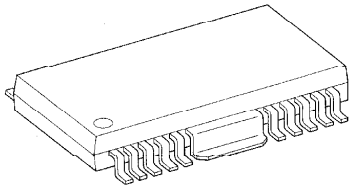
TOSHIBA BIPOLAR LINEAR INTEGRATED CIRCUIT SILICON MONOLITHIC

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.



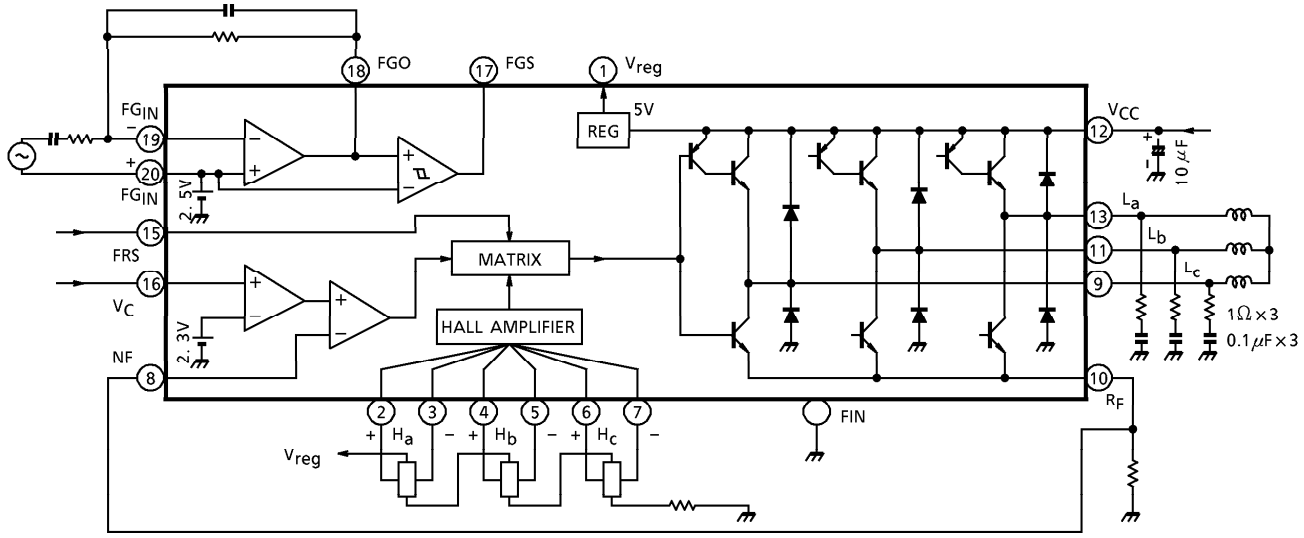
HSOP20-P-450-1.00

Weight : 0.79g (Typ.)

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} = 7~17V
- Built-in Thermal Shutdown Circuit, FG Amplifier and Regulator.
- 2 Brake Modes Available (Short Brake and Dumping Brake).
- Build in regulator for Hall Sensors.

BLOCK DIAGRAM



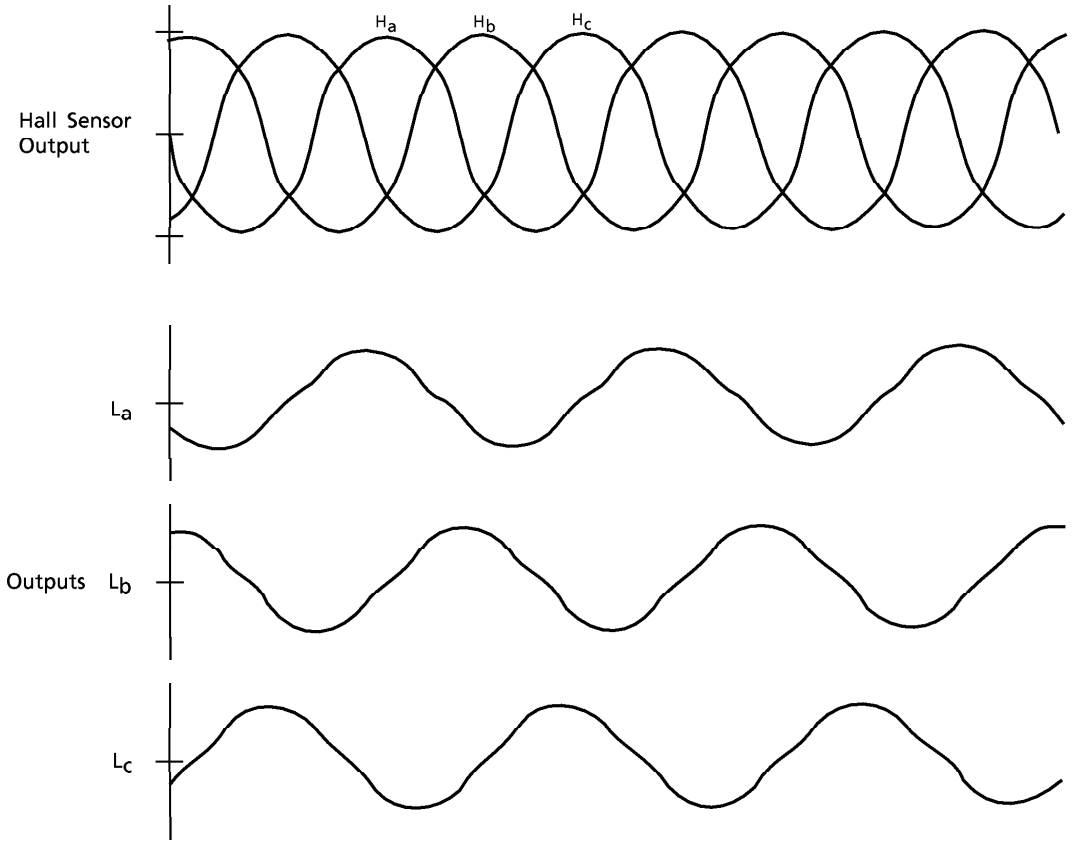
PIN FUNCTION

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	$FG_{IN}-$	FG Amp. negative input terminal.
20	$FG_{IN}+$	FG Amp. positive input terminal.
	FIN	GND terminal.

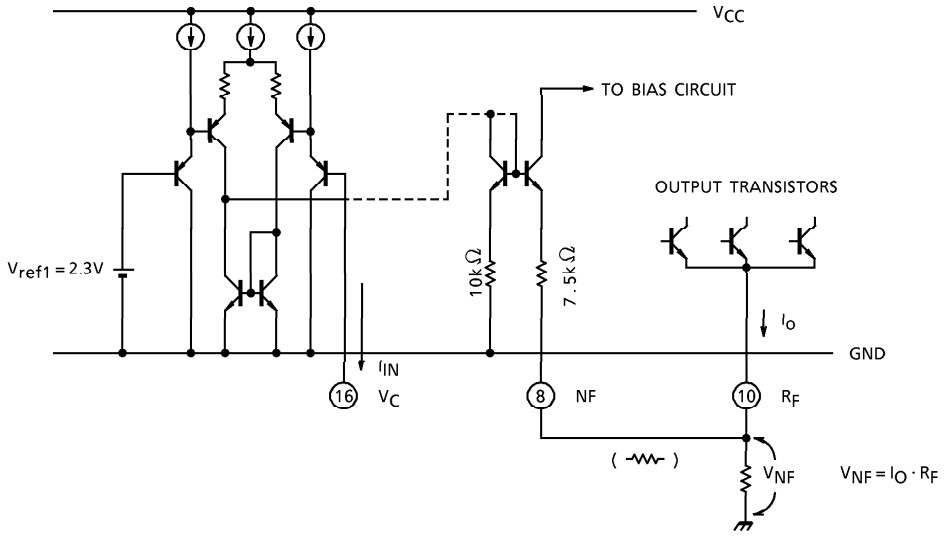
OPERATING MODE

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)

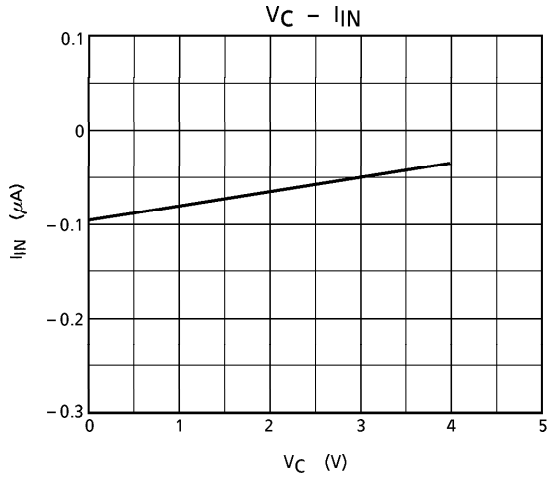
(Note) Low Impedance



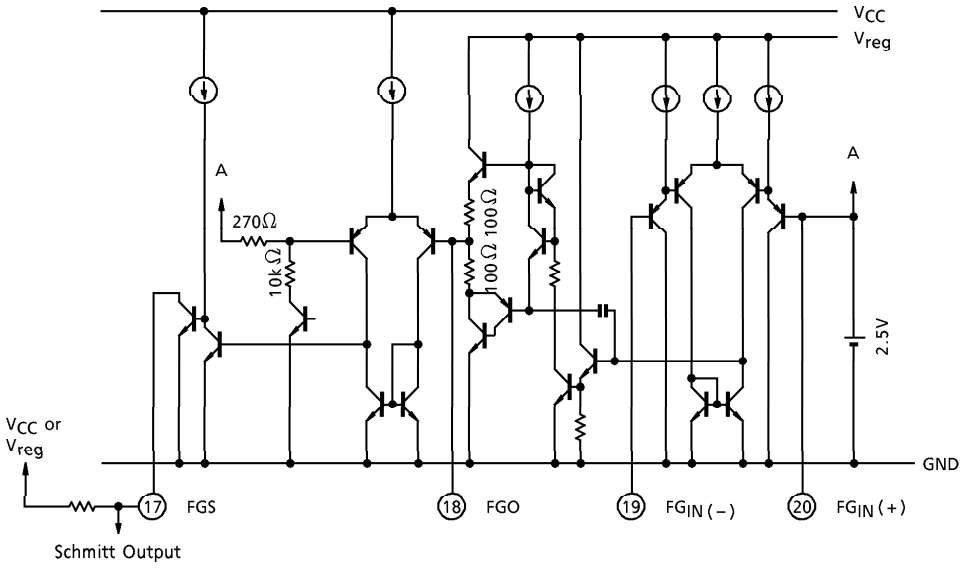
1. Control Gain (G_{VCO})



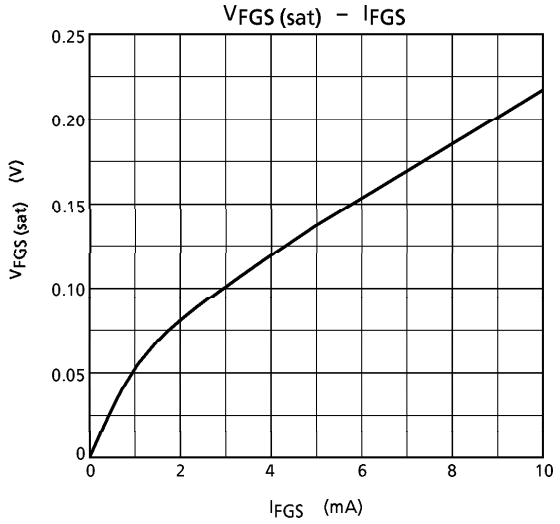
Negative Feedback is looped by R_F and connected its line to pin⑧.
Feedback Voltage V_{NF} is generated by R_F and Output Current I_O.
It is possible to decrease the feedback by connecting a resistor between pin⑩ and pin⑧.
Input current of V_C ($I_{C\ IN}$) vs V_C characteristic is shown below.



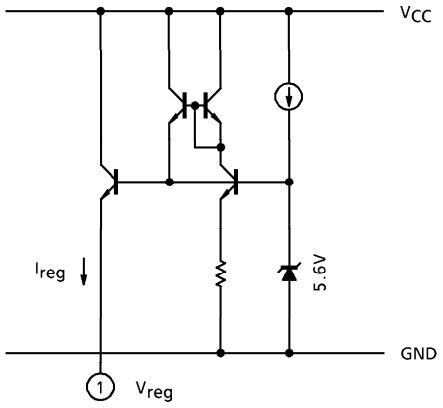
2. FG Amplifier and Hysteresis Amplifier



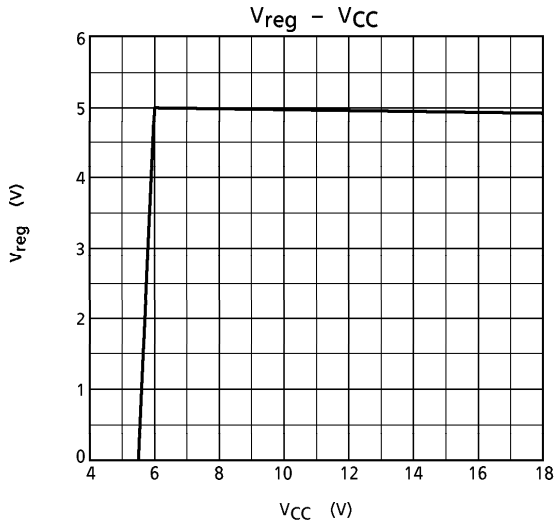
2.5V of Internal Reference is equipped with FG Amplifier. FG signal is fed into FG_{IN} + and FG_{IN} − inputs with differential mode and outputs to FGO (Pin⑱).
Amplified FG signal is wave shaped by Hysteresis Amplifier in following stage and outputs a wave shaped signal to FGS (Pin⑰).



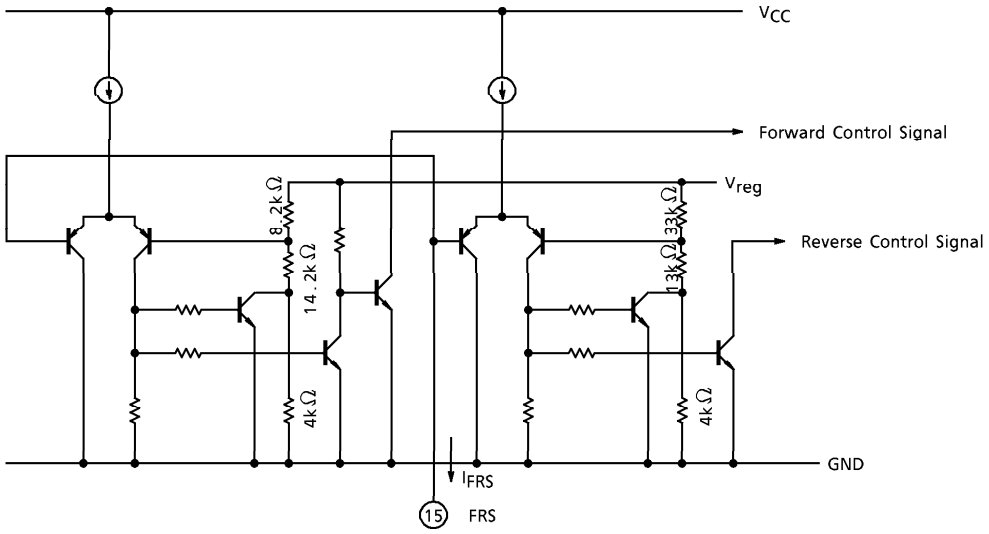
3. Regulator (V_{reg})



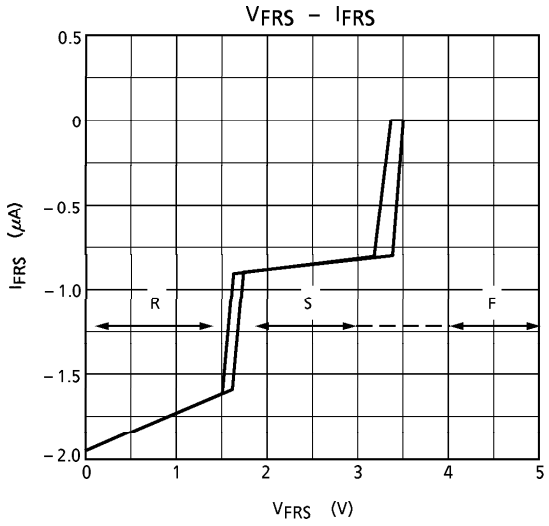
Internal regulator outputs 5V and this current capability is up to 30mA. V_{CC} vs V_{reg} characteristic is shown below.



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

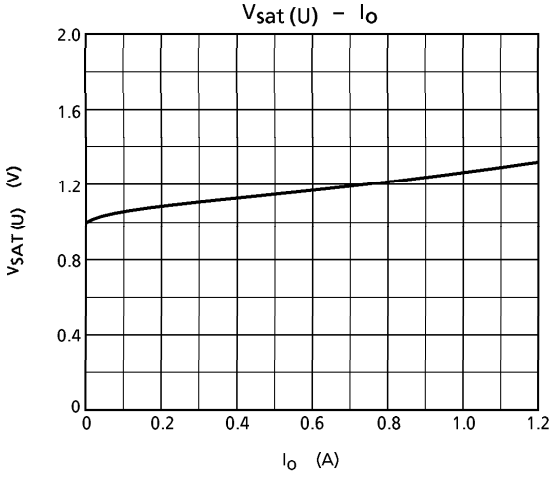
(Note 1) No Heat Sink
(Note 2) 50 × 50 × 1mm Fe board, Mounting
(Note 3) Tc = 75°C

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

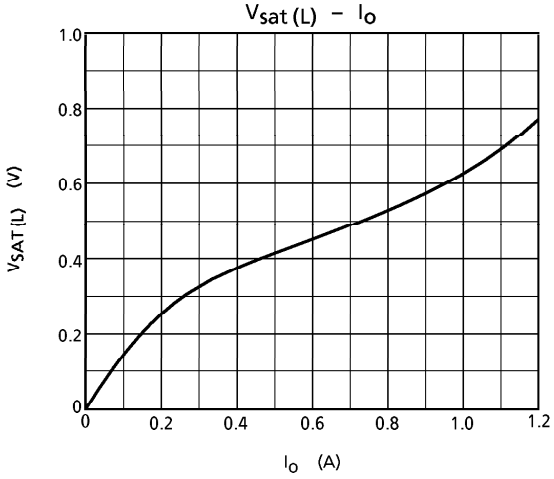
CHARACTERISTIC			SYMBOL	TEST CIR-CUIT	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Supply Current			$I_{CC\ 1}$	—	Output open, FRS = 2.5V	—	12.5	25	mA
			$I_{CC\ 2}$	—	Output open, FRS = GND	—	14	25	
			$I_{CC\ 3}$	—	Output open, FRS = 5V	—	14	25	
Rotation Control Circuit	Control Gain (V_C→Out)		G_{VCO}	—	V_{CC} = 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_{OOF}	—	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

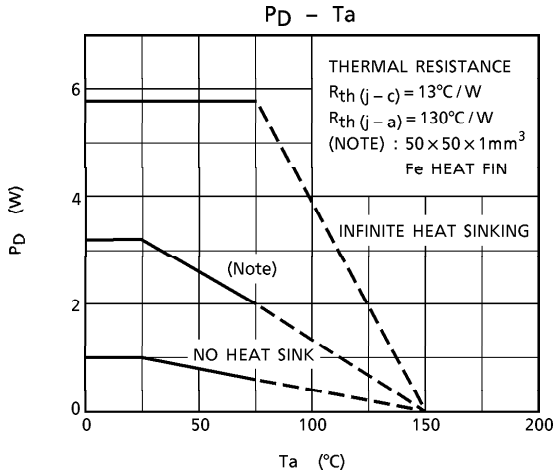
$V_{sat\,(U)}$ – I_O



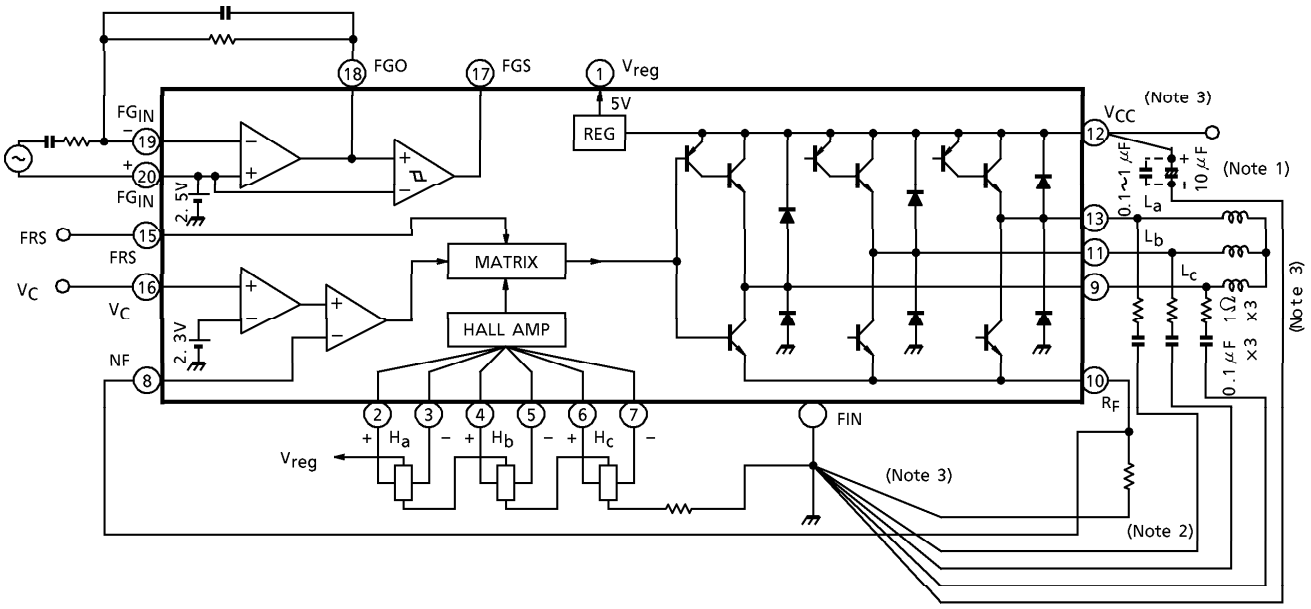
$V_{sat\,(L)}$ – I_O



P_D – Ta



APPLICATION CIRCUIT



(Note 1) Connect if required (0.1~1μF)

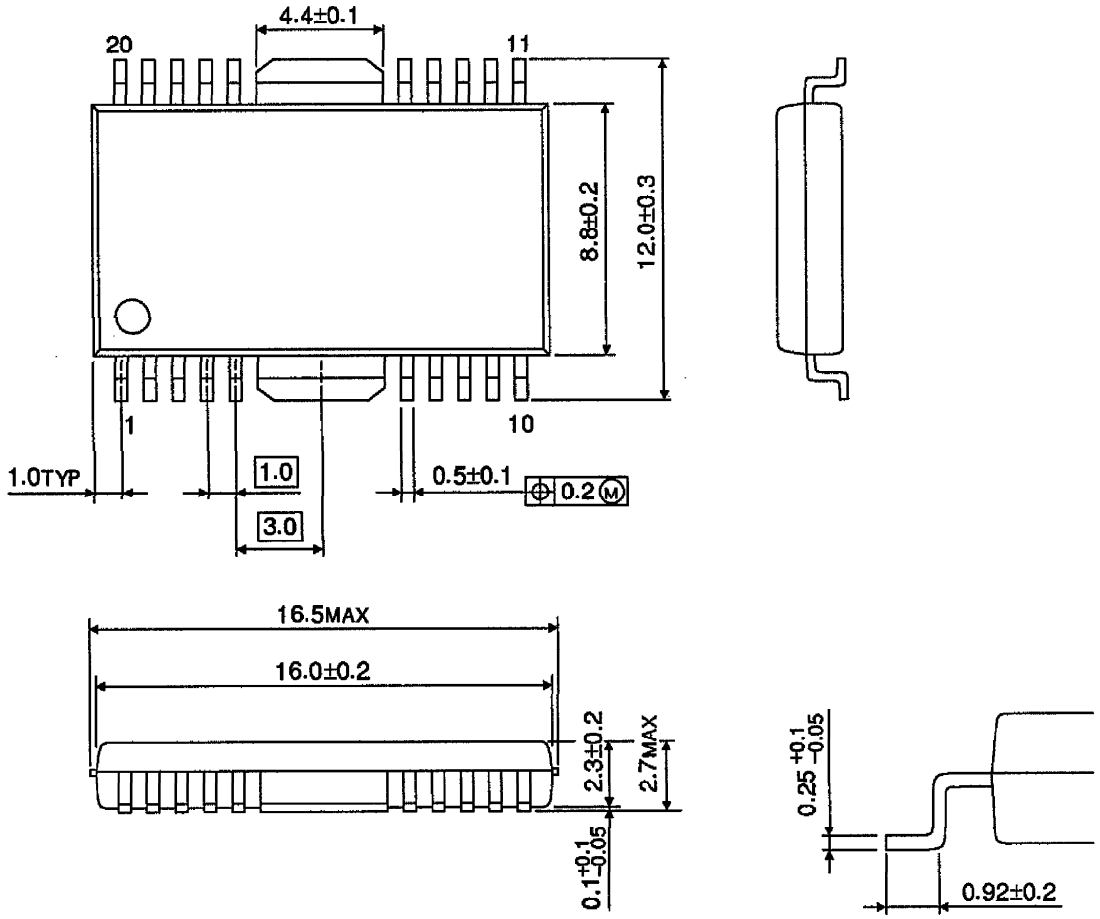
(Note 2) Care should be taken not to have common impedance between R_F GND Line and other small signal lines for stable operations (especially for Hall Sensor GND line).

(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.)