

**STRUCTURE** Silicon Monolithic Integrated Circuit  
**PRODUCT SERIES** 2phase MDA for VTR Cylinder  
**TYPE** BA6415AFS  
**PACKAGE OUTLINES** Fig-1 (Plastic Mold)  
**BLOCK DIAGRAM** Fig-2  
**FUNCTIONS**

- Output division supplies the motor driver current with two-phase, full-wave, and linear way.
- Control Amp1,2 control the motor drive current.
- Thermal shut down circuit detects the junction temperature and shut down the coil output at high temperature.
- Built in Amp1,2 and hysteresis Amp that FG or PG signal amplify.

**ABSOLUTE MAXIMUM RATINGS (Ta=25°C)**

Parameter	Symbol	Limits	Unit
Supply Voltage	Vcc	24	V
Power Dissipation	Pd	*1000	mW
Operating temperature	Topr	-25~+75	°C
Storage temperature	Tstg	-55~+150	°C
Output current	I <sub>OMAX</sub>	**1200	mA
Input current	I <sub>ECIMAX</sub>	5	mA
Regulator output current	I <sub>REGMAX</sub>	30	mA

\*To use at temperature above Ta=25°C, reduce 8mW/°C.  
 (Mounting on 90mm×50mm×1.6mm glass epoxy board)  
 \*\*Do not, however exceed Pd and ASO. (Each phase)

**RECOMMENDED OPERATING CONDITIONS (Ta=25°C)**

Parameter	Symbol	Limits	Unit
Supply voltage	Vcc	8.0 ~ 20.0	V

**ELECTRICAL CHARACTERISTICS (Unless otherwise specified Ta=25°C Vcc=12V)**

Parameter	Symbol	Limits			Unit	Condition	Test circuit
		Min.	Typ.	Max.			
Circuit current	I <sub>CC</sub>	—	8.5	13.0	mA		Fig-4
Regulator output voltage	V <sub>REG</sub>	4.6	5.0	5.4	V		Fig-4

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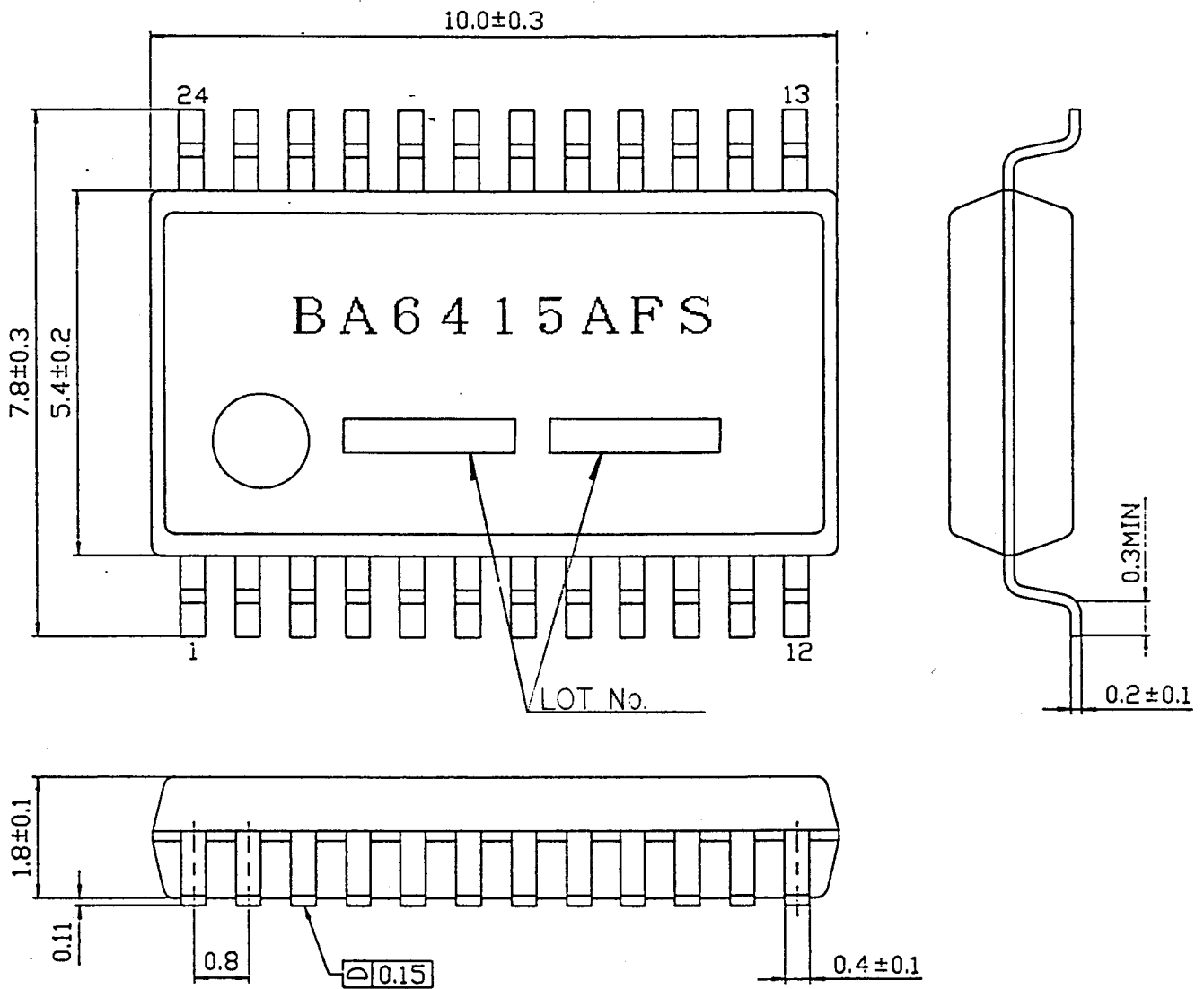
Design <i>T. Hashimura</i>	Check <i>K. Otsu</i>	Approval 25.4.1995 <i>H. Kawakami</i>	Date APR/21/1995	Specification <b>Rev. A</b>
			ROHM CO., LTD.	Specification No. TSZ02201-BA6415AFS-1-2

## ELECTRICAL CHARACTERISTICS (Unless otherwise specified Ta=25°C Vcc=12V)

Parameter	Symbol	Limit			Unit	Condition	Test circuit
		Min.	Typ.	Max.			
~ M D A ~							
Hall amplifier input sensibility	V <sub>INH</sub>	50	—	—	mV <sub>P-P</sub>		Fig-5
Hall amplifier input bias current	I <sub>BH</sub>	—	0.25	2.0	μA	I <sub>CONT</sub> =100μA	Fig-5
Output saturation voltage "H"	V <sub>OH</sub>	10.45	10.79	—	V	I <sub>OUT</sub> =800mA	Fig-6
Output saturation voltage "L"	V <sub>OL</sub>	—	1.33	2.16	V	I <sub>OUT</sub> =800mA	Fig-6
~E <sub>CV</sub> (Voltage control)~							
Input voltage range	E <sub>CV</sub>	0	—	V <sub>REG</sub>	V		Fig-7
Input voltage offset	E <sub>CV</sub> OFFS	-150	0	+150	mV	difference from 0.48×V <sub>REG</sub>	Fig-7
Input current	I <sub>ECVIN</sub>	—	1.0	6	μA	E <sub>CV</sub> =2.5V	Fig-7
Output idle current	I <sub>ECVidle</sub>	—	0	5	mA	E <sub>CV</sub> =2.0V	Fig-7
Input-Output gain	G <sub>ECV</sub>	0.42	0.55	0.68	A/V	E <sub>CV</sub> =2.8V, 3.3V ΔV <sub>IN</sub> =100mV	Fig-7
~E <sub>CI</sub> (Current control)~							
PIN18 Output/Input current ratio	I <sub>OUT</sub> / I <sub>CONT</sub>	3300	4000	4700	—	ΔV <sub>IN</sub> =100mV I <sub>CONT</sub> =30μA, 50μA	Fig-8
Output current difference	ΔI <sub>OUT</sub>	-30	0	+30	mA	I <sub>CONT</sub> =30μA	Fig-8
~ Amp 1, Amp 2 ~							
- Input current	I <sub>INA</sub>	—	0.1	0.2	μA	V <sub>IN</sub> =2.5V	Fig-9
Open loop gain	G <sub>A</sub>	65	70	—	dB	f <sub>IN</sub> =500Hz	Fig-9
DC bias voltage	ΔV <sub>BA</sub>	-10	0	+10	%	difference from 1/2V <sub>REG</sub>	Fig-9
output "H" voltage	V <sub>OH A</sub>	V <sub>REG</sub> -1.48	V <sub>REG</sub> -1.08	—	V	I <sub>OH A</sub> =0.5mA	Fig-9
output "L" voltage	V <sub>OL A</sub>	—	1.05	1.45	V	I <sub>OL A</sub> =0.5mA	Fig-9
Amp1,2 input voltage range	V <sub>AB</sub>	1.2	—	4.0	V		Fig-9
~Hys. Amp 1,2~							
Hysteresis width	V <sub>hys</sub>	±112	±150	±188	mV		Fig-10
Output "L" voltage	V <sub>OLhys</sub>	—	0.12	0.32	V	I <sub>OLhys</sub> =2mA	Fig-10
Output pull-up resistor	V <sub>Bhys</sub>	7.0	10.0	13.0	KΩ		Fig-10

©This product is not designed for protection against radioactive rays.

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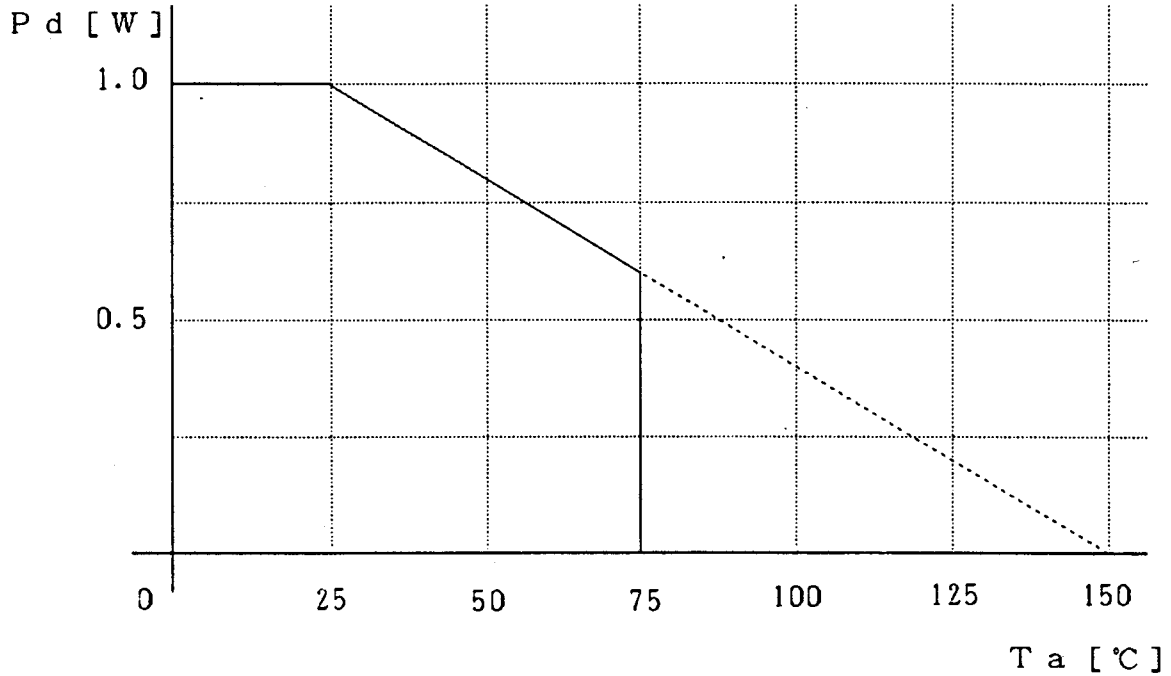


(UNIT: mm)

Fig-1 Package Outline  
Plastic Mold

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## POWER DISSIPATION CURVE



90mm×50mm×1.6mm glass epoxy board

To use at temperature above  $T_a=25^\circ\text{C}$ , reduce 8mW per.  $1^\circ\text{C}$

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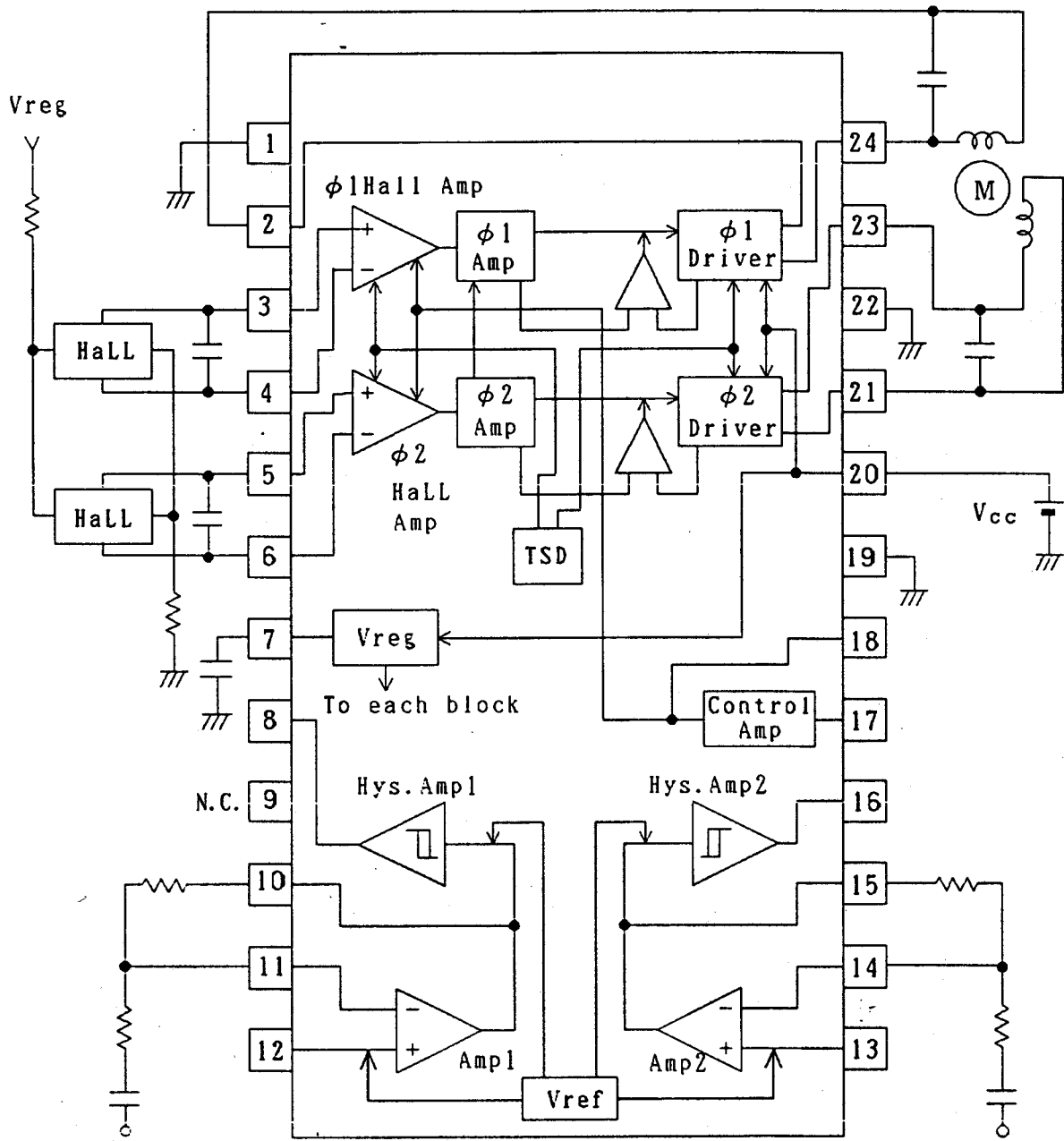


Fig-2 Block Diagram

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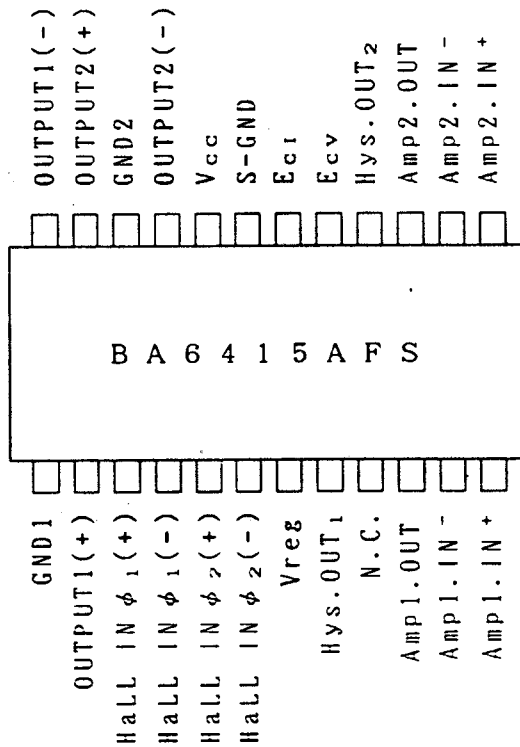
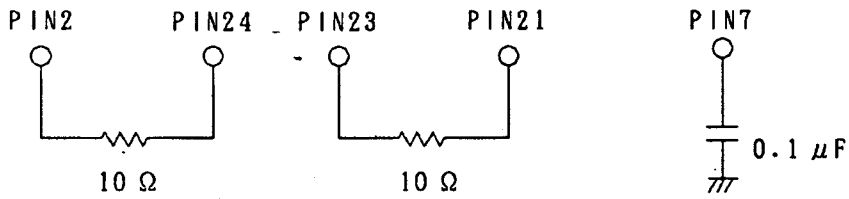


Fig-3 Pin Configuration

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(1) ADDITIONAL PARTS OF TEST CIRCUIT



(2) Function Table

INPUT				OUTPUT			
PIN3	PIN4	PIN5	PIN6	PIN2	PIN24	PIN23	PIN21
L	H	L	H	L	H	L	H
H	L	H	L	H	L	H	L

H = 2.6 V

L = 2.4 V

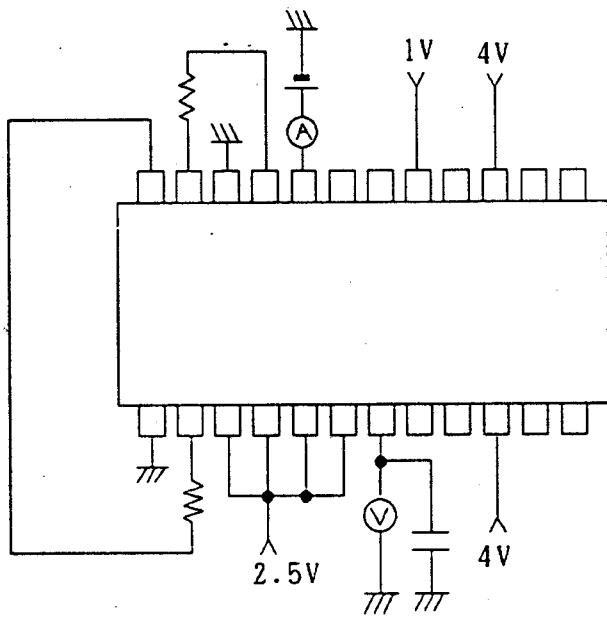
Date APR/21/1995

Specification

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Specification No.

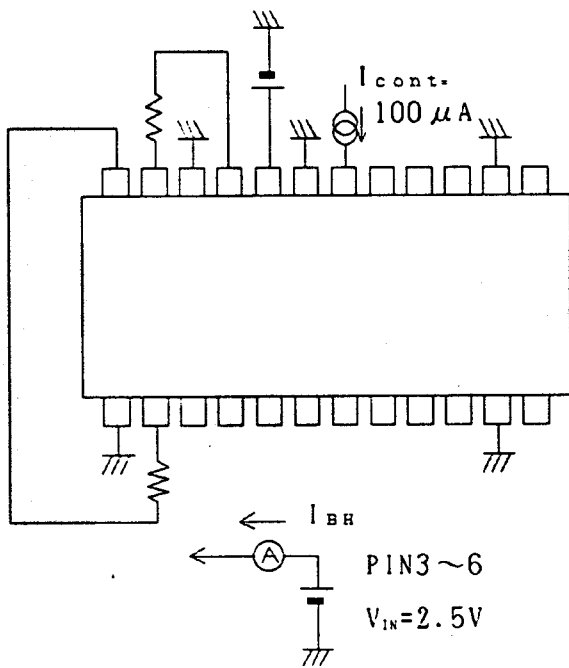
TSZ02201-BA6415AFS-1-2



$I_{cc}$ : Value of Ammeter

$V_{reg}$ : Value of Voltmeter

Fig - 4



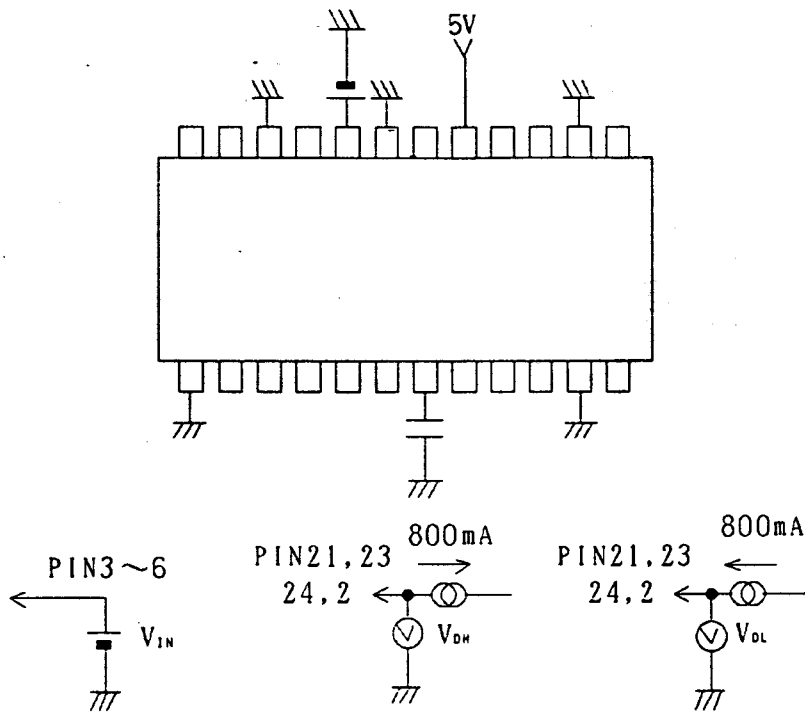
$I_{BH}$ : Value of Ammeter  
 $V_{IN} = 2.5V$

$V_{INH}$ : Value of  $|H_n^+ - H_n^-|$   
when outputs be altered.  
 $H_n^- = 2.5V$  ( $n=1,2$ )

Fig - 5

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$V_{OH}$ : Value of voltmeter  $V_{OH}$   
when output terminal "H"

$V_{OL}$ : Value of voltmeter  $V_{OL}$   
when output terminal "L"

Fig - 6

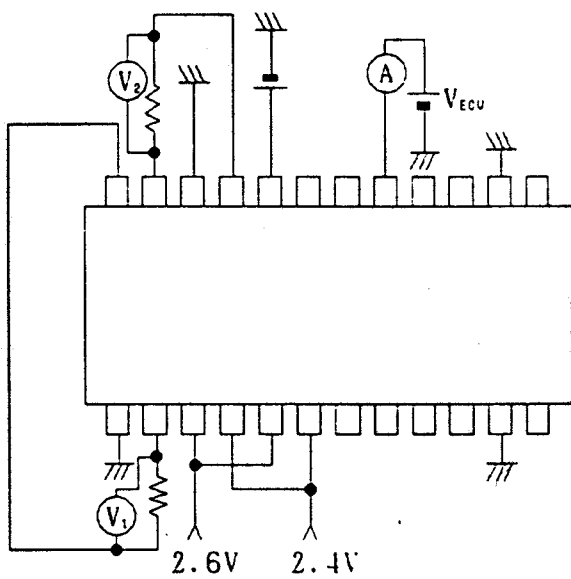


Fig - 7

$E_{CVOPS}$ :  $E_{CVOPS} = 0.48 \cdot V_{REG} - V_{ECV}$   
applies Value of  $V_{ECV}$  when  $V_1 V_2 = 50mV$

$I_{ECViale}$ : Output current when  $V_{ECV} = 2V$   
 $V_1/10\Omega$ 、 $V_2/10\Omega$

$I_{ECVIN}$ : Value of Ammeter

$G_{ECV}$ :  $V_3 = V_1$  or  $V_2$  when  $E_{CV} = 2.8V$   
 $V_4 = V_1$  or  $V_2$  when  $E_{CV} = 3.3V$

$G_{ECV} = \frac{(V_4/10\Omega - V_3/10\Omega)}{0.5V}$  [A/V]

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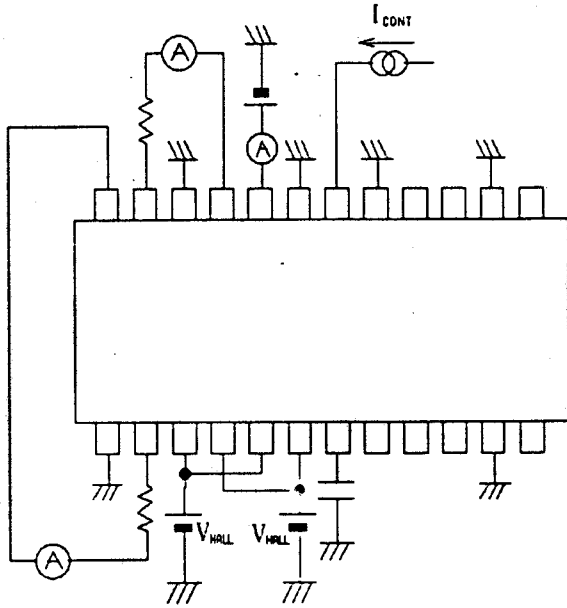


Fig - 8

$I_{OUT}/I_{CONT}$ :

$$I_{OUT}/I_{CONT} = \{A_2(\text{mA}) - A_1(\text{mA})\} / 20\mu\text{A}$$

applies the next value

$A_1(\text{mA})$  = value of ammeter when  $I_{CONT} = 30\mu\text{A}$

$A_2(\text{mA})$  = value of ammeter when  $I_{CONT} = 50\mu\text{A}$

Hall IN

$H = 2.6\text{V}, L = 2.4\text{V}$

$\Delta I_{OUT}$ : The maximum value of difference of the output current on next condition.

$I_{CONT} = 30\mu\text{A}, H_n^+ = H, L(n=1,2)$

$H_n^- = 2.5\text{V}$

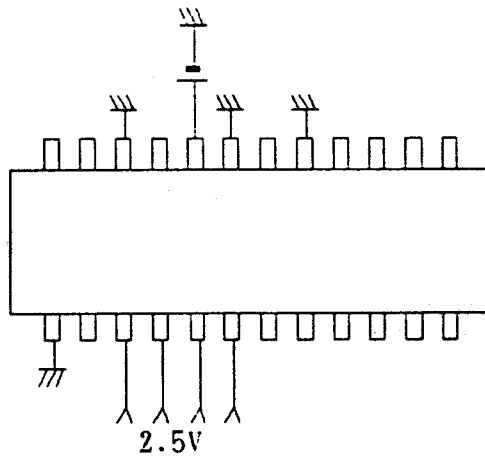
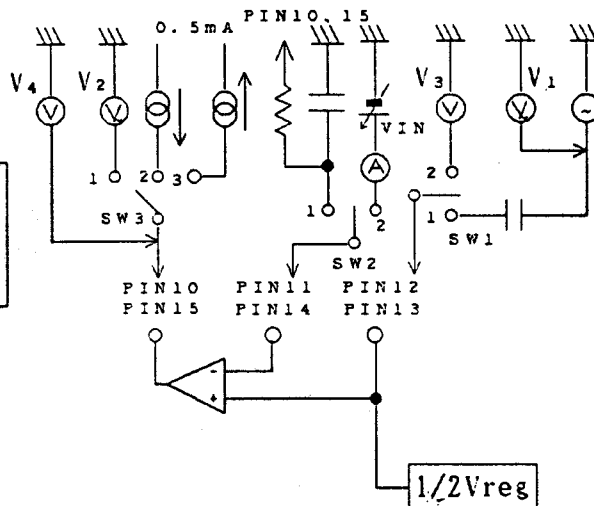


Fig - 9



$G_A: G_A = V_2/V_1, SW_1=1 SW_2=1 SW_3=1 f_{IN}=500\text{Hz}$

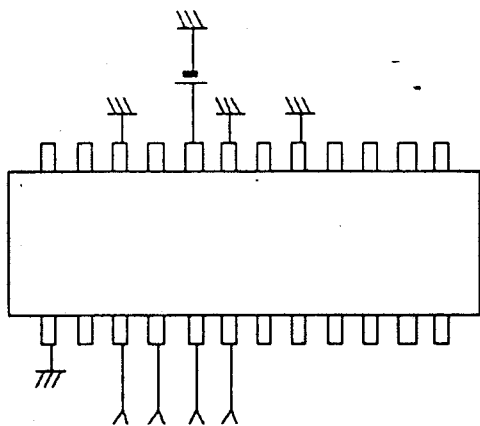
$I_{INA}$ : value of ammeter,  $SW_2=2 V_{IN}=2.5\text{V}$

$$\Delta V_{BA}: \Delta V_{BA} = \frac{V_3 - 1/2V_{REG}}{1/2V_{REG}} \times 100\%$$

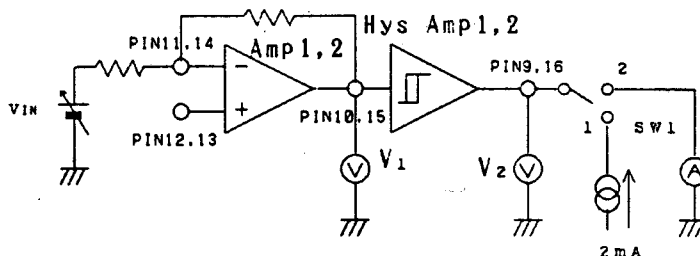
$V_{OHA}$ : value of  $V_4, SW_2=2 SW_3=3 V_{IN}=1/2V_{REG}-0.3\text{V}$

$V_{OLA}$ : value of  $V_4, SW_2=2 SW_3=2 V_{IN}=1/2V_{REG}+0.3\text{V}$

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2.5V Fig - 10



$V_{hys}$ : In case  $V_2 = "H"$ , by rise of  $V_{IN}$  level value of  $V_1$  is  $V_H$ .  
 In case  $V_2 = "H" \rightarrow "L"$ , by drop of  $V_{IN}$  level value of  $V_1$  is  $V_L$ .  
 $V_{hys} = \pm (V_H - V_L) / 2$   $S_{w1} = \text{open}$

$V_{OLhys}$ :  $V_{IN} = 4V$ , Value of  $V_2$  ( $S_{w1} = 1$ ).

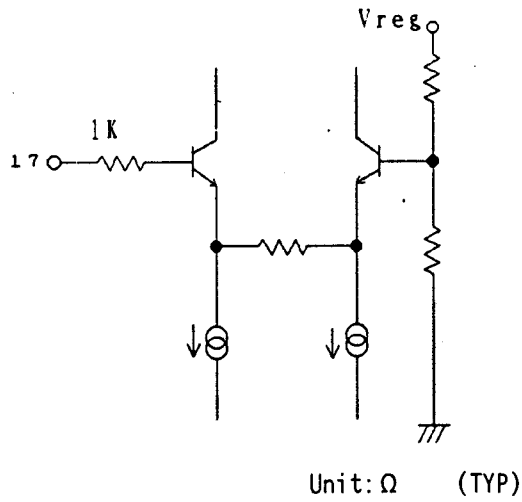
$R_{Bhys}$ : If value of "A" is  $A_1$ ,  $V_{IN} = 1V$ ,  $S_{w1} = 2$ , then  $R_{Bhys} = V_{reg} / A_1$ .

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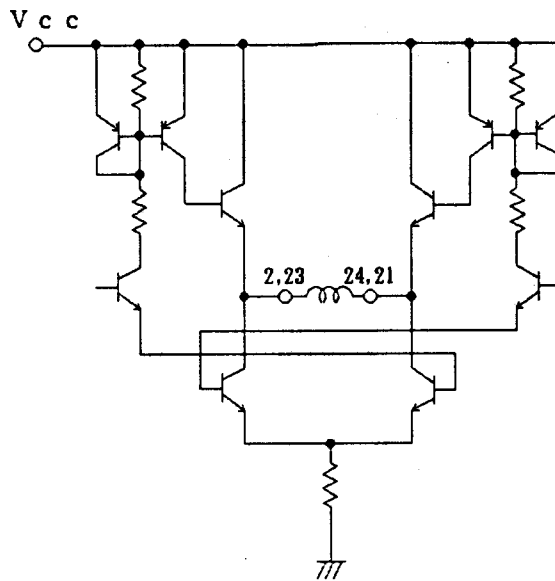
○ CAUTIONS

1. INPUT/OUTPUT CIRCUIT

(1)  $E_{cv}$ (pin17)

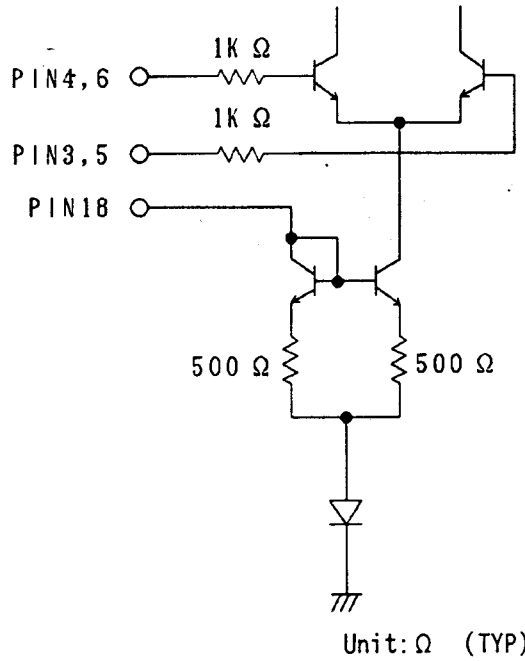


(2) Coil output (pin2,24,23,21)

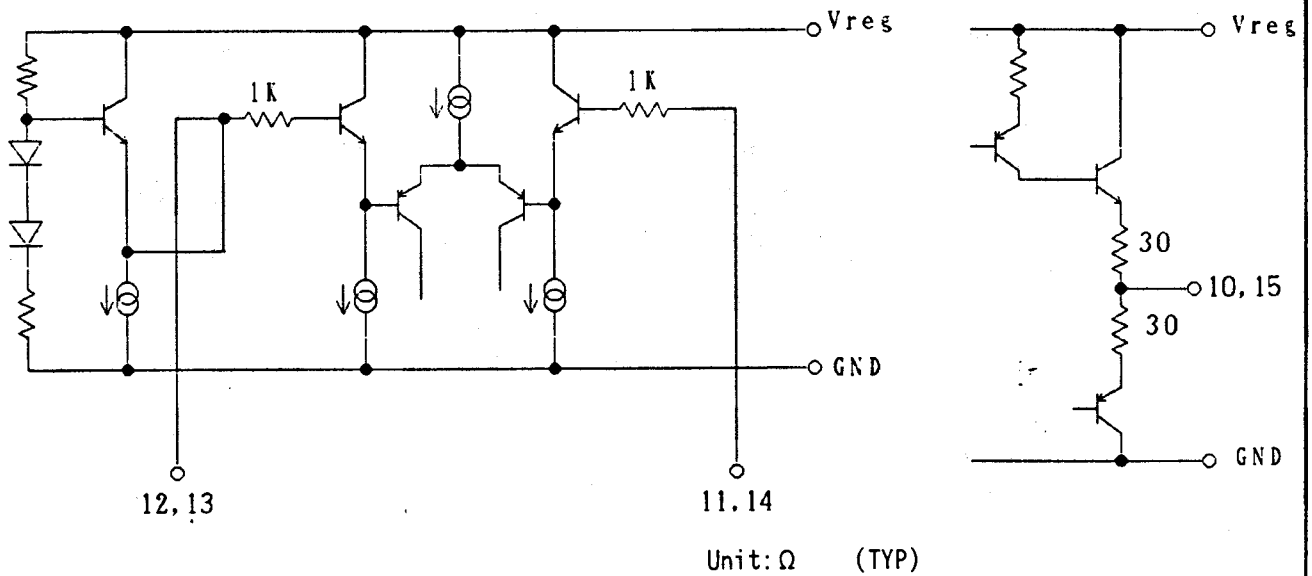


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(3) Hall input (pin3,4,5,6), ECI input



(4) Amp1, Amp2 input-output



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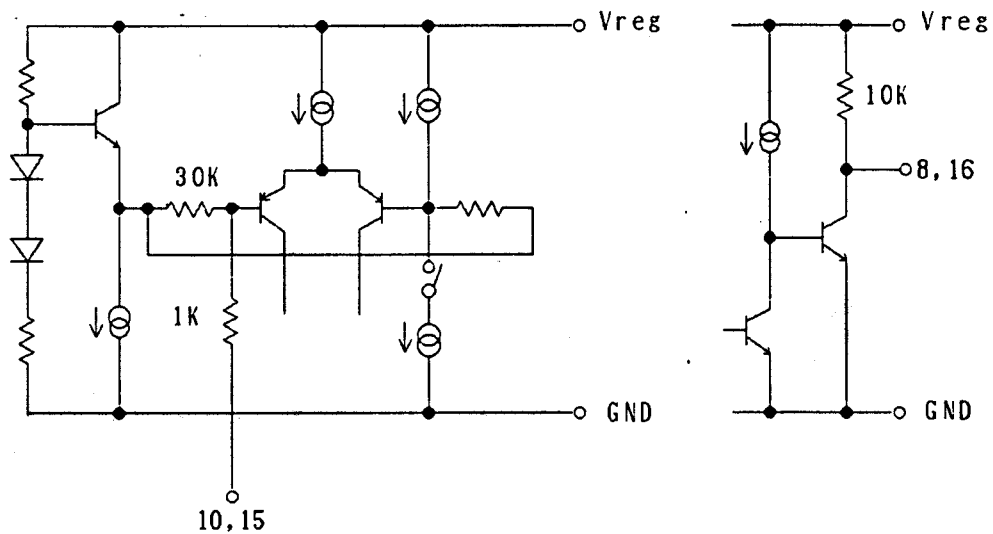
Specification

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(5)Hys.Amp input-output



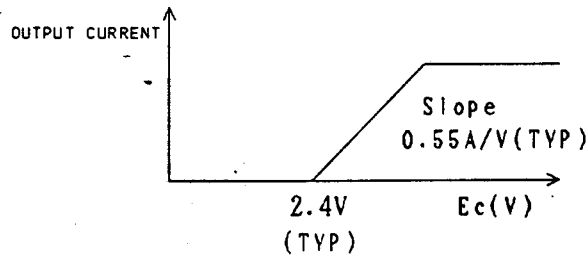
Unit:  $\Omega$  (TYP)

\*Note: resistors of input-output circuit derange up to 30%

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### 2. $E_{cv}$ input(pin17)

The relation of  $E_{cv}$  and output current is under mention.



### 3. Hall input

Input circuit of Hall Amp shows Cautions 1.(3).

For Hall input, a signal above 50mV<sub>p-p</sub> should be added between pin3-pin4 and pin5-pin6.

The input range of the DC level is from 2V to  $V_{reg}-1.5V$ .

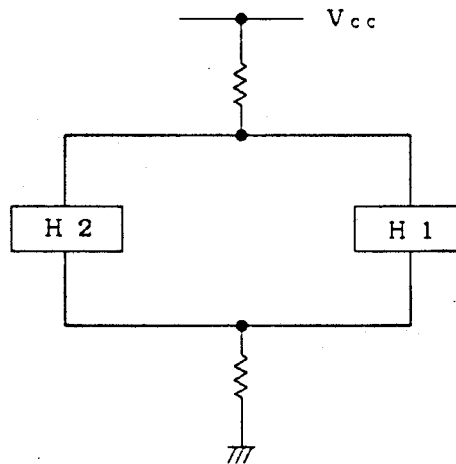
There is no problem if the input is around  $V_{reg}/2$  about the input range of the DC level.

Hall input impedance is above 1M $\Omega$ .

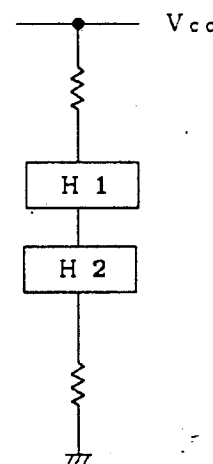
Since the differential operation of pin3-pin4 and pin5-pin6, current cannot flow during the transistor off period.

A Hall device with lower DC offset is recommended, because the BA6415AFS directly amplifies the DC offset of Hall device output by its linear driving.

Hall element can be used with both series connection and parallel connection.



Parallel connection



Series connection

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4.  $E_{c1}$  input

Input circuit is Cautions 1.(3).

$2V_F + 500\Omega$  resistance is directly inserted. There is no current limitation except  $500\Omega$  resistance.

## 5. Amp1, Amp2

Use Amp1, Amp2 within input range, if you exceed input range, they may be malfunction. It recommends that input range is  $0.6(V) \sim V_{CC} - 1.2(V)$ .

## 6. Hysteresis Amp

Use Amp1, Amp2 within input range, if you exceed input range, they may be malfunction. It recommends that input range is  $0.6(V) \sim V_{CC} - 1.2(V)$ .

## 7. Thermal Shut Down(TSD)

If temperature of chip becomes  $175^\circ\text{C}$ (TYP), it makes each output high impedance and shut down output current. It has the temperature hysteresis of about  $20^\circ\text{C}$ (TYP)

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