

TOSHIBA BIPOLAR LINEAR INTEGRATED CIRCUIT SILICON MONOLITHIC

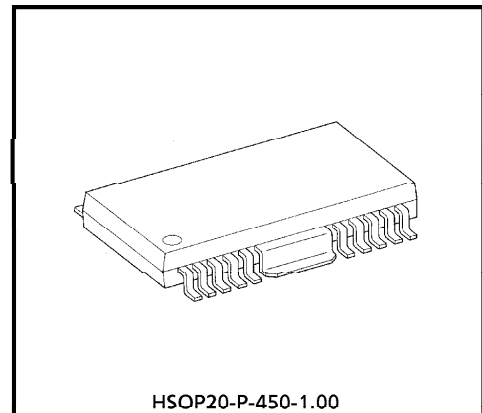
TA8424F

3 PHASE HALL MOTOR DRIVER IC

The TA8424F is non switching type 3 Phase Hall Motor Driver IC consisted of FG Amplifier, Regulator for Hall Sensors, control Amplifier and 3 Phase Output Drivers.

FEATURES

- Low Noise (Quasi Sinusoidal Drive), Current Control Motor Driver.
- Low Output Impedance with B Class Push-Pull Driver.
- Output Current Up to 1.2A.
- Operating Voltage Range : $V_{CC} = 7 \sim 17V$
- Built-in Thermal Shutdown Circuit, FG Amplifier and Regulator.
- 2 Brake Modes Available (Short Brake and Dumping Brake).
- Build in regulator for Hall Sensors.

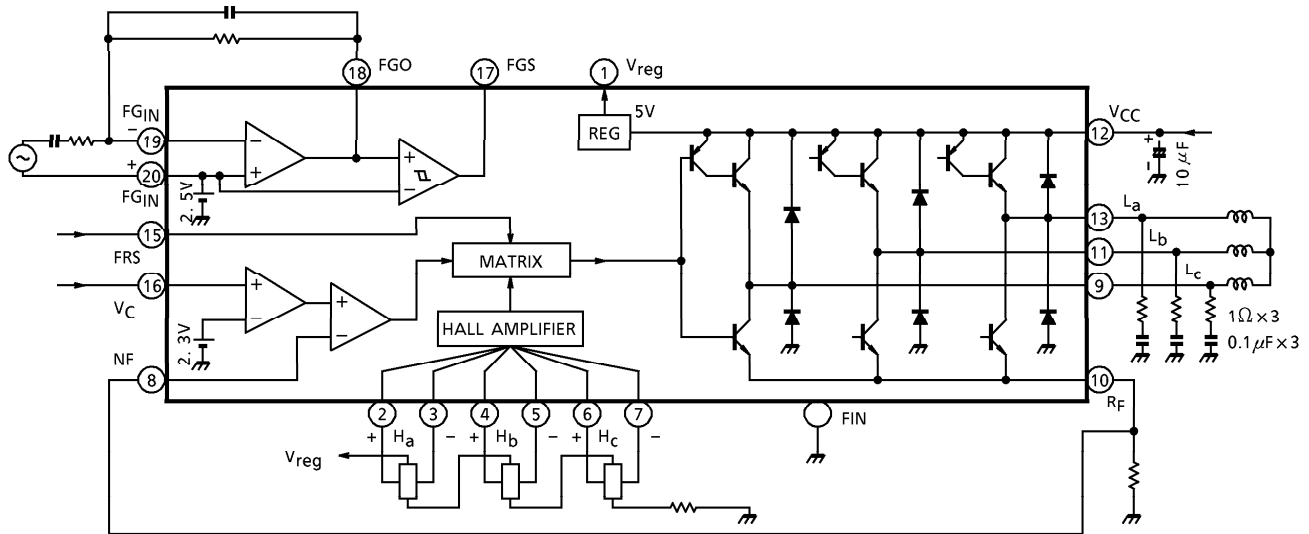


Weight : 0.79g (Typ.)

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BLOCK DIAGRAM



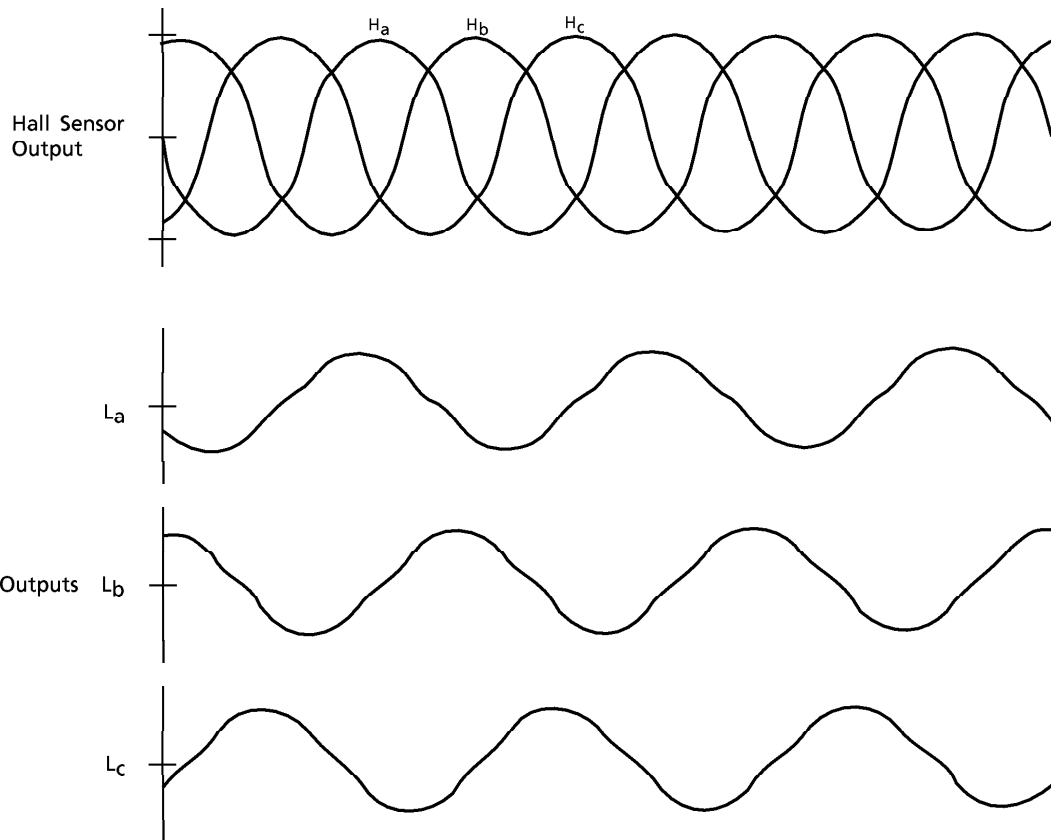
PIN FUNCTION

PIN No.	SYMBOL	FUNCTIONAL DESCRIPTION
1	V _{reg}	Internal power supply output terminal.
2	Ha ⁺	a-phase Hall-Amp positive input terminal.
3	Ha ⁻	a-phase Hall-Amp negative input terminal.
4	Hb ⁺	b-phase Hall-Amp positive input terminal.
5	Hb ⁻	b-phase Hall-Amp negative input terminal.
6	Hc ⁺	c-phase Hall-Amp positive input terminal.
7	Hc ⁻	c-phase Hall-Amp negative input terminal.
8	NF	Feedback resistance connection terminal.
9	L _c	c-phase drive output terminal.
10	R _f	Output current detection terminal.
11	L _b	b-phase drive output terminal.
12	V _{CC}	Power supply input terminal.
13	L _a	a-phase drive output terminal.
14	N.C.	Non connection.
15	FRS	Forward / Reverse control terminal.
16	V _C	Control signal input terminal.
17	FGS	Hysteresis Amp. output terminal.
18	FGO	FG Amp. output terminal.
19	FGIN ⁻	FG Amp. negative input terminal.
20	FGIN ⁺	FG Amp. positive input terminal.
	FIN	GND terminal.

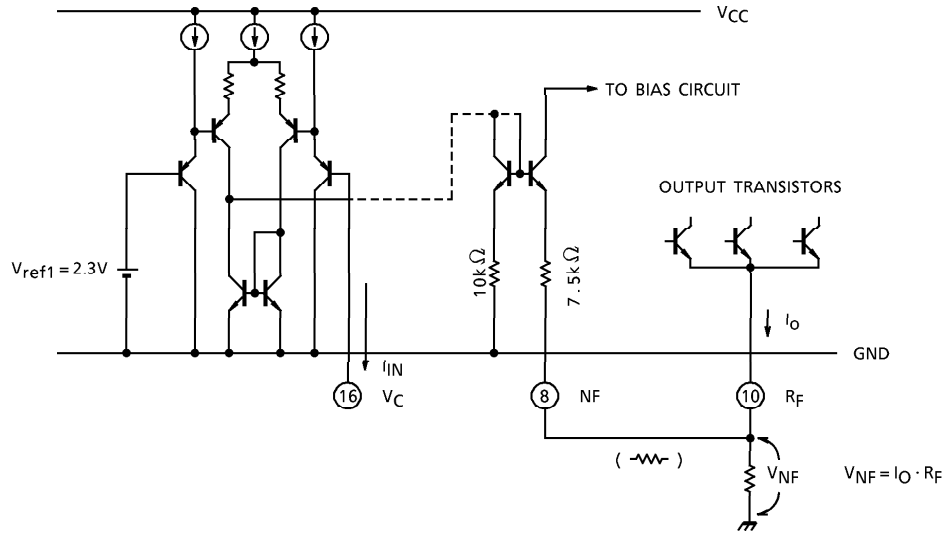
OPERATING MODE

MODE	FRS	V_C	OUTPUT
Forward	L	$V_C > 2.3V$	$L_a = H_a - H_b$ $L_b = H_b - H_c$ $L_c = H_c - H_a$
Reverse	H	$V_C > 2.3V$	$L_a = -(H_a - H_b)$ $L_b = -(H_b - H_c)$ $L_c = -(H_c - H_a)$
Stand-By	M	—	Center (Note)
Brake	—	$V_C < 2.3V$	Center (Note)

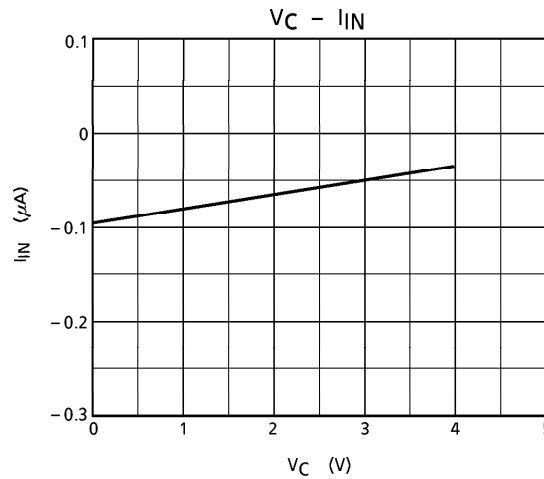
(Note) Low Impedance



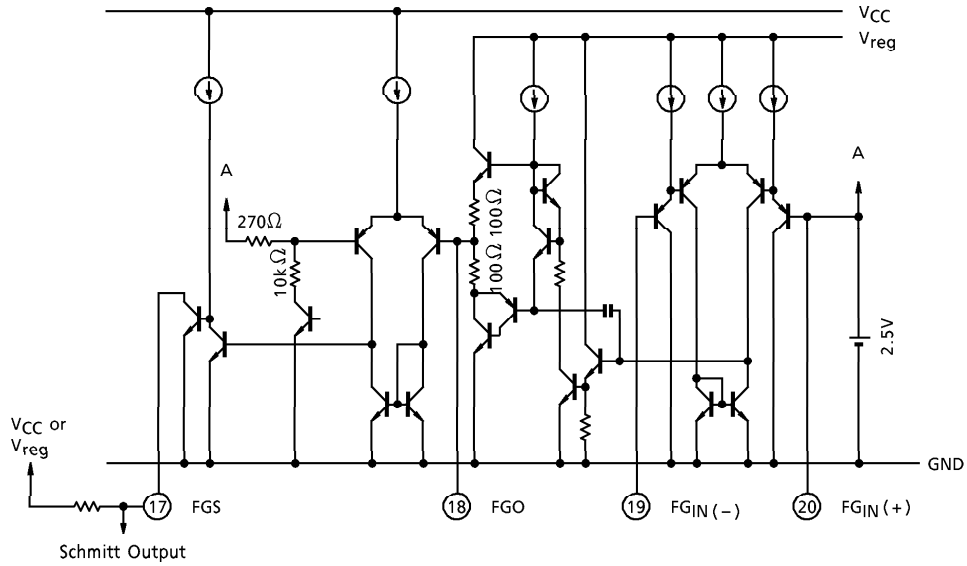
1. Control Gain (G_{VCO})



Negative Feedback is looped by R_F and connected its line to pin⑧.
 Feedback Voltage V_{NF} is generated by R_F and Output Current I_O .
 It is possible to decrease the feedback by connecting a resistor between pin⑩ and pin⑧.
 Input current of V_C (I_{IN}) vs V_C characteristic is shown below.

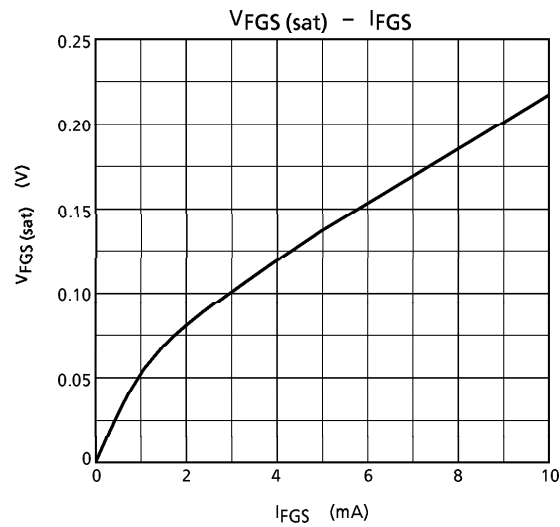


2. FG Amplifier and Hysteresis Amplifier

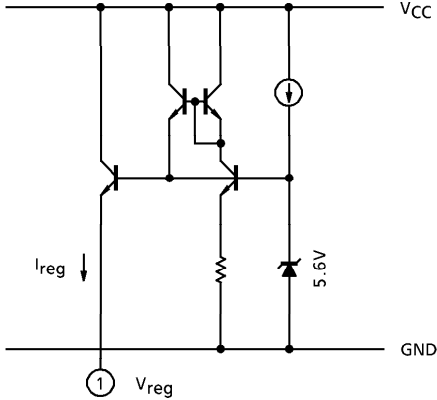


2.5V of Internal Reference is equipped with FG Amplifier. FG signal is fed into FG_{IN+} and FG_{IN-} inputs with differential mode and outputs to FGO (Pin¹⁸).

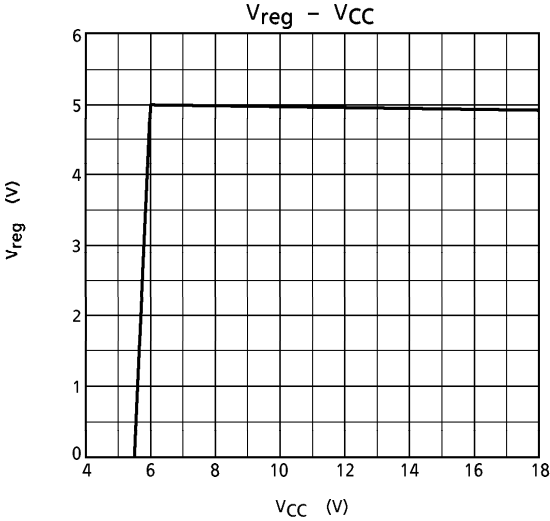
Amplified FG signal is wave shaped by Hysteresis Amplifier in following stage and outputs a wave shaped signal to FGS (Pin¹⁷).



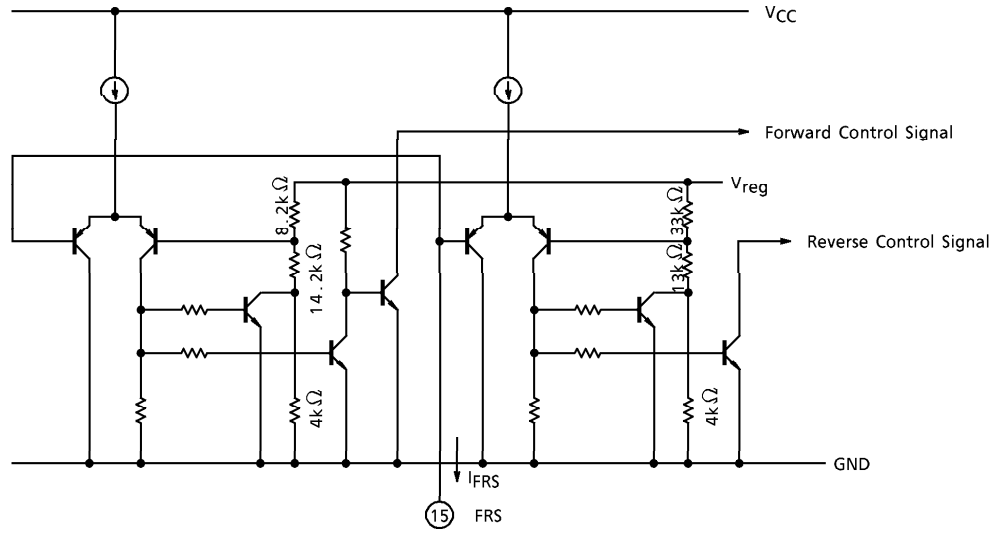
3. Regulator (V_{reg})



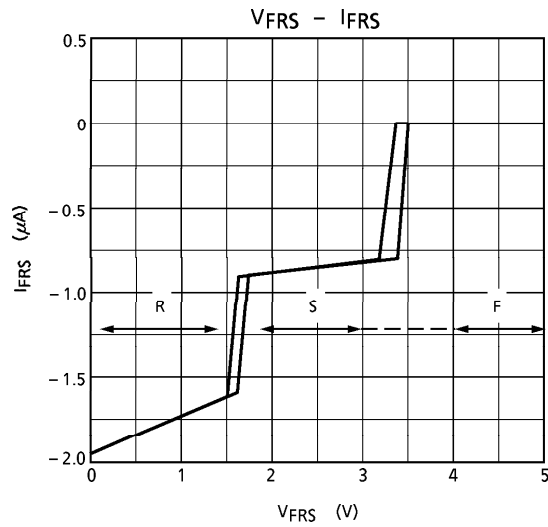
Internal regulator outputs 5V and this current capability is up to 30mA. V_{CC} vs V_{reg} characteristic is shown below.



4. FRS input (Rotation direction and stop control)



FRS input is a control terminal of Motor Rotation Direction and Stop.
 V_{FRS} vs I_{FRS} characteristic is shown below.



MAXIMUM RATINGS (Ta = 25°C)

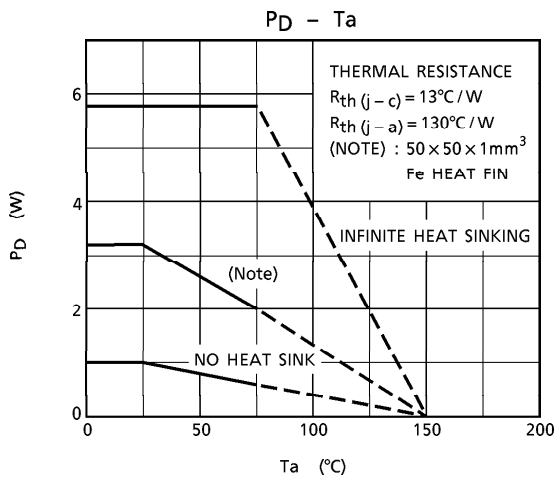
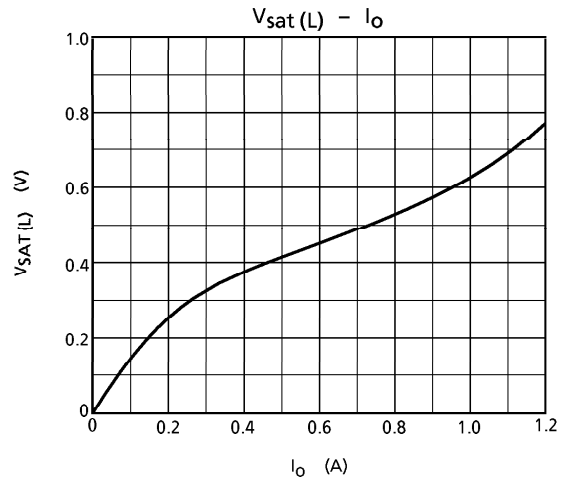
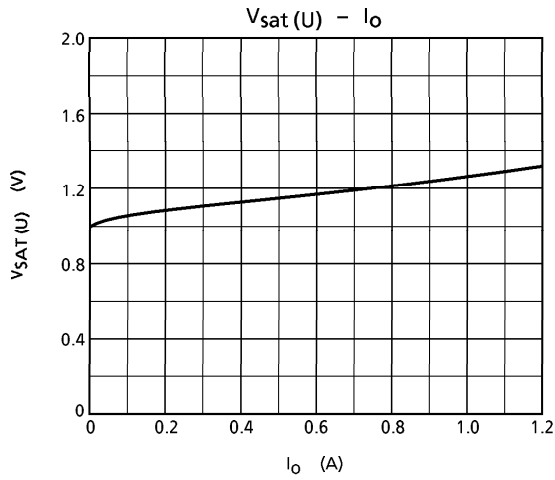
CHARACTERISTIC	SYMBOL	RATING	UNIT
Supply Voltage	V _{CC}	18	V
Output Current (Average)	I _O (MAX.)	1.2	A
FG Output Current	I _{FGO}	12	mA
	I _{FGS}	14	
Power Dissipation	P _D	1.0 (Note 1)	W
		3.2 (Note 2)	
		5.8 (Note 3)	
Operating Temperature	T _{opr}	-30~75	°C
Storage Temperature	T _{stg}	-55~150	°C

(Note 1) No Heat Sink
 (Note 2) 50×50×1mm Fe board,
 Mounting
 (Note 3) T_c = 75°C

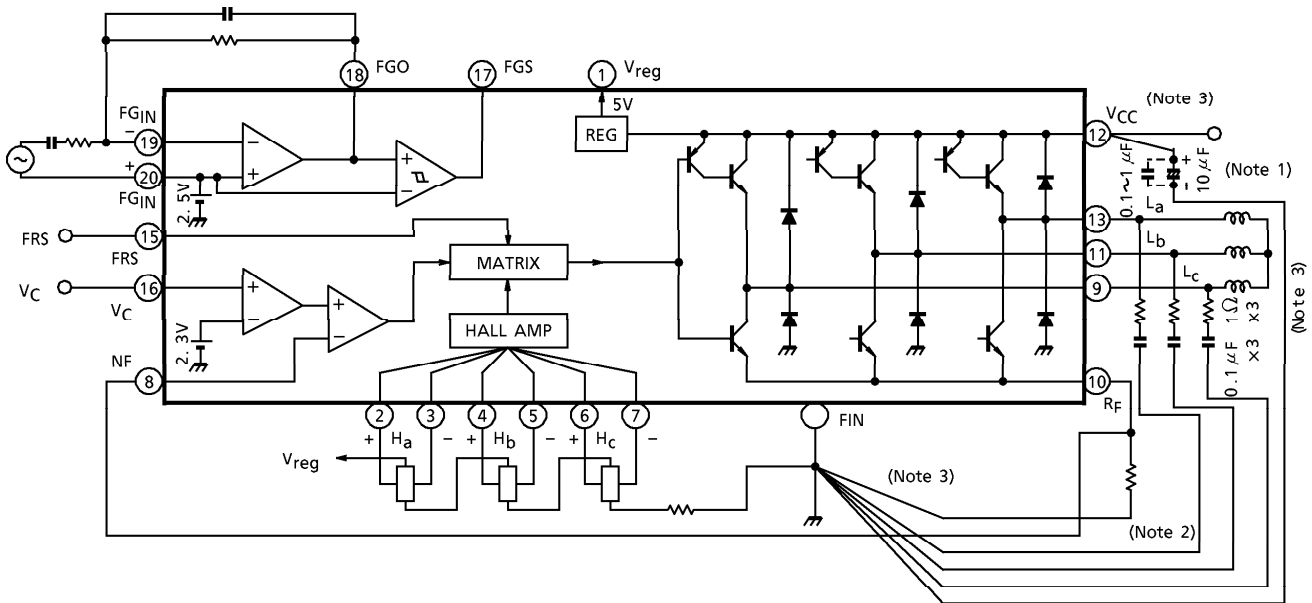
ELECTRICAL CHARACTERISTICS (V_{CC} = 12V, Ta = 25°C)

CHARACTERISTIC		SYMBOL	TEST CIRCUIT	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Supply Current		I _{CC 1}	—	Output open, FRS = 2.5V	—	12.5	25	mA
		I _{CC 2}	—	Output open, FRS = GND	—	14	25	
		I _{CC 3}	—	Output open, FRS = 5V	—	14	25	
Rotation Control Circuit	Control Gain (V _C →Out)	G _{VCO}	—	V _{CC} = 12V, V _H = 50mV _{p-p}	7.5	13	18	dB
	Input Current (V _C)	I _{CIN}	—	V _C = GND (Sink current)	—	0.2	5	μA
	Internal Reference-1	V _{ref 1}	—	—	2.15	2.30	2.45	V
Position Sensing Circuit	Common Mode Range	CMR _H	—	—	1.5	—	5	V
	Input Current	I _H	—	V _{IH} = 2.5V	—	0.2	3	μA
	Voltage Gain (Each Hall Input to OUT)	G _{VHO}	—	V _C = 5V, V _{CC} = 12V	40	47	51	dB
Output Driver	Upper Side Saturation	V _{sat (U)}	—	I _O = 1.0A	—	1.2	1.9	V
	Lower Side Saturation	V _{sat (L)}	—	I _O = 1.0A	—	0.7	1.5	
	Quiescent Voltage	V _{OS}	—	V _C = 1.0V	5.0	5.5	7.0	V
	Quiescent Voltage Difference	V _{OOFF}	—	Each output to output	—	25	50	mV
FG Amp	Open Loop Gain	G _{VFG}	—	f _{FG} = 1kHz	—	70	—	dB
	Band Width	f _{FG}	—	—	DC	—	50	kHz
	Output Voltage Swing	V _{FGO}	—	I _{FGO} = 5mA	1.0	2.1	4	V
	FGS Saturation	V _{sat (FGS)}	—	I _{FGS} = 4mA	—	0.15	0.25	V
	Internal Reference-2	V _{ref 2}	—	—	2.1	2.5	2.9	V
	Hysteresis Voltage	V _{HYS}	—	—	—	100	250	mV
Rotation Direction Control	FWD	Operating Voltage	V _{FWD}	—	4.0	—	V _{CC}	V
	STOP	Operating Voltage	V _{STOP}	—	1.9	—	3.1	V
	REVERSE	Operating Voltage	V _{REV}	—	0	—	1.3	V
Regulator Output Voltage		V _{REG}	—	I _H = 10mA	4.7	5.1	5.5	V
Thermal Shutdown Operating Temperature		T _{SD}	—	—	150	—	—	°C

Output Amplifier Saturation Voltage Characteristics



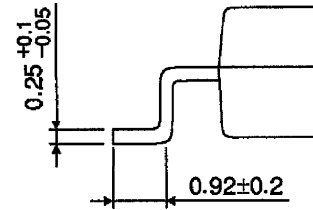
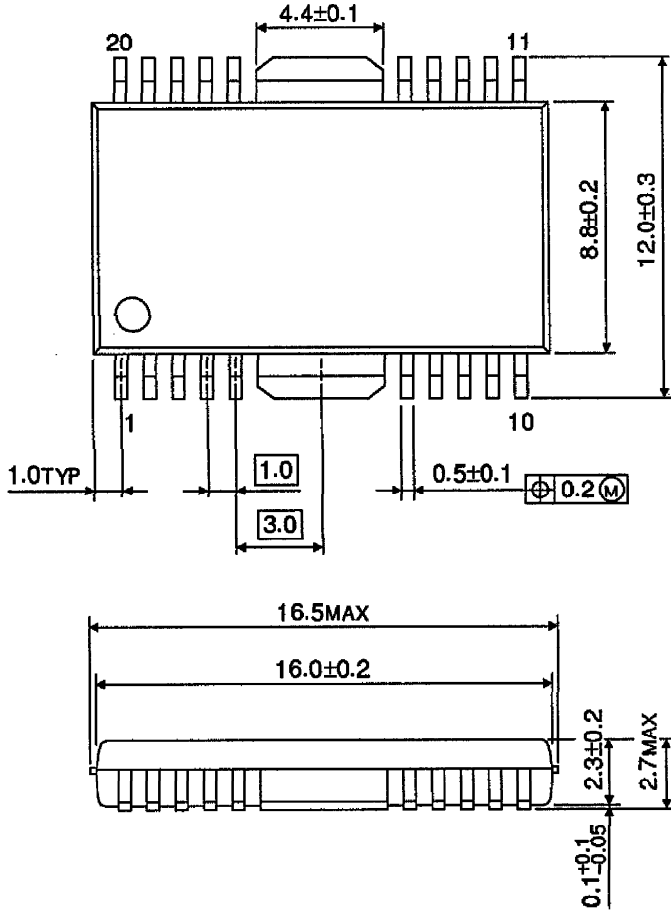
APPLICATION CIRCUIT



- (Note 1) Connect if required (0.1~1µF)
- (Note 2) Care should be taken not to have common impedance between R_F GND Line and other small signal lines for stable operations (especially for Hall Sensor GND line).
- (Note 3) 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.

OUTLINE DRAWING
HSOP20-P-450-1.00

Unit : mm



Weight : 0.79g (Typ.)