Reversible Motor Driver ICs for Brush Motors

Reversible Motor Drivers for Output 2.0A or more (1 Motor)

BA6219BFP-Y,BA6222

●Description

The BA6219BFP-Y and BA6222 are reversible motor driver ICs suitable for brush motors. Two logic inputs allow four output modes: forward, reverse, idling, and braking. Two revolution speeds can be set by controlling the voltage applied to the motor.

●Features

1) Large output current (Io=2.2A max)
2) Built-in thermal shutdown circuit
3) Output voltage-setting pins
4) Small standby current.

●Applications

VCRs

●Absolute Maximum Ratings (Ta=25°C)

Parameter	Symbol	Limits		Unit
		BA6219BFP-Y	BA6222	
Supply voltage	VCC1, VCC2	24	24	V
Power dissipation	Pd	1450*	2000**	mW
Operating temperature	Topr	-25～+75	-25～+75	°C
Storage temperature	Tstg	-55～+150	-55～+125	°C
Output current	Iomax	2200***	2200***	mA
Junction temperature	Tjmax	150		°C

* Derated at 11.6 mW/°C at Ta>25°C
(when mounted on a 90 mm x 50 mm x 1.6 mm glass epoxy substrate)
** Derated at 20.0mW/°C at Ta> 25°C
*** Do not allow current to exceed Pd and SOA.
500μs pulse with a duty cycle of 1%

●Recommended Operating Conditions (Ta＝25°C)

BA6219BFP-Y、BA6222

Parameter	Symbol	Range	Unit
Supply voltage	VCC1, VCC2	8 ～ 18	V

Ver.B Oct.2005

●Electrical Characteristics

BA6219BFP-Y (Unless otherwise specified, Ta＝25°C, VCC1=12V, VCC2=12V)

Parameter	Symbol	Limits			Unit	Conditions
		Min.	Typ.	Max.		
Supply current 1	ICC1	-	1.2	2.5	mA	Standby mode
Supply current 2	ICC2	-	16	35	mA	FWD/REV mode
Supply current 3	ICC3	-	25	60	mA	Brake mode
Input threshold voltage ”H”	VIH	3.0	-	VCC	V	
Input threshold voltage ”L”	VIL	0	-	1.0	V	
VR bias current	IVREF	0.6	1.2	2.4	mA	RL=60Ω, VR=6.8V
CD1 current	ICD1	0.7	1.5	3.0	mA	(IN1, IN2)=(H, L) CD1→GND
CD2 current	ICD2	0.7	1.5	3.0	mA	(IN1, IN2)=(H, L) CD2→GND
Output leak current	IOL	-	-	1	mA	(IN1, IN2)=(L, L) VCC2 current
FOUT output voltage H	VHF	6.5	-	-	V	RL=60Ω, VR=6.8V
FOUT output voltage L	VLF	-	-	1.2	V	RL=60Ω, VR=6.8V
ROUT output voltage H	VHR	6.5	-	-	V	RL=60Ω, VR=6.8V
ROUT output voltage L	VLR		-	1.2	V	RL=60Ω, VR=6.8V

BA6222 (Unless otherwise specified, Ta＝25°C, VCC1=12V, VCC2=12V)

Parameter	Symbol	Limits			Unit	Conditions
		Min.	Typ.	Max.		
Supply current 1	ICC1	-	1.2	2.5	mA	Standby mode
Supply current 2	ICC2	-	16	35	mA	FWD/REV mode
Supply current 3	ICC3	-	25	60	mA	Brake mode
Input threshold voltage ”H”	VIH	3.0	-	VCC	V	
Input threshold voltage ”L”	VIL	0	-	1.0	V	
VR bias current	IVREF	-	1.2	5.0	mA	VR=1.0V
VR-output gain	GV	10.35	11.35	12.35	dB	VR,OUT1,OUT2 (Note) IN1 or IN2="H" Io=100mA
CD1 current	ICD1	0.7	1.5	3.0	mA	(IN1, IN2)=(H, L) CD11→GND
CD2 current	ICD2	0.7	1.5	3.0	mA	(IN1, IN2)=(H, L) CD2→GND
Output leak current	IOL	-	-	1	mA	(IN1, IN2)=(L, L) VCC2 current
FOUT output voltage H	VHF	9.5	-	-	V	I_{OUT}=0.1A VREF=5V
FOUT output voltage L	VLF	-	-	0.5	V	I_{OUT}=0.1A VREF=5V
ROUT output voltage H	VHR	9.5	-	-	V	I_{OUT}=0.1A VREF=5V
ROUT output voltage L	VLR		-	0.5	V	I_{OUT}=0.1A VREF=5V

Note: Vout1 denotes the difference between output High voltage and output Low voltage when VR=1V, while Vout2 denotes the difference when VR=2V. Both values are defined when the output is stabilized without the use of a heat-radiating board.

●Input / Output Table

BA6219BFP-Y, BA6222

Input		Output		Mode
IN1	IN2	OUT1	OUT2	
L	L	OPEN	OPEN	Idle
H	L	H	L	Forward
L	H	L	H	Reverse
H	H	L	L	Brake

●Electrical Characteristics Curves (Reference)

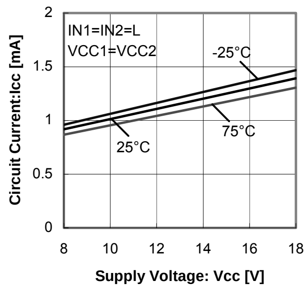


Fig.1 Supply Current 1(IDLE)
(BA6219BFP-Y)

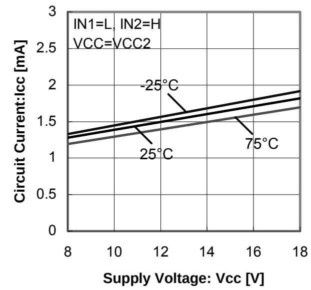


Fig.2 Supply Current 2(REV)
(BA6219BFP-Y)

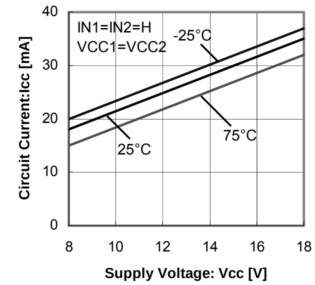


Fig.3 Supply Current 3(BRK)
(BA6219BFP-Y)

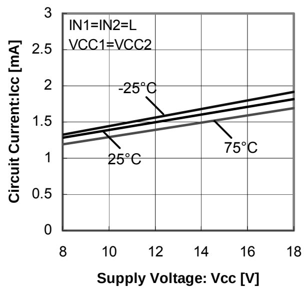


Fig.4 Supply Current 1(IDLE)
(BA6222)

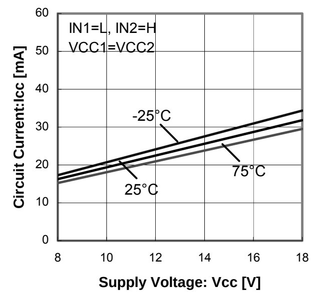


Fig.5 Supply Current 2(REV)
(BA6222)

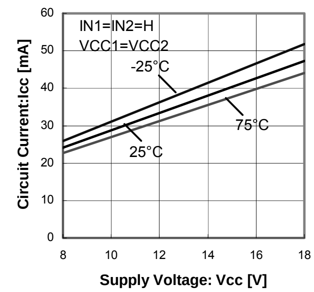


Fig.6 Supply Current 3(BRK)
(BA6222)

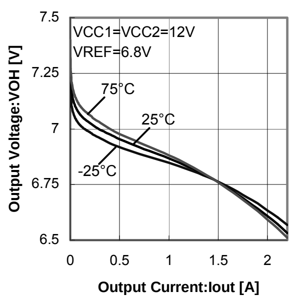


Fig.7 Output Saturation Voltage H
(BA6219BFP-Y)

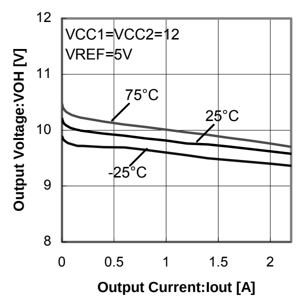


Fig.8 Output Saturation Voltage H
(BA6222)

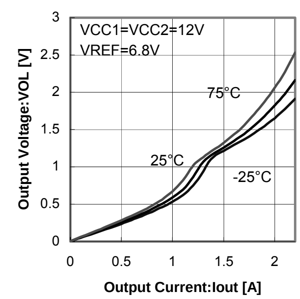


Fig.9 Output Saturation Voltage L
(BA6219BFP-Y)

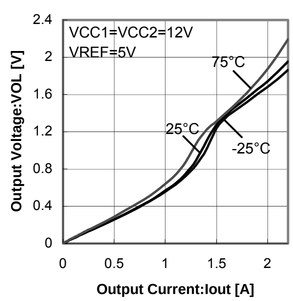


Fig.10 Output Saturation Voltage L
(BA6222)

●Block Diagrams / Standard Example Application Circuit

・BA6219BFP-Y

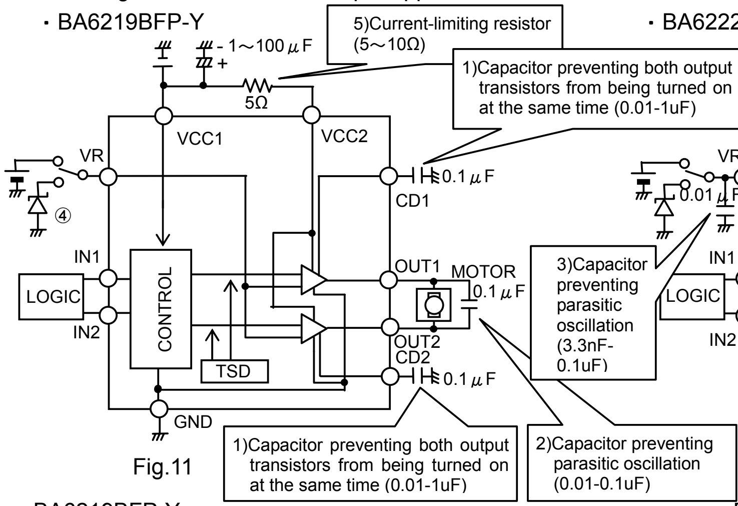


Fig.11

・BA6222

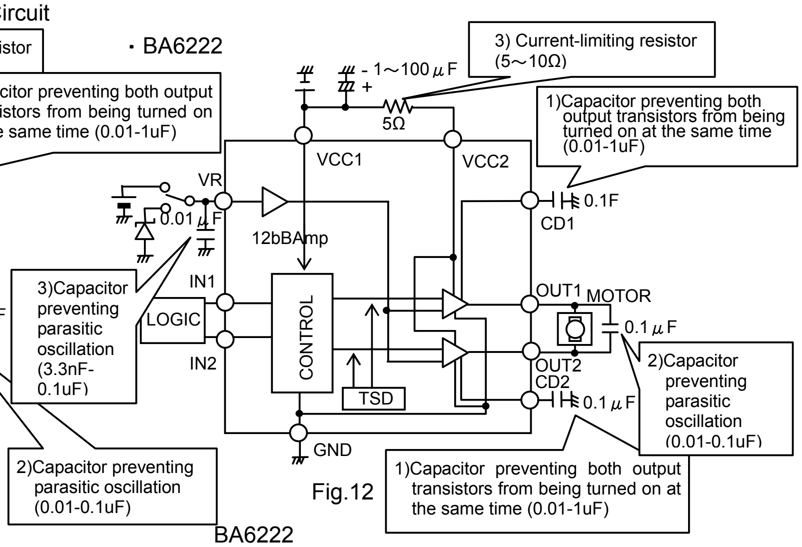


Fig.12

BA6219BFP-Y

Pin No.	Pin name	Function
2	CD1	Capacitor preventing both output transistors from being turned on at the same time
4	VR	Output high voltage setting pin
6	IN1	Control logic input
7	GND	Ground
8	IN2	Control logic input
10	VCC1	Power supply for small signal
11	VCC2	Power supply for motor
13	CD2	Capacitor preventing both output transistors from being turned on at the same time
15	OUT2	Driver output
19	GND	Ground
20	GND	Ground
24	OUT1	Driver output
FIN	GND	Ground

Note: Pins 1,3,5,9,12,14,16,17,18,21,22,23, and 25 are N.C

BA6222

Pin No.	Pin name	Function
1	GND	Ground
2	OUT1	Driver output
3	CD1	Capacitor preventing both output transistors from being turned on at the same time
4	VR	Output high voltage setting pin
5	IN1	Control logic input
6	IN2	Control logic input
7	VCC1	Power supply for small signal
8	VCC2	Power supply for motor
9	CD2	Capacitor preventing both output transistors from being turned on at the same time
10	OUT2	Driver output

BA6222

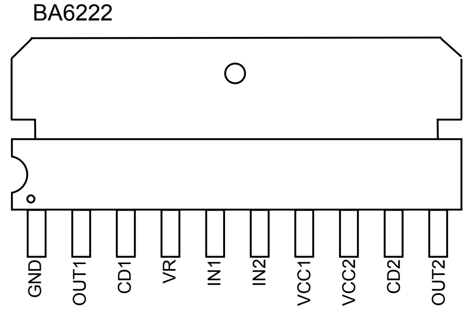


Fig.13

BA6219BFP-Y

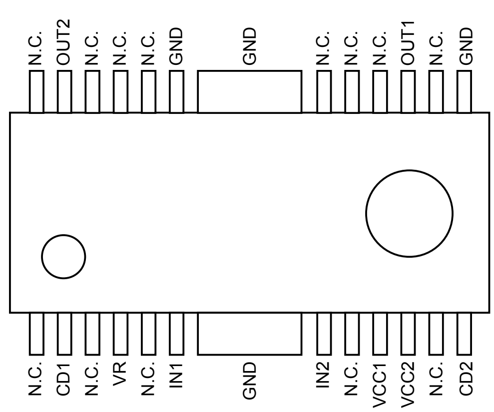


Fig.14

●Application Notes

[1] Capacitor preventing both output transistors from being turned on at the same time: The transistors are prevented from simultaneously turning on by delaying the potential build-up at the Base during the High output mode. Use capacitances between 0.01 to 1 μF and make sure through-current caused when the transistors are on at the same time does not flow when output mode is switched.

[2] Capacitor for preventing parasitic oscillation:
Noise or oscillation is generated at the output terminals due to various factors. Use a capacitance between 0.01 to 0.1uF.

[3] Current-limiting resistor:
Current limiting resistors are used to reduce Collector loss and for protection should the output be short-circuited. Use resistances between 5-10Ω depending on the power supply voltage and taking into account the voltage drop caused by inrush current that flows when the motor is started.

[4] Zener diode for setting output voltage:
Used when the output High voltage VR (VREF) is set.
It is possible to set to Zener voltage ≒ output H voltage

●Operations

1) Input Terminals (IN1, IN2) and I/O Mode

When IN1 is “H” and IN2 is “L,” normal mode is achieved and current flows from OUT1 to OUT2. When IN1 is “L” and IN2 is “H,” reverse mode is set and current flows from OUT2 to OUT1. When both IN1 and IN2 are “H”, the system is in brake mode. The operation mechanism is described as follows: the upper-side output transistor turns OFF to stop driving the motor while the lower-side output transistor turns ON to absorb the electromotive force and brake the motor. When both IN1 and IN2 are “L,” OUT1 and OUT2 become open (all output transistors are OFF) and the motor stops.

2) Output High Voltage Setting Function

This function sets the output voltage by the Output H Voltage setting terminal (VR) and controls the motor rotation speed. However, when the output H voltage is set to a low level, current consumption increases. Please take this into account when calculating the power dissipation (Pd).

Regarding BA6222 (See Fig. 15)

The relationship between the output High voltage setting (VR) voltage and output High voltage VOH is expressed by:

VOH=4×V4(VR voltage)+Vofs

The output voltage can be set to around four times the VR voltage. In such an event, there is a tolerance Vofs, which varies depending on output current and chip temperature.

The VR voltage region can be classified into 3 categories depending on the output state:

A：Output high voltage 0V offset region;

B：Fourfold gain region; and

C：Output voltage saturated region*

*Using this function with the VR terminal connected to a circuit which has output impedance of several hundreds of ohms may result in oscillation. In this case, connect a capacitor between 3300pF to 0.1 μF across VR and GND.

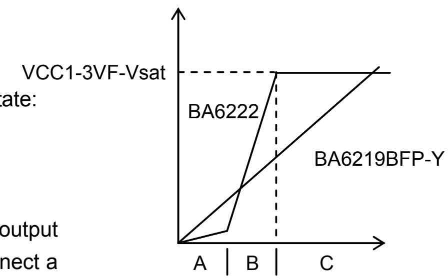


Fig.15

Regarding BA6219BFP-Y (See Fig. 16)

The circuit diagram associated with the output High voltage setting VR terminal is shown on the right.

The maximum output voltage Vomax is expressed by:

Vomax=VCC1-Vsat(Q1)-VF(Q2)-VF(Q3)-VF(Q4)

In addition, the relation of the VR voltage to the output voltage at Vomax or lower is expressed by:

Vo=VR+ {VF(Q5)+VF(Q6)+VF(Q7)-VF(Q2)-VF(Q3)-VF(Q4)}

=VR+△VF≒VR

ΔVF depends on the output current but is nearly Vo=VR.

Reference values: Vsat=0.1V, VF=0.75V

Set VCC1 and VCC2 to the following values.

Pin	Voltage	Unit
VCC1	8 ～ 18	V
VCC2	8 ～ 18	V

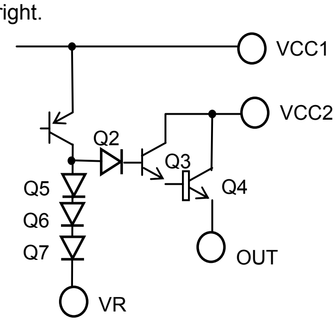


Fig.16

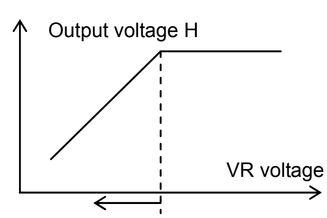


Fig.17

Power supply voltage range of VR

1) When the output voltage control terminal (VR) is used:

VR＜VCC1-{Vsat(Q1)+VF(Q5)+VF(Q6)+VF(Q7)}

≒VCC1-2.5V

VR＜VCC2-{Vsat(Q3)-VF(Q3)-VF(Q2)}+{VF(Q5)+VF(Q6)+VF(Q7)}

≒VCC2-1V

The output voltage control function does not operate in regions outside this range.

In addition, when the VR terminal is not used, short VR to VCC1.

2) Normal/reverse rotation switching

Before switching, bring the motor to either the brake or idle condition.

When brake is applied：The longer the braking time the better

(Braking time is defined as the time required for the output L terminal to achieve a potential below GND once the brake is activated)

When idle is applied: A time longer than 1msec is recommended..

●Thermal Derating Curves

BA6219BFP-Y

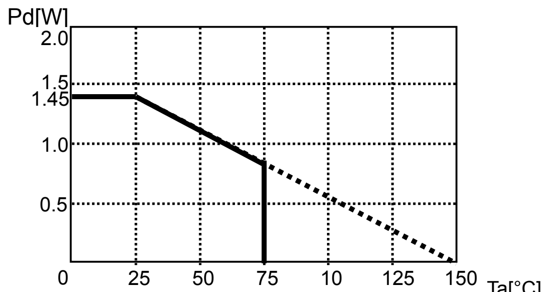


Fig.18

BA6222

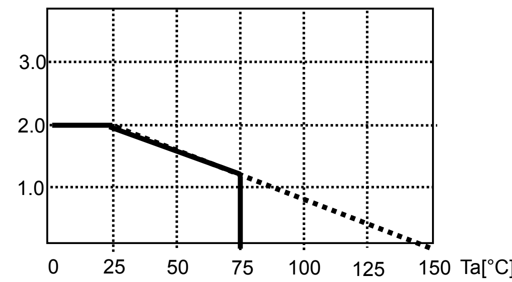


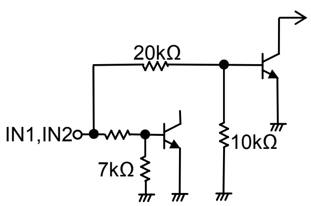
Fig.19

Derated at 11.6 mW/°C at Ta>25°C,

(mounted on a 90 mm x 50 mm x 1.6 mm glass epoxy substrate).

●Input / Output Equivalent Circuits

・BA6219BFP-Y, BA6222



The input circuit is comprised of the inverter illustrated on the left.

The following input logic levels are used:

VIL(0～1.0V)

VIH(3.0～VCC)

Fig.20

・BA6219BFP-Y

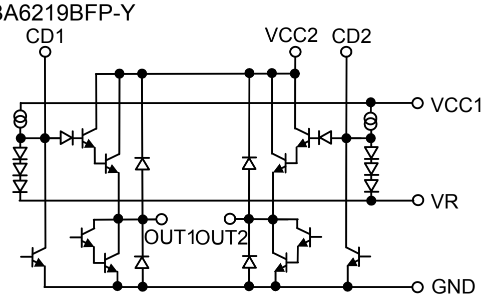


Fig.21

・BA6222

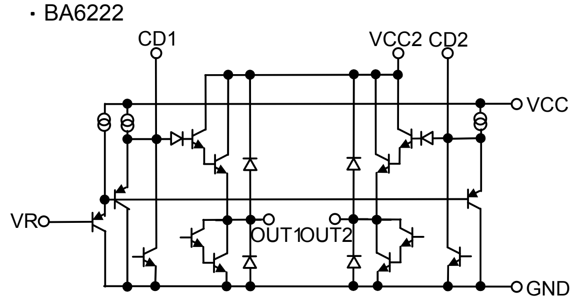


Fig.22

●Operation Notes

1. Absolute maximum ratings

   An excess in the absolute maximum ratings, such as supply voltage, temperature range of operating conditions, etc., can break down the devices, thus making impossible to identify breaking mode, such as a short circuit or an open circuit. If any over rated values will expect to exceed the absolute maximum ratings, consider adding circuit protection devices, such as fuses.

2. Connecting the power supply connector backward

   Connecting of the power supply in reverse polarity can damage IC. Take precautions when connecting the power supply lines. An external direction diode can be added.

3. Power supply lines

   Design PCB layout pattern to provide low impedance GND and supply lines. To obtain a low noise ground and supply line, separate the ground section and supply lines of the digital and analog blocks. Furthermore, for all power supply terminals to ICs, connect a capacitor between the power supply and the GND terminal. When applying electrolytic capacitors in the circuit, not that capacitance characteristic values are reduced at low temperatures.

4. GND voltage

   The potential of GND pin must be minimum potential in all operating conditions.

5. Thermal design

Use a thermal design that allows for a sufficient margin in light of the power dissipation (Pd) in actual operating conditions.

6. Inter-pin shorts and mounting errors

Use caution when positioning the IC for mounting on printed circuit boards. The IC may be damaged if there is any connection error or if pins are shorted together.

7. Actions in strong electromagnetic field

Use caution when using the IC in the presence of a strong electromagnetic field as doing so may cause the IC to malfunction.

8. ASO

When using the IC, set the output transistor so that it does not exceed absolute maximum ratings or ASO.

9. Thermal shutdown circuit

The IC incorporates a built-in thermal shutdown circuit (TSD circuit). The thermal shutdown circuit (TSD circuit) is designed only to shut the IC off to prevent thermal runaway. It is not designed to protect the IC or guarantee its operation. Do not continue to use the IC after operating this circuit or use the IC in an environment where the operation of this circuit is assumed.

	TSD on temperature [°C] (typ.)	Hysteresis temperature [°C] (typ.)
BA6219BFP-Y	175	15
BA6222	150	15

10. Testing on application boards

When testing the IC on an application board, connecting a capacitor to a pin with low impedance subjects the IC to stress. Always discharge capacitors after each process or step. Always turn the IC's power supply off before connecting it to or removing it from a jig or fixture during the inspection process. Ground the IC during assembly steps as an antistatic measure. Use similar precaution when transporting or storing the IC.

11. Regarding input pin of the IC

This monolithic IC contains P+ isolation and P substrate layers between adjacent elements in order to keep them isolated.

P-N junctions are formed at the intersection of these P layers with the N layers of other elements, creating a parasitic diode or transistor. For example, the relation between each potential is as follows:

When GND > Pin A and GND > Pin B, the P-N junction operates as a parasitic diode.

When GND > Pin B, the P-N junction operates as a parasitic transistor.

Parasitic diodes can occur inevitable in the structure of the IC. The operation of parasitic diodes can result in mutual interference among circuits, operational faults, or physical damage. Accordingly, methods by which parasitic diodes operate, such as applying a voltage that is lower than the GND (P substrate) voltage to an input pin, should not be used.

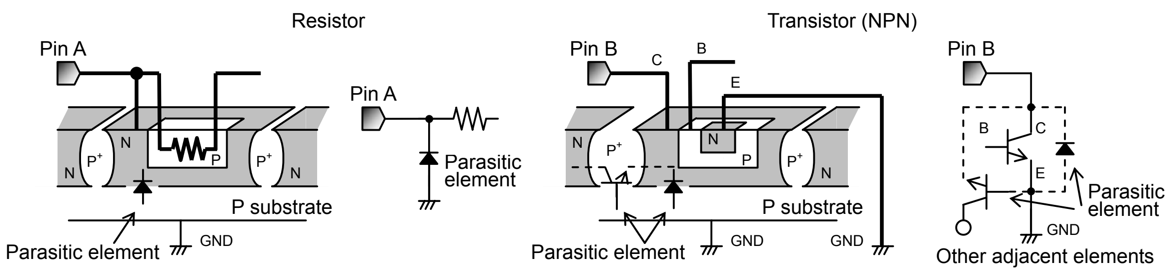


Fig.23 Example of IC structure

12. Ground Wiring Pattern

When using both small signal and large current GND patterns, it is recommended to isolate the two ground patterns, placing a single ground point at the ground potential of application so that the pattern wiring resistance and voltage variations caused by large currents do not cause variations in the small signal ground voltage. Be careful not to change the GND wiring pattern of any external components, either.

● Part Number Explanation

B	A		6	2	1	9	B		F	P	−	Y	–	E	2

ROHM part number

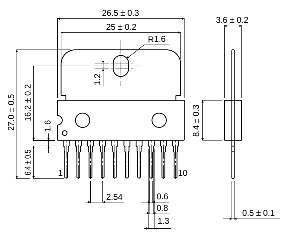
Type

Package
None = HSIP10
FP-Y = HSOP25

Package specification
E2 = Embossed taping

HSIP10

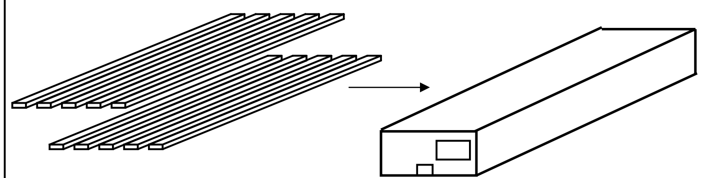
<Dimensions>



(Unit:mm)

<Packing Information>

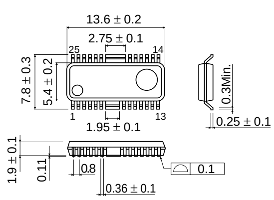
Container	Tube
Quantity	500pcs
Direction of feed	Direction of products is fixed in a container tube.



※Please order in multiples of the minimum package quantity

HSOP25

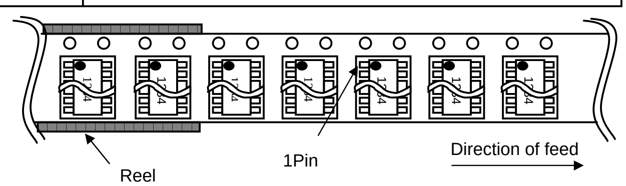
<Dimensions>



(Unit:mm)

〈Tape and Reel Information〉

Tape	Embossed carrier tape
Quantity	2,000pcs
Feeding Direction	E2 (Pin 1 is at the upper left when holding the reel with the left hand and pulling towards the right)



※Please order in multiples of the minimum package quantity

- The contents described herein are correct as of October, 2005
- The contents described herein are subject to change without notice. For updates of the latest information, please contact and confirm with ROHM CO.,LTD.
- Any part of this application note must not be duplicated or copied without our permission.
- Application circuit diagrams and circuit constants contained herein are shown as examples of standard use and operation. Please pay careful attention to the peripheral conditions when designing circuits and deciding upon circuit constants in the set.
- Any data, including, but not limited to application circuit diagrams and information, described herein are intended only as illustrations of such devices and not as the specifications for such devices. ROHM CO.,LTD. disclaims any warranty that any use of such devices shall be free from infringement of any third party's intellectual property rights or other proprietary rights, and further, assumes no liability of whatsoever nature in the event of any such infringement, or arising from or connected with or related to the use of such devices.
- Upon the sale of any such devices, other than for buyer's right to use such devices itself, resell or otherwise dispose of the same, implied right or license to practice or commercially exploit any intellectual property rights or other proprietary rights owned or controlled by ROHM CO., LTD. is granted to any such buyer.
- The products described herein utilize silicon as the main material.
- The products described herein are not designed to be X ray proof.

The products listed in this catalog are designed to be used with ordinary electronic equipment or devices (such as audio visual equipment, office-automation equipment, communications devices, electrical appliances and electronic toys).
Should you intend to use these products with equipment or devices which require an extremely high level of reliability and the malfunction of which would directly endanger human life (such as medical instruments, transportation equipment, aerospace machinery, nuclear-reactor controllers, fuel controllers and other safety devices), please be sure to consult with our sales representative in advance.

Excellence in Electronics

ROHM CO., LTD.
21, Saiin Mizosaki-cho, Ukyo-ku, Kyoto
615-8585, Japan
TEL: (075)311-2121 FAX: (075)315-0172
URL http: // www. rohm. com

Published by
Application Engineering Group

Contact us for further information about the products.

Atlanta U.S.A. / ROHM ELECTRONICS ATLANTA SALES OFFICE (DIVISION OF ROHM ELE. U.S.A.,LLC) TEL: +1(770)754-5972 FAX: +1(770)754-0691
Dallas U.S.A. / ROHM ELECTRONICS DALLAS SALES OFFICE (DIVISION OF ROHM ELE. U.S.A.,LLC) TEL: +1(972)312-8818 FAX: +1(972)312-0330
San Diego U.S.A. / ROHM ELECTRONICS SAN DIEGO SALES OFFICE (DIVISION OF ROHM ELE. U.S.A.,LLC) TEL: +1(858)625-3630 FAX: +1(858)625-3670
Germany / ROHM ELECTRONICS GMBH (GERMANY) TEL: +49(2154)9210 FAX: +49(2154)921400
United Kingdom / ROHM ELECTRONICS GMBH (UK) TEL: +44(0)1908-306700 FAX: +44(0)1908-235788
France / ROHM ELECTRONICS GMBH (FRANCE) TEL: +33(0)1 56 97 30 60 FAX: +33(0)1 56 97 30 80
Hong Kong China / ROHM ELECTRONICS (H.K.) CO., LTD. TEL: +852(2)7406262 FAX: +852(2)375-8971
Shanghai China / ROHM ELECTRONICS (SHANGHAI) CO., LTD. TEL: +86(21)6279-2727 FAX: +86(21)6247-2066
Dalian China / ROHM ELECTRONICS TRADING (DALIAN) CO., LTD. TEL:+86(411)8230-8549 FAX:+86(411)8230-8537
Beijing China / BEIJING REPRESENTATIVE OFFICE TEL: +86(10)8525-2483 FAX: +86(10)8525-2489
Taiwan / ROHM ELECTRONICS TAIWAN CO., LTD. TEL: +886(2)2500-6956 FAX: +886(2)2503-2869
Korea / ROHM ELECTRONICS KOREA CORPORATION TEL: +82(2)8182-700 FAX: +82(2)8182-715
Singapore / ROHM ELECTRONICS ASIA PTE. LTD. (RES / REI) TEL: +65-6332-2322 FAX: +65-6332-5662
Malaysia / ROHM ELECTRONICS (MALAYSIA) SDN. BHD. TEL: +60(3)7958-8355 FAX: +60(3)7958-8377
Philippines / ROHM ELECTRONICS (PHILIPPINES) SALES CORPORATION TEL: +63(2)807-6872 FAX: +63(2)809-1422
Thailand / ROHM ELECTRONICS (THAILAND) CO., LTD. TEL: +66(2)254-4890 FAX: +66(2)256-6334

Catalog No.05T289Be '05.10 ROHM©2000 TSU

Notes

- No technical content pages of this document may be reproduced in any form or transmitted by any means without prior permission of ROHM CO.,LTD.
- The contents described herein are subject to change without notice. The specifications for the product described in this document are for reference only. Upon actual use, therefore, please request that specifications to be separately delivered.
- Application circuit diagrams and circuit constants contained herein are shown as examples of standard use and operation. Please pay careful attention to the peripheral conditions when designing circuits and deciding upon circuit constants in the set.
- Any data, including, but not limited to application circuit diagrams information, described herein are intended only as illustrations of such devices and not as the specifications for such devices. ROHM CO.,LTD. disclaims any warranty that any use of such devices shall be free from infringement of any third party's intellectual property rights or other proprietary rights, and further, assumes no liability of whatsoever nature in the event of any such infringement, or arising from or connected with or related to the use of such devices.
- Upon the sale of any such devices, other than for buyer's right to use such devices itself, resell or otherwise dispose of the same, no express or implied right or license to practice or commercially exploit any intellectual property rights or other proprietary rights owned or controlled by
- ROHM CO., LTD. is granted to any such buyer.
- Products listed in this document are no antiradiation design.

The products listed in this document are designed to be used with ordinary electronic equipment or devices (such as audio visual equipment, office-automation equipment, communications devices, electrical appliances and electronic toys).
Should you intend to use these products with equipment or devices which require an extremely high level of reliability and the malfunction of which would directly endanger human life (such as medical instruments, transportation equipment, aerospace machinery, nuclear-reactor controllers, fuel controllers and other safety devices), please be sure to consult with our sales representative in advance.
It is our top priority to supply products with the utmost quality and reliability. However, there is always a chance of failure due to unexpected factors. Therefore, please take into account the derating characteristics and allow for sufficient safety features, such as extra margin, anti-flammability, and fail-safe measures when designing in order to prevent possible accidents that may result in bodily harm or fire caused by component failure. ROHM cannot be held responsible for any damages arising from the use of the products under conditions out of the range of the specifications or due to non-compliance with the NOTES specified in this catalog.

Thank you for your accessing to ROHM product informations.
More detail product informations and catalogs are available, please contact your nearest sales office.

ROHM Customer Support System **THE AMERICAS** / **EUROPE** / **ASIA** / **JAPAN**

www.rohm.com **Contact us** : webmaster@rohm.co.jp

ROHM CO., LTD. 21 Saiin Mizosaki-cho, Ukyo-ku, Kyoto 615-8585, Japan
TEL : +81-75-311-2121
FAX : +81-75-315-0172