Inoput Voltage Range		V_{CMRH}	3		1.5	—	5	V
	Input Current		I_H	3	V_{INH} = 2.5 V	—	0.2	3	μA
	Input Voltage Gain		G_{VHO}	4	V_{IN}^+ = 5 V	40	47	51	dB
Output Circuit	Saturation Voltage	Upper Side	$V_{sat\ (U)}$	5	I_O = 1.0 A	—	1.2	1.9	V
		Lower Side	$V_{sat\ (L)}$	5	I_O = 1.0 A	—	0.7	1.5	
	Quiescent Voltage		V_{OS}	5	V_{IN}^+ = 1.0 V	5.0	5.5	7.0	V
	Quiescent Voltage Difference		V_{OOF}	5	Each Output to Output	—	25	50	mV
FG Amp	Open Loop Voltage Gain		G_{VFG}	—	f_{FG} = 1 kHz	—	70	—	dB
	Band Width		f_{FG}	6		DC	—	50	kHz
	FGO Output Amplitude		V_{FGO}	6	I_{FGO} = 5 mA	1.0	2.1	4	V
	FGS Output Saturation Voltage		$V_{sat\ (FGS)}$	6	I_{FGS} = 4 mA	—	0.15	0.25	V
	Internal Reference Voltage 2		$V_{ref\ 2}$	6		2.1	2.5	2.9	V
	Schmitt Circuit Hysteresis Width		V_{HYS}	6		—	100	250	mV
Rotation Direction Control Circuit	FWD Operating Voltage		V_{FWD}	5		4.0	—	V_{CC}	V
	Stop Operating Voltage		V_{STOP}	5		1.9	—	3.1	V
	Reverse Operating Voltage		V_{REV}	5		0	—	1.3	V
Thermal Shutdown Operating Temperature			T_{SD}	—		150	—	—	°C

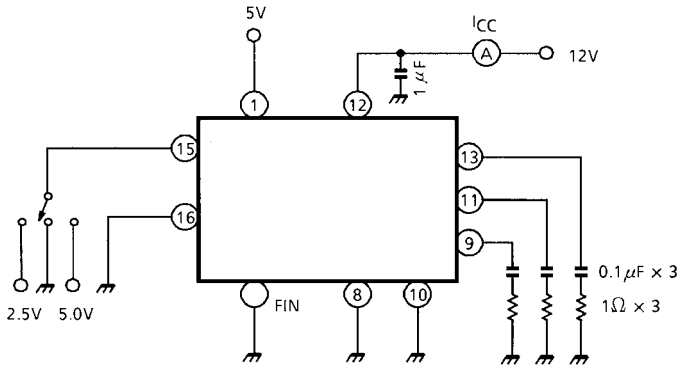
CHARACTERISTICS OF OUTPUT AMP SATURATION VOLTAGE



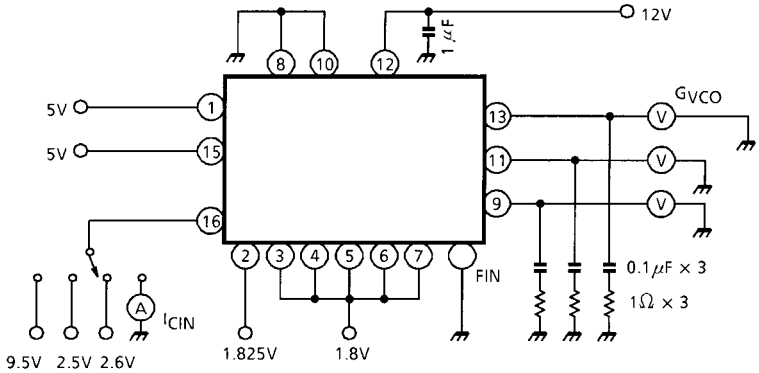




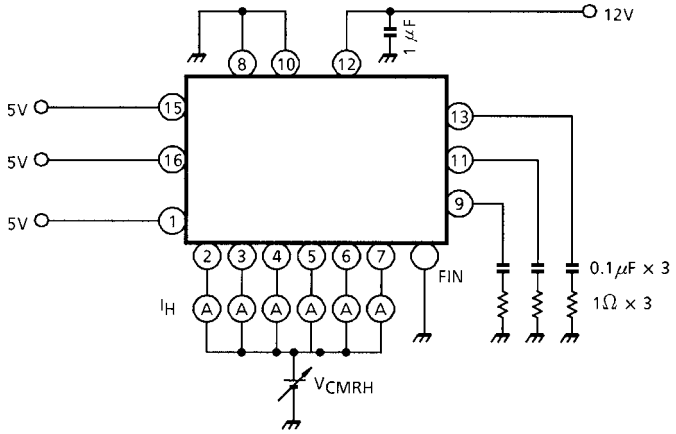
TEST CIRCUIT 1



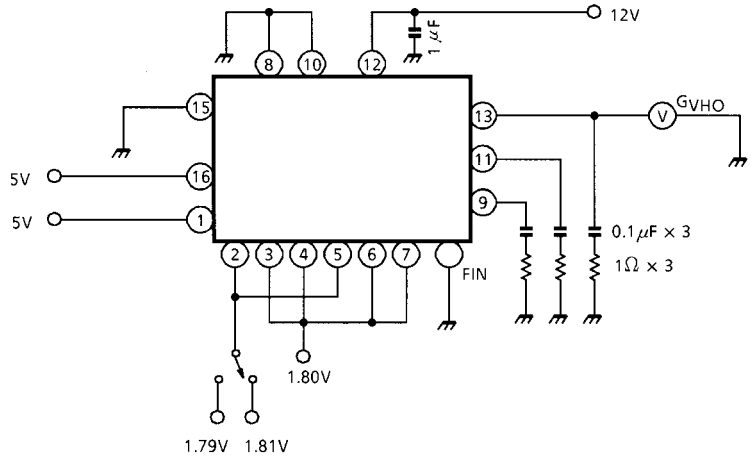
TEST CIRCUIT 2



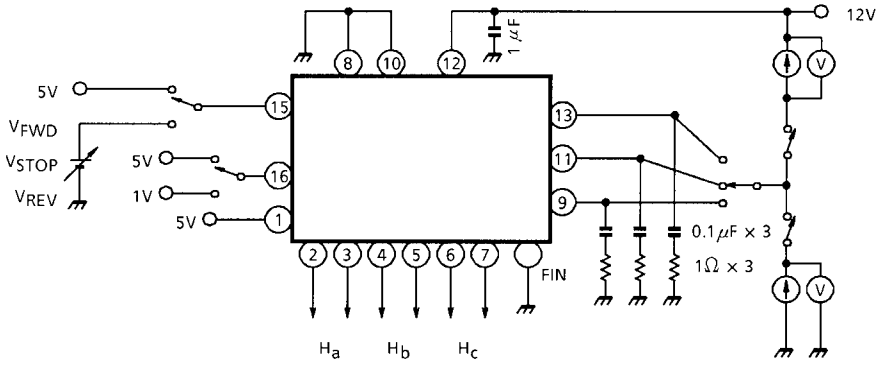
TEST CIRCUIT 3



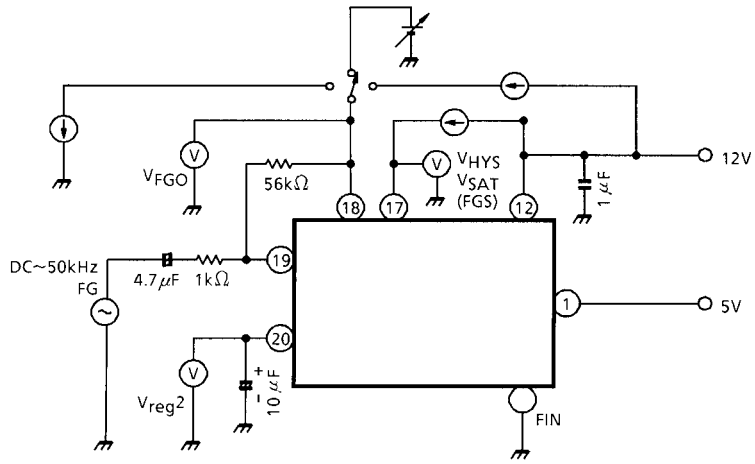
TEST CIRCUIT 4



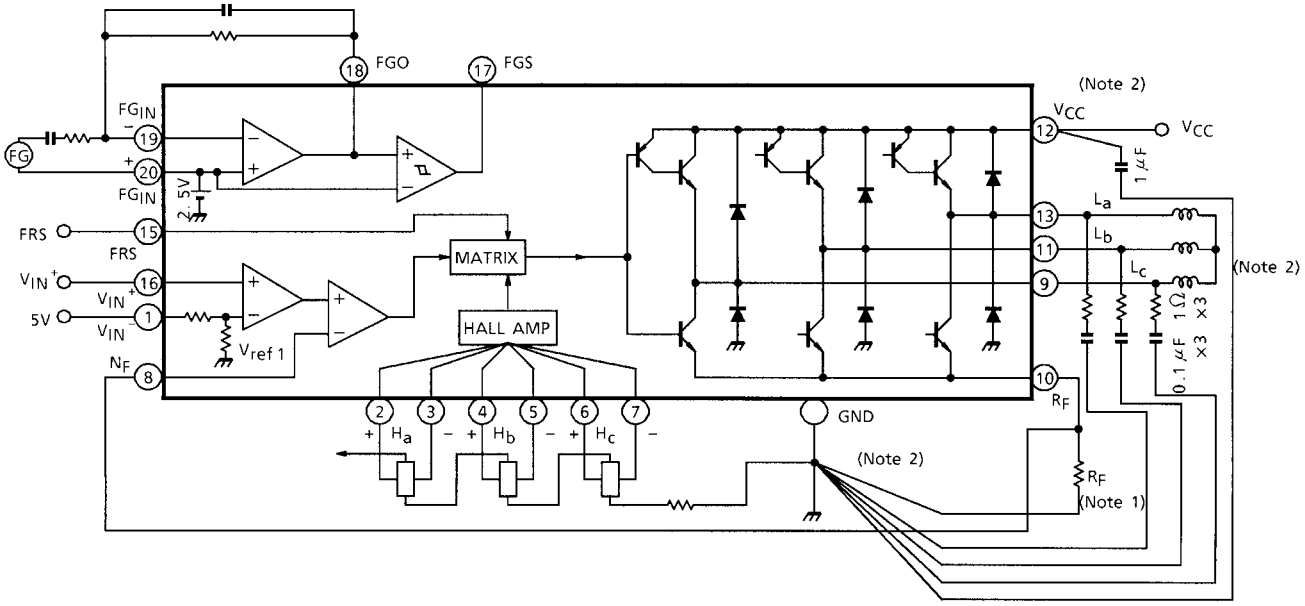
TEST CIRCUIT 5



TEST CIRCUIT 6



APPLICATION CIRCUIT

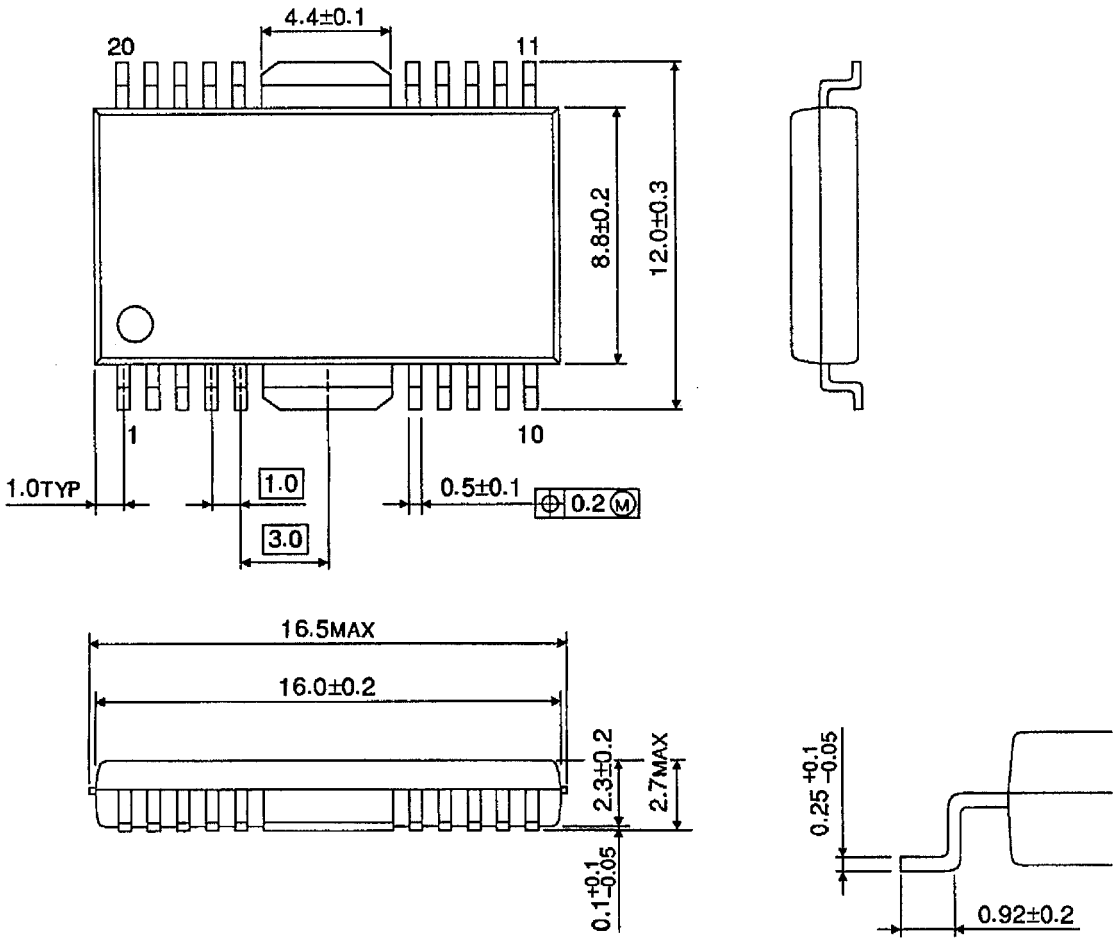


Note 1: All output currents flow into R_F pins ; therefore, be sure to provide GND separately from other GND lines. Care should be taken not to have common impedance among other GND lines, either, in making pattern designs (especially for Hall Sensor GND line).

Note 2: Utmost care is necessary in the design of the output line, V_{CC} and GND line since IC may be destroyed due to short−circuit between outputs, air contamination fault, or fault by improper grounding.

PACKAGE DIMENSIONS

HSOP20−P−450−1.00 Unit : mm



Weight : 0.79 g (Typ.)

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