

Compact Video Driver Series for DSCs and Portable Devices



# Ultra-compact Waferlevel Chip Size Package Output Capacitor-less Single Output Video Drivers

BH76906GU, BH76909GU, BH76912GU, BH76916GU, BH76706GU

No. 09064EAT01

## ●Description

Due to a built-in charge pump circuit, this video driver does not require the large capacity tantalum capacitor at the video output pin that is essential in conventional video drivers. Features such as a built-in LPF that has bands suited to mobile equipment, current consumption of 0  $\mu$ A at standby, and low voltage operation from as low as 2.5 V make it optimal for digital still cameras, mobile phones, and other equipment in which high density mounting is demanded.

## ●Features

- 1) WLCSP ultra-compact package (1.6 mm x 1.6 mm x 0.75 mm)
- 2) Improved noise characteristics over BH768xxFVM series
- 3) Four video driver amplifier gains in lineup: 6 dB, 9 dB, 12 dB, 16.5 dB
- 4) Large output video driver of maximum output voltage 5.2 Vpp. Ample operation margin for supporting even low voltage operation
- 5) Output coupling capacitor not needed, contributing to compact design
- 6) Built-in standby function and circuit current of 0  $\mu$ A (typ) at standby
- 7) Clear image playback made possible by built-in 8<sup>th</sup>-order 4.5 MHz LPF
- 8) Due to use of bias input format, supports not only video signals but also chroma signals and RGB signals
- 9) Due to built-in output pin shunt switch, video output pin can be used as video input pin (BH76706GU)

## ●Applications

Mobile phone, digital still camera, digital video camera, hand-held game, portable media player

## ●Line up matrix

| Product Name | Video Driver Amplifier Gain | Recommended Input Level | Video Output Pin Shunt Function |
|--------------|-----------------------------|-------------------------|---------------------------------|
| BH76906GU    | 6dB                         | 1Vpp                    | —                               |
| BH76909GU    | 9dB                         | 0.7Vpp                  |                                 |
| BH76912GU    | 12dB                        | 0.5Vpp                  |                                 |
| BH76916GU    | 16.5dB                      | 0.3Vpp                  |                                 |
| BH76706GU    | 6dB                         | 1Vpp                    | O                               |

## ●Absolute Maximum Ratings (Ta = 25 °C)

| Parameter                   | Symbol           | Rating   | Unit |
|-----------------------------|------------------|----------|------|
| Supply voltage              | V <sub>CC</sub>  | 3.55     | V    |
| Power dissipation           | P <sub>d</sub>   | 580      | mW   |
| Operating temperature range | T <sub>opr</sub> | -40~+85  | °C   |
| Storage temperature range   | T <sub>stg</sub> | -55~+125 | °C   |

\* When mounted on a 50 mmx58 mmx1.6 mm glass epoxy board, reduce by 5.8mW/°C above Ta=+25°C.

## ●Operating Range

| Parameter      | Symbol          | Min. | Typ. | Max. | Unit |
|----------------|-----------------|------|------|------|------|
| Supply voltage | V <sub>CC</sub> | 2.5  | 3.0  | 3.45 | V    |

## ●Electrical Characteristics

[Unless otherwise specified, Typ. : T<sub>a</sub> = 25 °C, V<sub>CC</sub> = 3V]

| Parameter                                      | Symbol             | Typical Values       |               |               |               |                                   | Unit            | Measurement Conditions  |
|--|--------------------|----------------------|---------------|---------------|---------------|-----------------------------------|-----------------|---|
|  |                    | BH76906<br>GU        | BH76909<br>GU | BH76912<br>GU | BH76916<br>GU | BH76706<br>GU                     |                 |   |
| Circuit current 1-1                            | I <sub>CC1-1</sub> | 15.0                 |               |               |               |                                   | mA              | In active mode (No signal)  |
| Circuit current 1-2                            | I <sub>CC1-2</sub> | 17.0                 |               |               |               |                                   | mA              | In active mode<br>(Outputting NTSC color bar<br>signal)                       |
| Circuit current 2                              | I <sub>CC2</sub>   | 0.0                  |               |               |               |                                   | μA              | In standby mode   |
| Circuit current 3                              | I <sub>CC3</sub>   | —                    |               |               |               | 100                               | μA              | In input mode (Applying B3 =<br>1.5 V)  |
| Standby switch input current<br>High Level     | I <sub>thH1</sub>  | 45                   |               |               |               | —                                 | μA              | Applying B3 = 3.0 V   |
| Standby switch switching voltage<br>High Level | V <sub>thH1</sub>  | 1.2V <sub>min</sub>  |               |               |               |                                   | V               | Active mode   |
| Standby switch switching voltage<br>Low Level  | V <sub>thL1</sub>  | 0.45V <sub>max</sub> |               |               |               |                                   | V               | Standby mode  |
| Standby switch outflow current<br>High Level   | I <sub>thH2</sub>  | —                    |               |               |               | 0                                 | μA              | Applying B3 = 3.0 V   |
| Standby switch outflow current<br>Middle Level | I <sub>thM2</sub>  |                      |               |               |               | 8                                 | μA              | Applying B3 = 1.5 V   |
| Standby switch outflow current<br>Low Level    | I <sub>thL2</sub>  |                      |               |               |               | 23                                | μA              | Applying B3 = 0 V   |
| Mode switching voltage<br>High Level           | V <sub>thH2</sub>  |                      |               |               |               | V <sub>CC</sub><br>-0.2<br>(MIN.) | V               | Standby mode  |
| Mode switching voltage<br>Middle Level         | V <sub>thM2</sub>  |                      |               |               |               | V <sub>CC</sub> /2<br>(TYP.)      | V               | Input mode  |
| Mode switching voltage<br>low Level            | V <sub>thL2</sub>  |                      |               |               |               | 0.2<br>(MAX.)                     | V               | Active mode   |
| Voltage gain                                   | G <sub>V</sub>     | 6.0                  | 9.0           | 12.0          | 16.5          | 6.0                               | dB              | V <sub>o</sub> =100kHz, 1.0V <sub>pp</sub>                                    |
| Maximum output level                           | V <sub>omv</sub>   | 5.2                  |               |               |               |                                   | V <sub>pp</sub> | f=10kHz,THD=1%  |
| Frequency characteristic 1                     | G <sub>f1</sub>    | -0.2                 |               |               |               | -0.2                              | dB              | f=4.5MHz/100KHz   |
| Frequency characteristic 2                     | G <sub>f2</sub>    | -1.5                 |               |               |               | -1.4                              | dB              | f=8.0MHz/100KHz   |
| Frequency characteristic 3                     | G <sub>f3</sub>    | -26                  |               |               |               | -28                               | dB              | f=18MHz/100KHz  |
| Frequency characteristic 4                     | G <sub>f4</sub>    | -44                  |               |               |               | -48                               | dB              | f=23.5MHz/100KHz  |
| Differential gain                              | D <sub>G</sub>     | 0.5                  |               |               |               |                                   | %               | V <sub>o</sub> =1.0V <sub>p-p</sub><br>Inputting standard staircase<br>Signal |
| Differential phase                             | D <sub>P</sub>     | 1.0                  |               |               |               |                                   | deg             | V <sub>o</sub> =1.0V <sub>p-p</sub><br>Inputting standard staircase<br>signal |
| Y signal to noise ratio                        | SN <sub>Y</sub>    | +74                  | +73           | +70           | +70           | +74                               | dB              | 100 kHz~6MHz band<br>Inputting 100% white video signal                        |
| C AM signal to noise ratio                     | SN <sub>CA</sub>   | +77                  | +76           | +75           | +75           | +77                               | dB              | 100~500 kHz band<br>Inputting 100% chroma video signal                        |
| C PM signal to noise ratio                     | SN <sub>CP</sub>   | +65                  |               |               |               |                                   | dB              | 100~500 kHz band<br>Inputting 100% chroma video signal                        |
| Current able to flow into output pin           | I <sub>extin</sub> | 30                   |               |               |               |                                   | mA              | Applying 4.5 V to output pin<br>through 150 Ω                                 |
| Output DC offset                               | V <sub>off</sub>   | ±50 <sub>max</sub>   |               |               |               |                                   | mV              | With no signal<br>V <sub>off</sub> = (V <sub>out</sub> pin voltage) ÷ 2       |
| Input impedance                                | R <sub>in</sub>    | 150                  |               |               |               |                                   | kΩ              | Measure inflowing current when<br>applying A3 = 1 V                           |
| Output pin shunt switch<br>on resistance       | R <sub>on</sub>    | —                    |               |               |               | 3                                 | Ω               |   |

●Test Circuit Diagram

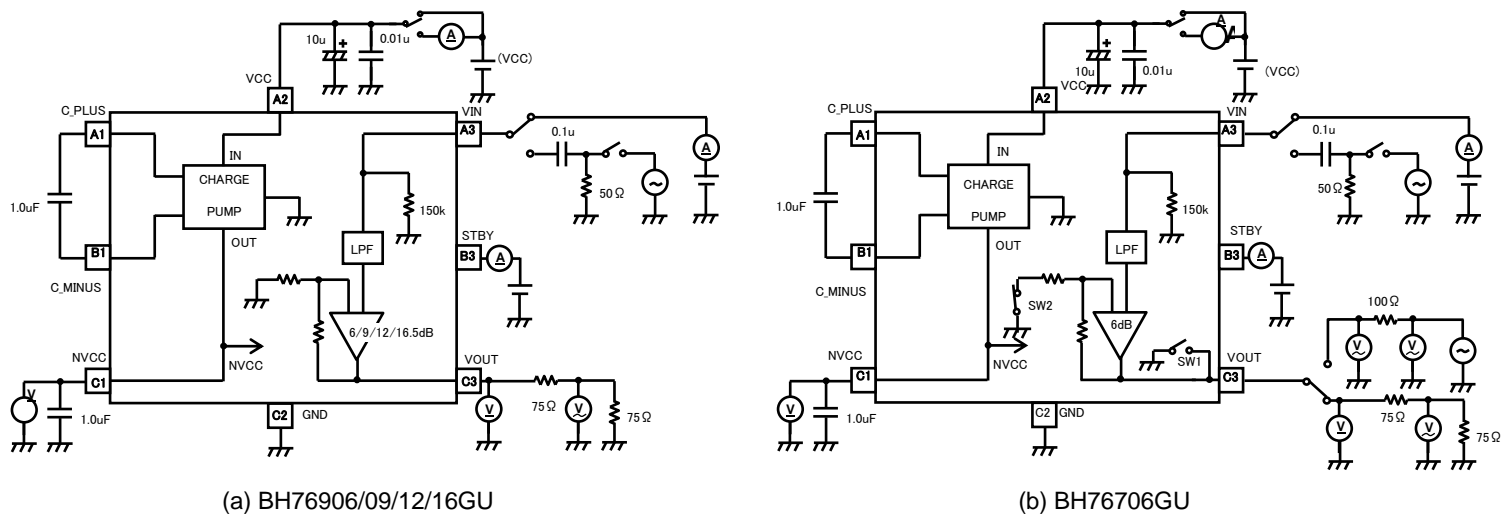


Fig. 1

※ A test circuit is a circuit for shipment inspection and differs from an application circuit example.

●Block Diagram

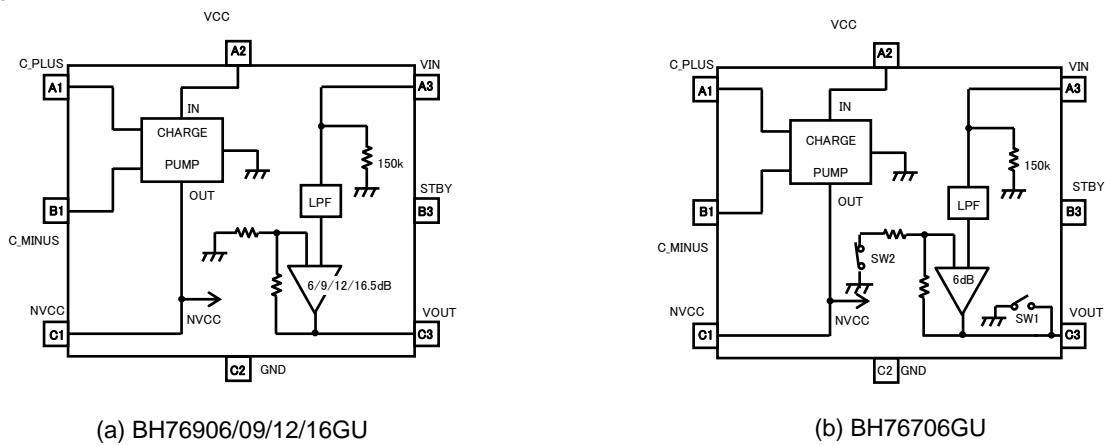


Fig. 2

●Operation Logic

| BH769xxGU      |                |
|----------------|----------------|
| STBY Pin Logic | Operating Mode |
| H              | Active         |
| L              | Standby        |
| OPEN           |                |

| BH76706GU      |                   |     |     |
|----------------|-------------------|-----|-----|
| STBY Pin Logic | Operating Mode    | SW1 | SW2 |
| H              | Standby           | OFF | OFF |
| M              | Input (Record)    | ON  | OFF |
| L              | Active (Playback) | OFF | ON  |

※Use of the BH76706GU with the STBY pin OPEN is inappropriate

## ● Pin Descriptions

| Ball              | Pin Name   | Pin Internal Equivalent Circuit Diagram | DC Voltage        | Functional Description  |             |                   |                 |                 |                   |        |
|-------------------|--|---|-------------------|---|-------------|-------------------|-----------------|-----------------|-------------------|--------|
| A1                | C_PLUS   |   | +VCC<br>↑ ↓<br>0V | Flying capacitor “+” pin<br><br>See functional descriptions of 7pin, 8pin   |             |                   |                 |                 |                   |        |
| A2                | VCC  |   | VCC               | VCC pin   |             |                   |                 |                 |                   |        |
| A3                | VIN  |   | 0V                | Video signal input pin<br><br>Suitable input signals include composite video signals, chroma signals, R.G.B. signals  |             |                   |                 |                 |                   |        |
| B3                | STBY   | BH769xxGU<br>                           | VCC to 0V         | ACTIVE/STANBY switching pin<br><table><tr><th>Pin Voltage</th><th>MODE</th></tr><tr><td>1.2 V ~ VCC (H)</td><td>ACTIVE</td></tr><tr><td>0 V ~ 0.45 V (L)</td><td>STANBY</td></tr></table> | Pin Voltage | MODE              | 1.2 V ~ VCC (H) | ACTIVE          | 0 V ~ 0.45 V (L)  | STANBY |
|                   |  | Pin Voltage                             |                   | MODE  |             |                   |                 |                 |                   |        |
| 1.2 V ~ VCC (H)   | ACTIVE   |   |                   |   |             |                   |                 |                 |                   |        |
| 0 V ~ 0.45 V (L)  | STANBY   |   |                   |   |             |                   |                 |                 |                   |        |
| BH76706GU<br>     | MODE switching pin<br><table><tr><th>Pin Voltage</th><th>MODE</th></tr><tr><td>2.8 V ~ VCC (H)</td><td>STANBY</td></tr><tr><td>1.3 V ~ 1.7 V (M)</td><td>GND (Record)</td></tr><tr><td>0 V ~ 0.2 V (L)</td><td>ACTIVE (Playback)</td></tr></table> | Pin Voltage                             | MODE              | 2.8 V ~ VCC (H)   | STANBY      | 1.3 V ~ 1.7 V (M) | GND (Record)    | 0 V ~ 0.2 V (L) | ACTIVE (Playback) |        |
| Pin Voltage       | MODE   |   |                   |   |             |                   |                 |                 |                   |        |
| 2.8 V ~ VCC (H)   | STANBY   |   |                   |   |             |                   |                 |                 |                   |        |
| 1.3 V ~ 1.7 V (M) | GND (Record)   |   |                   |   |             |                   |                 |                 |                   |        |
| 0 V ~ 0.2 V (L)   | ACTIVE (Playback)  |   |                   |   |             |                   |                 |                 |                   |        |
| C3                | VOUT   |   | 0V                | Video signal output pin<br><br>75Ω  |             |                   |                 |                 |                   |        |
| C2                | GND  |   | 0V                | GND pin   |             |                   |                 |                 |                   |        |

Note 1) DC voltages in the figure are those when VCC = 3.0 V. Moreover, these values are reference values which are not guaranteed.

Note 2) Numeric values in the figure are settings which do not guarantee ratings.

|    |         |  |  |
|----|---------|--|--|
| C1 | NVCC    |  | <p>Flying capacitor “-” pin (8pin)</p> |
| B1 | C_MINUS |  | <p>Negative voltage pin (7pin)</p>     |

Note 1) DC voltages in the figure are those when  $V_{CC} = 3.0\text{ V}$ . Moreover, these values are reference values which are not guaranteed.

Note 2) Numeric values in the figure are settings which do not guarantee ratings.

### ●Description of Operation

## 1) Principles of output coupling capacitorless video drivers

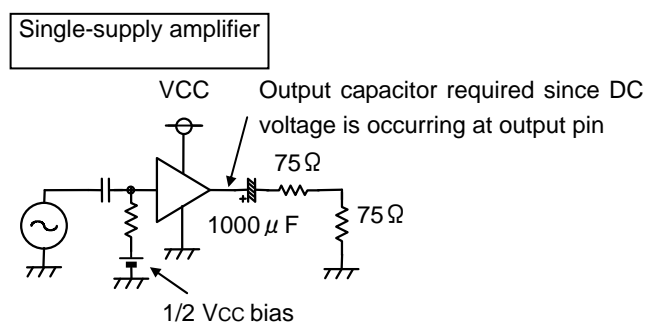


Fig.3

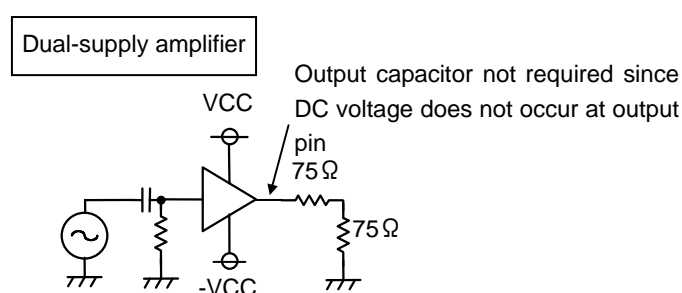


Fig.4

For an amplifier operated from a single power supply (single-supply), since the operating point has a potential of approximately  $1/2 V_{CC}$ , a coupling capacitor is required for preventing direct current in the output. Moreover, since the load resistance is  $150 \Omega$  ( $75 \Omega + 75 \Omega$ ) for the video driver, the capacity of the coupling capacitor must be on the order of  $1000 \mu F$  if you take into account the low band passband. (Fig.3)

For an amplifier operated from dual power supplies ( $\pm$  supply), since the operating point can be at GND level, a coupling capacitor for preventing output of direct current is not needed.

Moreover, since a coupling capacitor is not needed, in principle, there is no lowering of the low band characteristic at the output stage. (Fig.4)

### 2) Occurrence of negative voltage due to charge pump circuit

A charge pump, as shown in Fig. 5, consists of a pair of switches (SW1, SW2) and a pair of capacitors (flying capacitor, anchor capacitor). Switching the pair of switches as shown in Fig. 5 causes a negative voltage to occur by shifting the charge in the flying capacitor to the anchor capacitor as in a bucket relay.

In this IC, by applying a voltage of +3 V, a negative voltage of approximately -2.8 V is obtained.

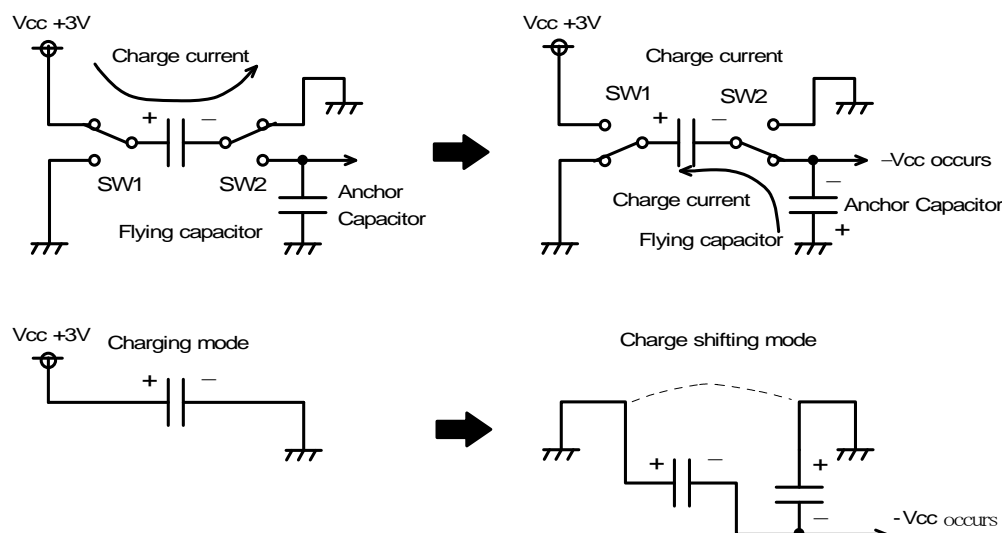


Fig.5 Principles of Charge Pump Circuit

### 3) Configuration of BH769xxGU and BH76706GU

As shown in Fig. 6, a BH769xxGU or BH76706GU is a dual-supply amplifier and charge pump circuit integrated in one IC. Accordingly, while there is +3 V single-supply operation, since a dual-supply operation amplifier is used, an output coupling capacitor is not needed.

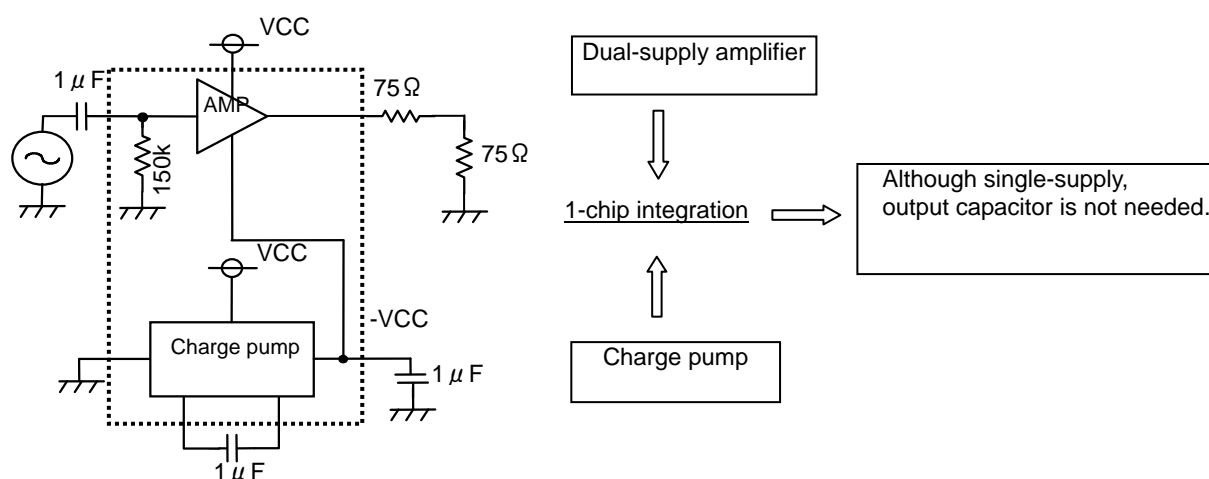


Fig.6 Configuration Diagram of BH769xxGU or BH76706GU

### 4) Input pin format and sag characteristic

While a BH769xxGU or BH76706GU is a low voltage operation video driver, since it has a large dynamic range of approximately 5.2 Vpp, a resistance termination method that is compatible regardless of signal form (termination by 150 kΩ) is used, and not a clamp method that is an input method exclusively for video signals.

Therefore, since a BH769xxGU or BH76706GU operates normally even if there is no synchronization signal in the input signal, it is compatible with not only normal video signals but also chroma signals and R.G.B. signals and has a wide application range.

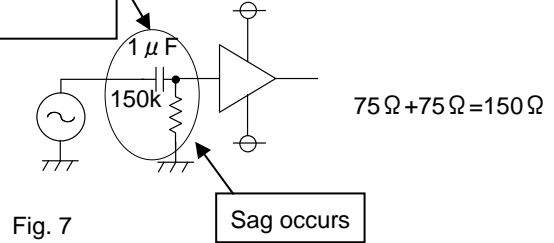
Moreover, concerning sag (lowering of low band frequency) that occurs at the input pin and becomes a problem for the resistance termination method, since the input termination resistor is a high 150 kΩ, even if it is combined with a small capacity input capacitor, a sag characteristic that is not a problem in actual use is obtained.

In evaluating the sag characteristic, it is recommended that you use an H-bar signal in which sag readily stands out. (Fig. 8 to Fig. 10)

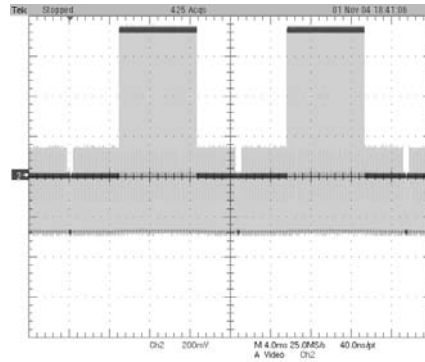
Input capacitor and input impedance cutoff frequency is the same as when output capacitor in generic 75  $\Omega$  driver is made 1000  $\mu\text{F}$ .

$1\text{ }\mu\text{F} \times 150\text{ k}\Omega = 1000\text{ }\mu\text{F} \times 150\text{ }\Omega$   
(Input pin time constant) (Output pin time constant)

Sag is determined by input capacitor and input resistor only.



a) Video signal without sag (TG-7/1 output, H-bar)



TV screen output image of H-bar signal

Fig. 8

b) BH769xxGU or BH76706GU output (Input = 1.0  $\mu\text{F}$ , TG-7/1 output, H-bar)

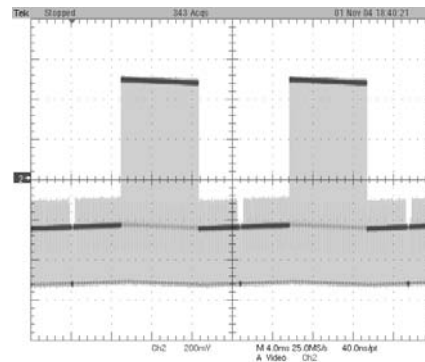
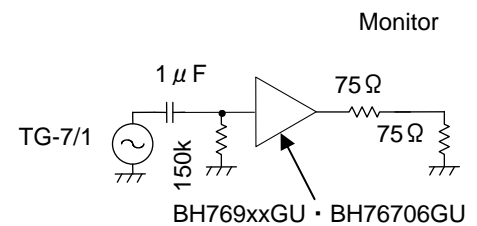


Fig. 9



c) 1000  $\mu\text{F}$  + 150  $\Omega$  sag waveform (TG-7/1 output, H-bar)

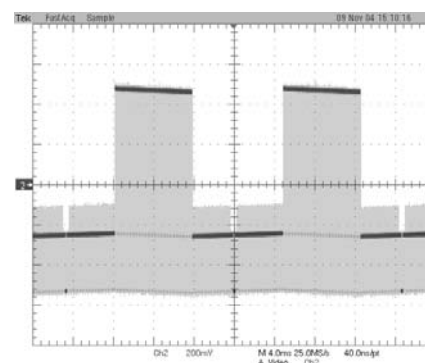
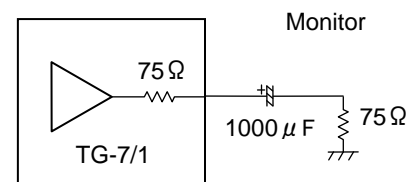
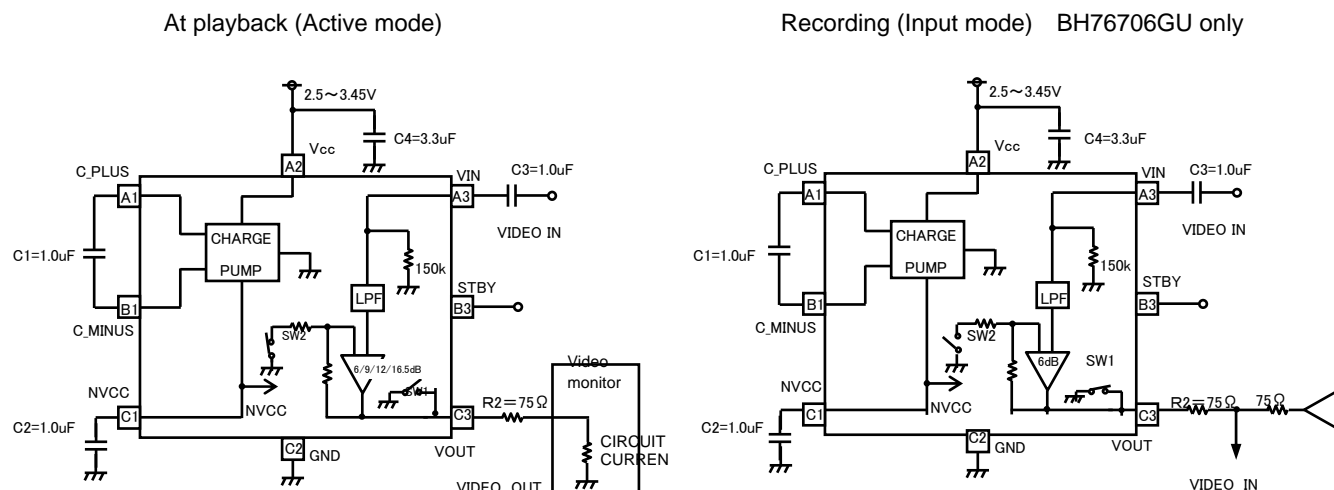


Fig. 10



## ● Application Circuit Example



\* SW1 and SW2 are built-in BH76706GU only

See page 3/16 for STBY pin logic in each mode

Fig.11

※ We are confident in recommending the above application circuit example, but we ask that you carefully check not just the static characteristics but also transient characteristics of this circuit before using it.

## ● Caution on use

1. Wiring from the decoupling capacitor C4 to the IC should be kept as short as possible. Moreover, this capacitor's capacitance value may have ripple effects on the IC, and may affect the S-N ratio for signals, so we recommend using as large a decoupling capacitor as possible. (Recommended C4: 3.3  $\mu$ F, B characteristics, 6.3 V or higher maximum voltage)  
Make mount board patterns follow the layout example shown on page 10 as closely as possible.
2. Capacitors to use  
In view of the temperature characteristics, etc., we recommend a ceramic capacitor with B characteristics.
3. The NVCC (C1 pin) terminal generates a voltage that is used within the IC, so it should never be connected to a load unless absolutely necessary. Moreover, this capacitor (C2) has a large capacitance value but very little negative voltage ripple.  
(Recommended C2: 1.0  $\mu$ F, B characteristic, 6.3 V or higher maximum voltage)
4. Capacitors C1 and C4 should be placed as close as possible to the IC. If the wiring to the capacitor is too long, it can lead to intrusion of switching noise. (Recommended C1: 1.0  $\mu$ F, B characteristics, 6.3 V or higher maximum voltage)
5. The HPF consists of input coupling capacitor C3 and 150 k $\Omega$  of internal input impedance. Be sure to check for video signal sag before determining the C3 value. The cut-off frequency  $f_c$  can be calculated using the following formula.  
 $f_c = 1/(2\pi \times C3 \times 150k\Omega)$  (Recommended C3: 1.0  $\mu$ F, B characteristic, 6.3 V or higher maximum voltage)
6. The output resistor R2 should be placed close to the IC.
7. If the IC is mounted in the wrong direction, there is a risk of damage due to problems such as inverting VCC and GND. Be careful when mounting it.
8. A large current transition occurs in the power supply pin when the charge pump circuit is switched. If this affects other ICs (via the power supply line), insert a resistor (approximately 10  $\Omega$ ) in the VCC line to improve the power supply's ripple effects. Although inserting a 10  $\Omega$  resistor lowers the voltage by about 0.2 V, this IC has a wide margin for low-voltage operation, so dynamic range problems or other problems should not occur. (See Figures 12 to 14.)

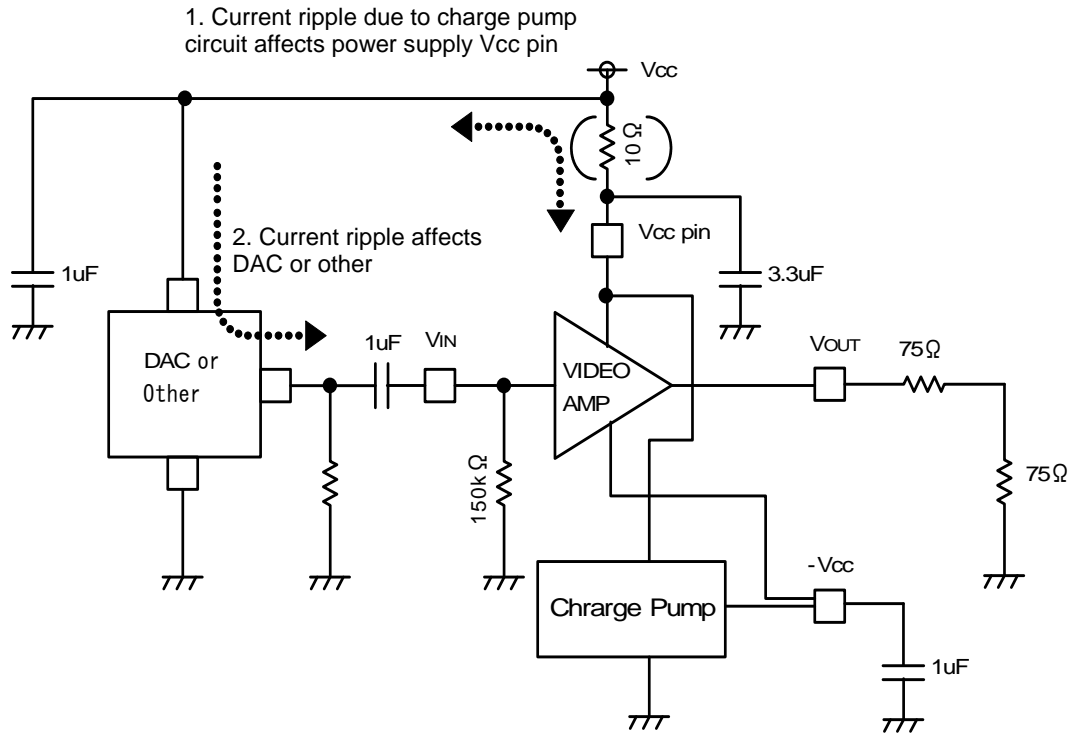


Fig.12 Effects of Charge Pump Circuit Current Ripple on External Circuit

## 1) Decoupling capacitor only

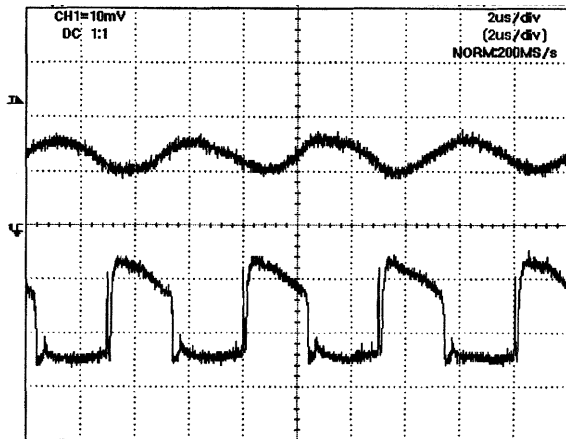
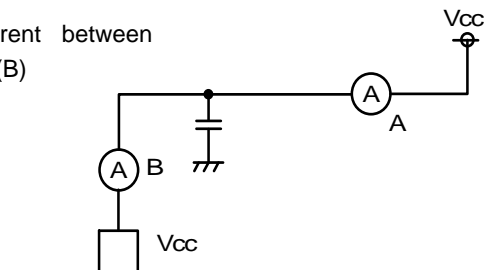


Fig.13

Waveform of current between  
power supply and capacitor (A)  
10 mA/div

Waveform of current between  
capacitor and IC (B)  
10 mA/div



## 2) Decoupling capacitor + 10 Ω resistor

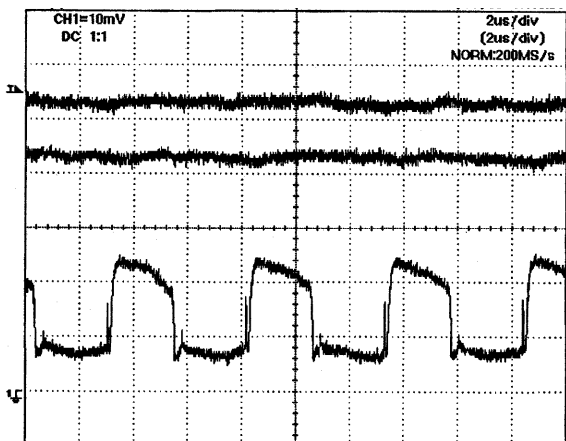
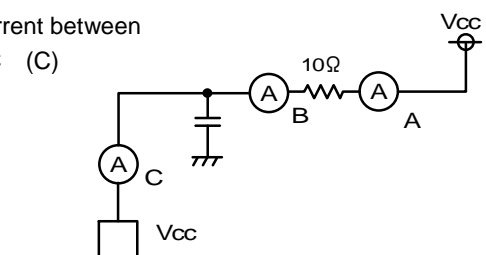


Fig.14

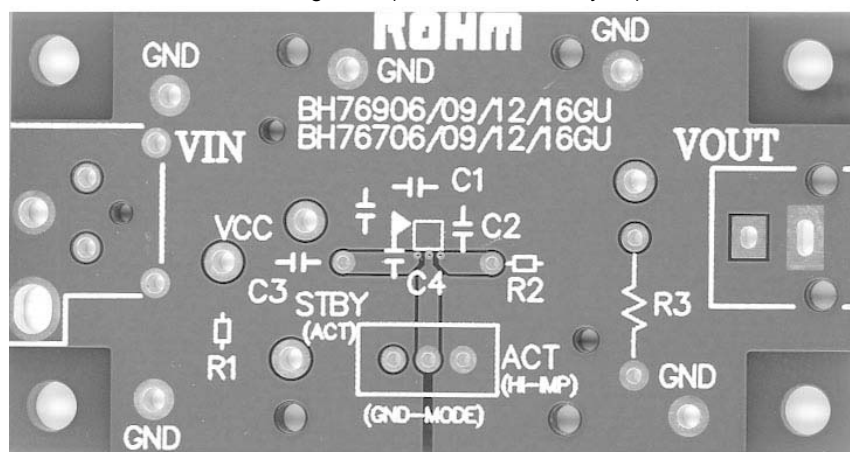
Waveform of current between  
power supply and capacitor (A)  
10 mA/div

Waveform of current between  
resistor and capacitor (B)  
10 mA/div

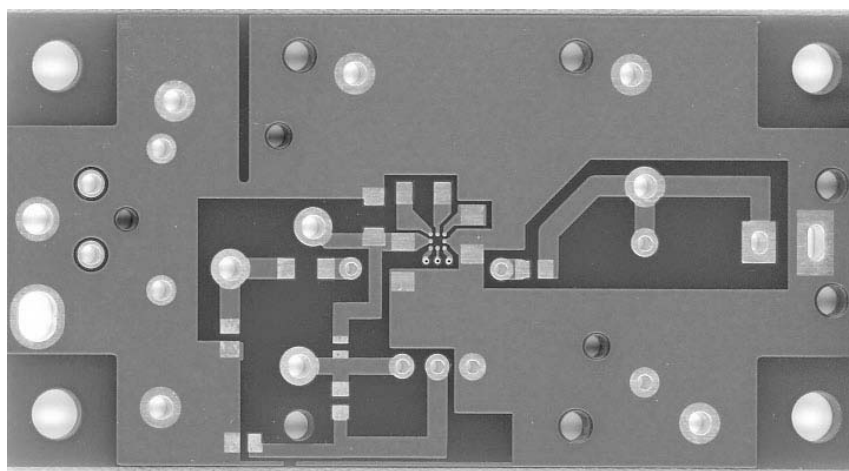
Waveform of current between  
capacitor and IC (C)  
10 mA/div



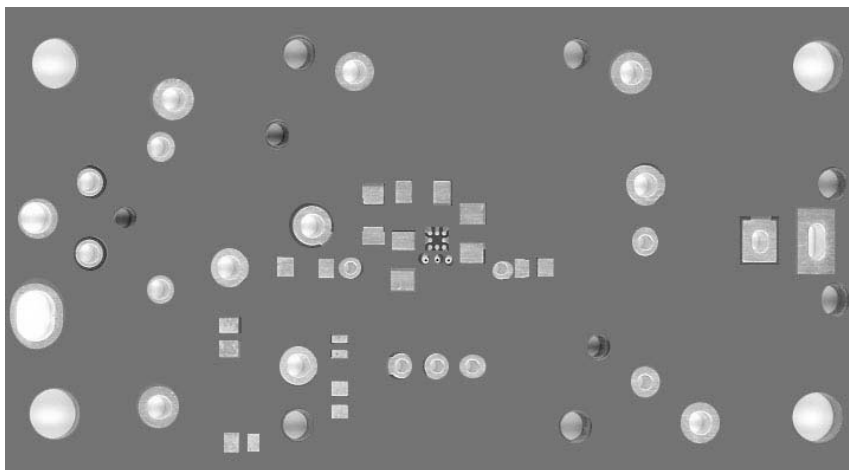
## ●Evaluation Board Pattern Diagram (Double-sided, 2 layers)



Layer 1 wiring + Silkscreen legend



Layer 2 wiring



Solder pattern

Fig.15

## Parts List

| Symbol | Function                    | Recommended Value | Remarks   |
|--------|-----------------------------|-------------------|---|
| C1     | Flying capacitor            | 1 $\mu$ F         | B characteristic recommended                                    |
| C2     | Tank capacitor              | 1 $\mu$ F         | B characteristic recommended                                    |
| C3     | Input coupling capacitor    | 1 $\mu$ F         | B characteristic recommended                                    |
| C4     | Decoupling capacitor        | 3.3 $\mu$ F       | B characteristic recommended                                    |
| R1     | Input termination resistor  | 75 $\Omega$       | Needed when connected to video signal measurement set           |
| R2     | Output resistor             | 75 $\Omega$       | —   |
| R3     | Output termination resistor | 75 $\Omega$       | Not needed when connected to TV or video signal measurement set |
|        | Input connector             | BNC               |   |
|        | Output connector            | RCA (Pin jack)    |   |

## ●Reference Data

BH76906GU

Ta=25°C

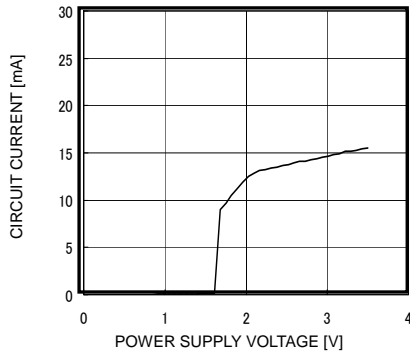


Fig. 16 Circuit Current vs Supply Voltage

BH76906GU

VCC=3V

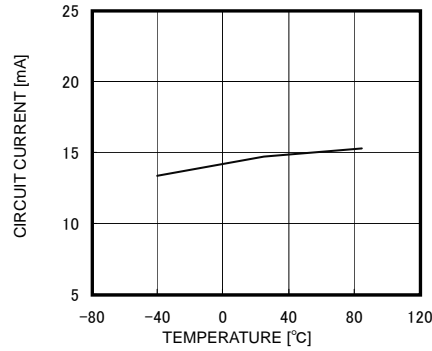


Fig. 17 Circuit Current vs Ambient Temperature

BH76906GU

Ta=25°C

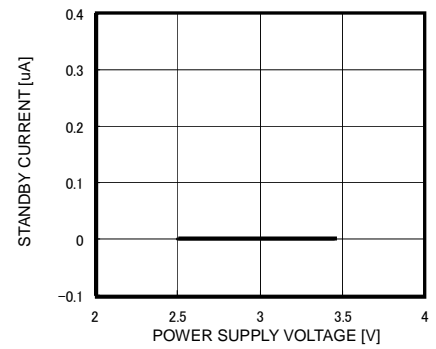


Fig. 18 Standby Circuit Current vs Supply Voltage

BH76906GU

VCC=3V

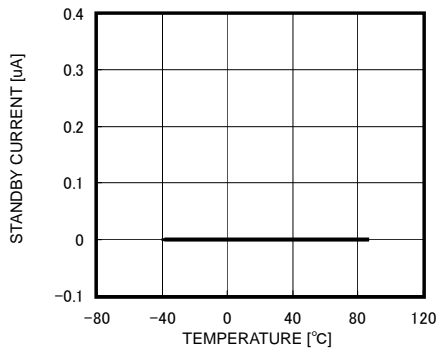


Fig. 19 Standby Circuit Current vs Ambient Temperature

BH76706GU

Ta=25°C

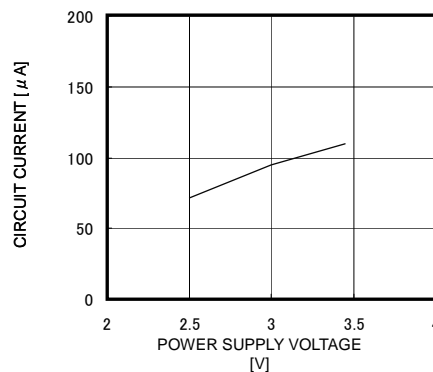


Fig. 20 GND Mode Circuit Current vs Supply Voltage

BH76706GU

VCC=3V

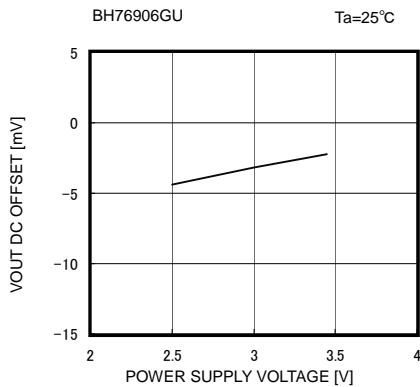
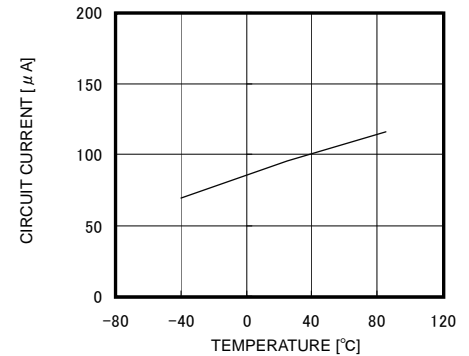


Fig. 22 VOUT Pin Output DC Offset vs Supply Voltage

BH76906GU

VCC=3V

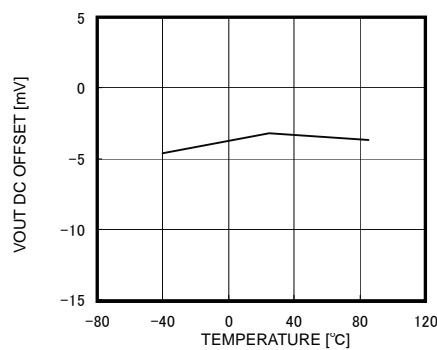


Fig. 23 VOUT Pin Output DC Offset vs Ambient Temperature

BH76906GU

VCC=3V Ta=25°C

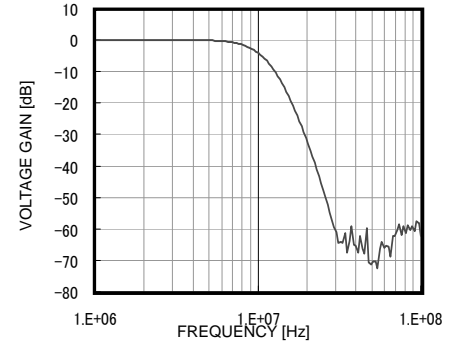


Fig. 24 Frequency Characteristic

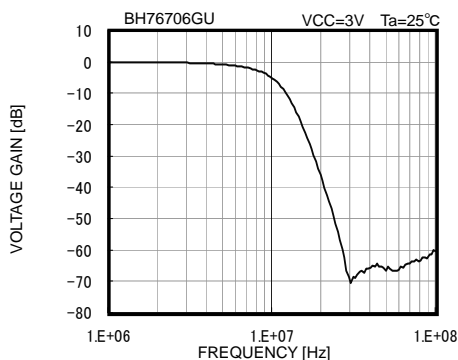


Fig. 25 Frequency Characteristic

BH76906GU

Ta=25°C

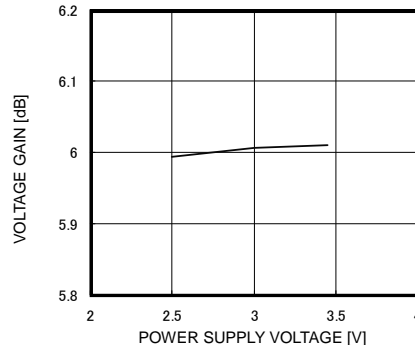


Fig. 26 Voltage Gain vs Supply Voltage

BH76906GU

VCC=3V

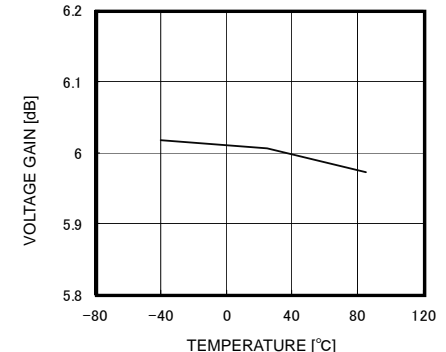


Fig. 27 Voltage Gain vs Ambient Temperature

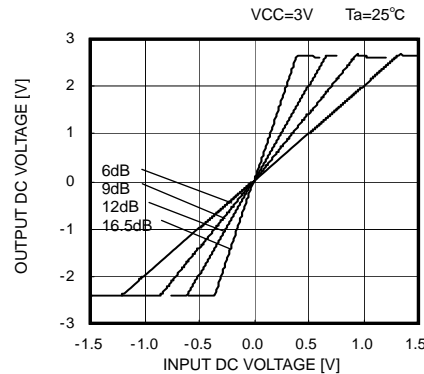
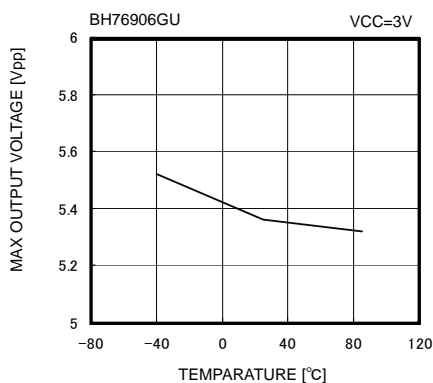
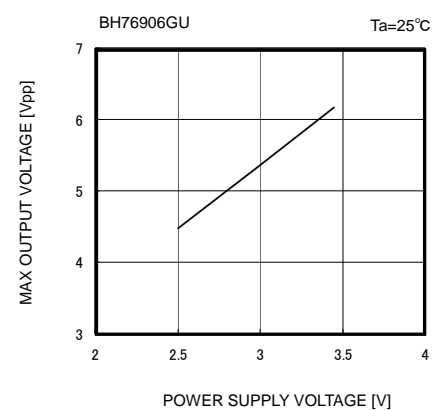
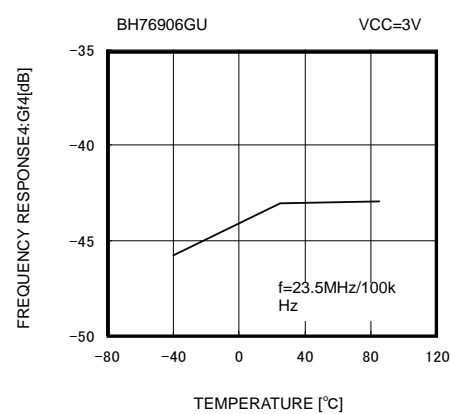
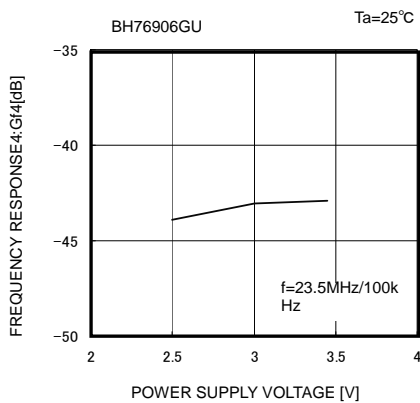
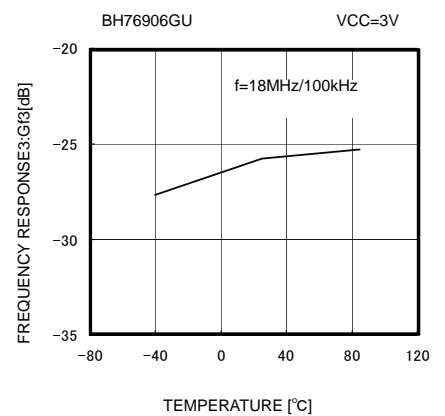
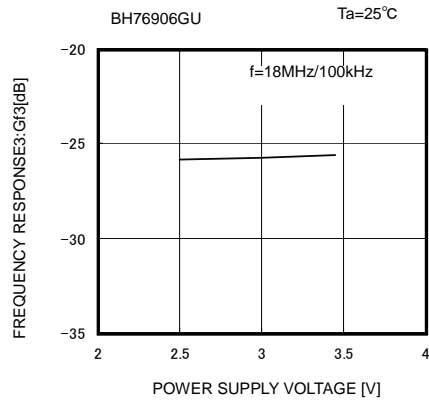
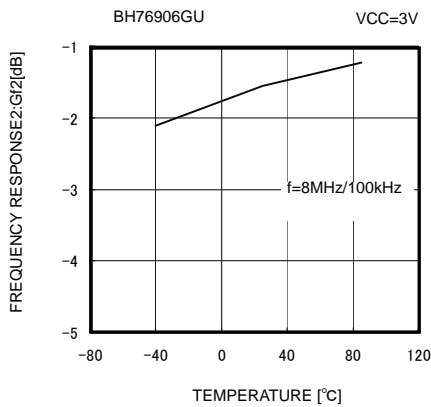
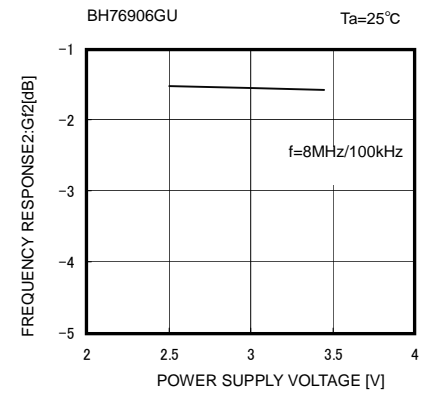
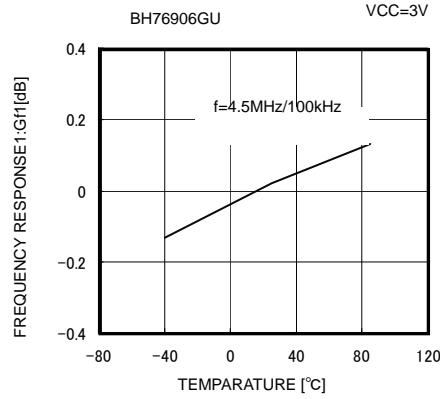
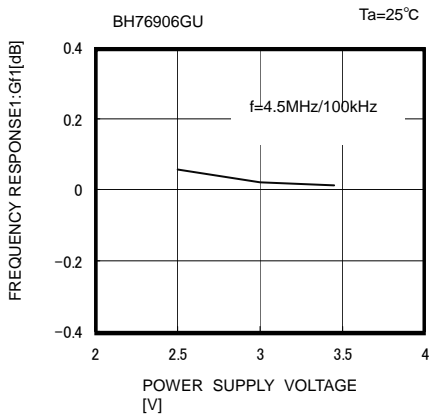


Fig. 37 Max. Output Level vs Ambient Temperature

Fig. 38 DC I/O Characteristic

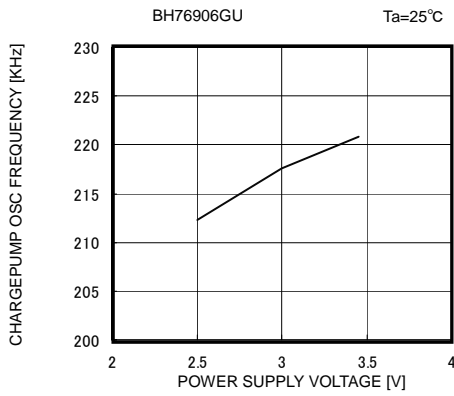


Fig. 39 Charge Pump Oscillation Frequency vs Supply Voltage

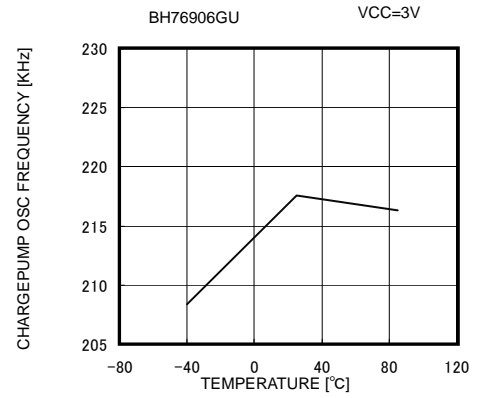


Fig. 40 Charge Pump Oscillation Frequency vs Ambient Temperature

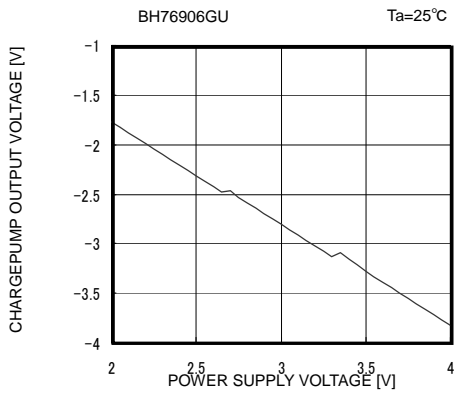


Fig. 41 Charge Pump Output Voltage vs Supply Voltage

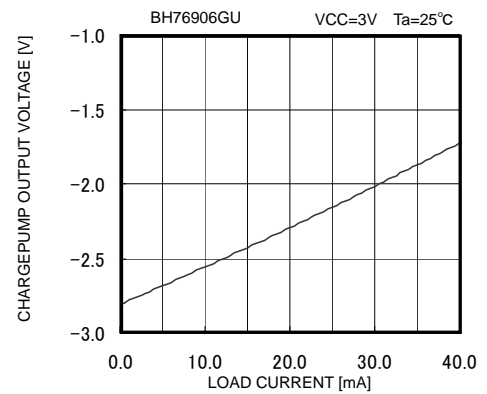


Fig. 42 Charge Pump Load Regulation

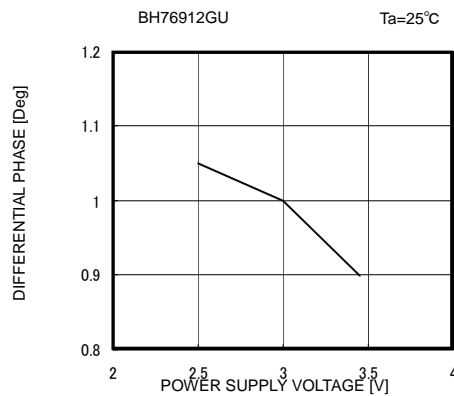


Fig. 43 Differential Phase vs Supply Voltage

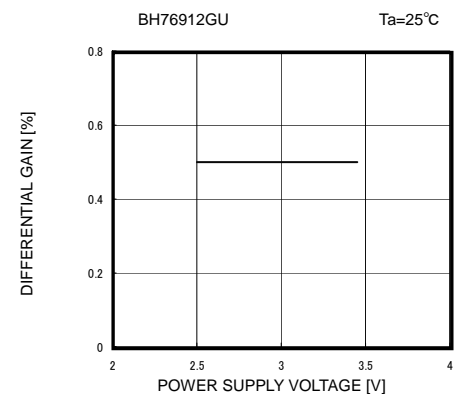
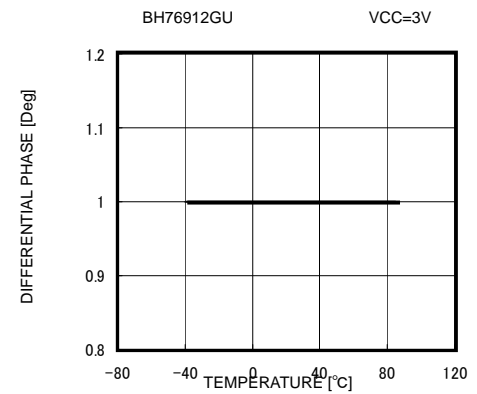


Fig. 45 Differential Gain vs Supply Voltage

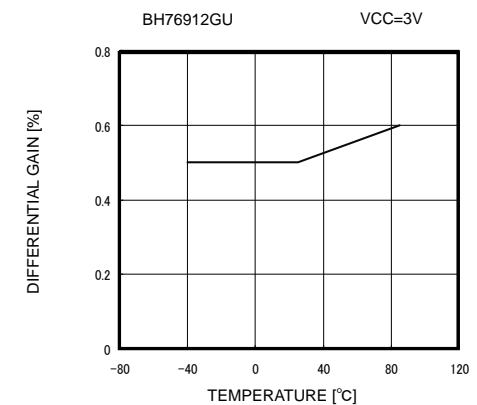


Fig. 46 Differential Gain vs Ambient Temperature

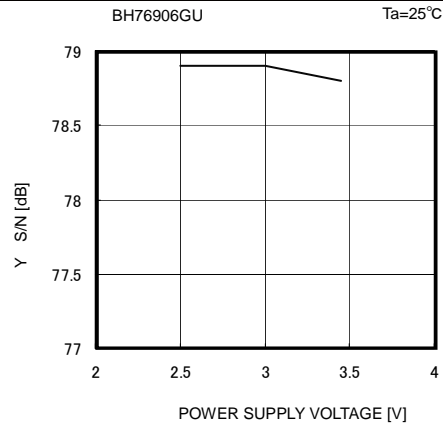


Fig. 47 Y S/N vs Supply Voltage

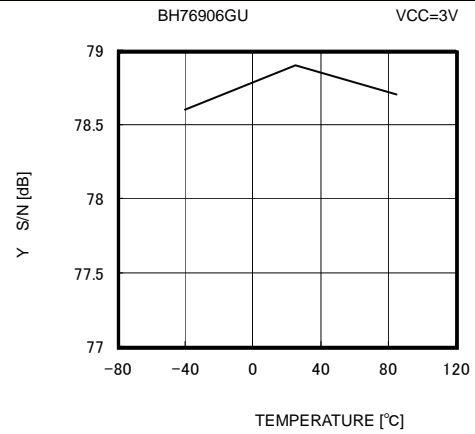


Fig.48 Y S/N vs Ambient Temperature

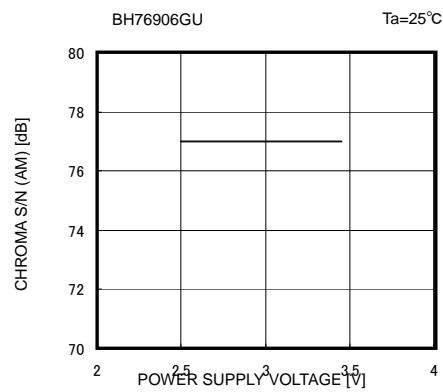


Fig. 49 C AM S/N vs Supply Voltage

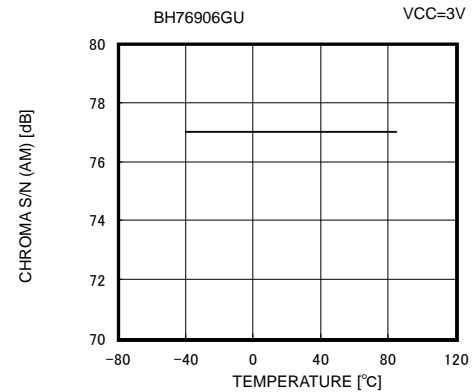


Fig. 50 C AM S/N vs Ambient Temperature

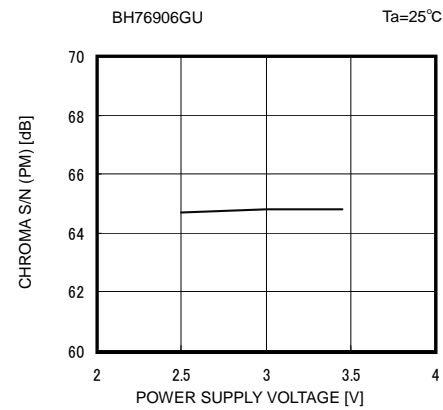


Fig. 51 C PM S/N vs Supply Voltage

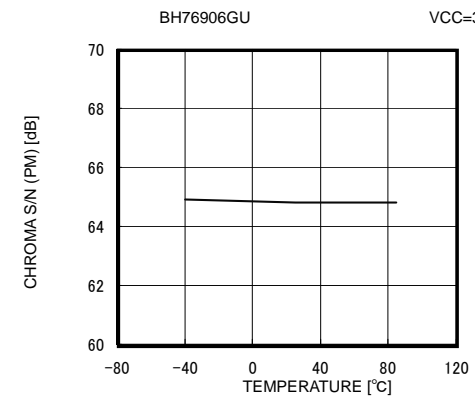


Fig. 52 C PM S/N vs Ambient Temperature

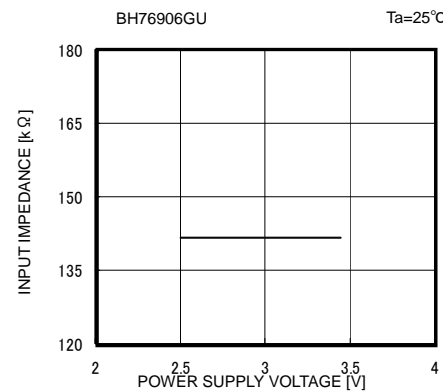


Fig. 53 Input Impedance vs Supply Voltage

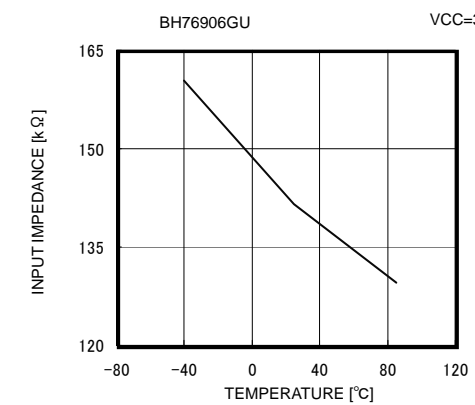


Fig. 54 Input Impedance vs Ambient Temperature

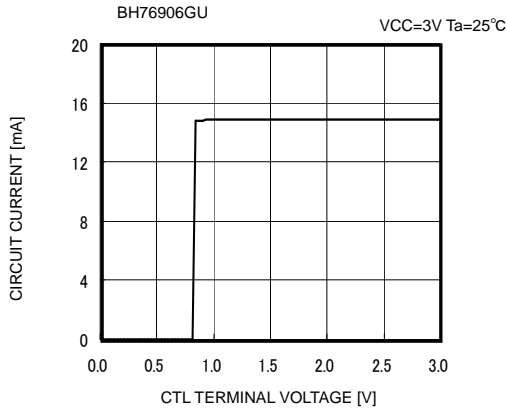


Fig. 55 Control Pin Characteristic

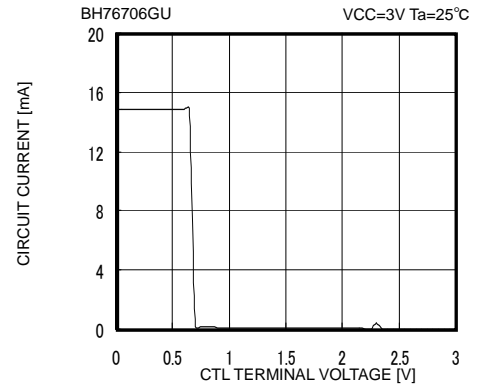


Fig. 56 Control Pin Characteristic

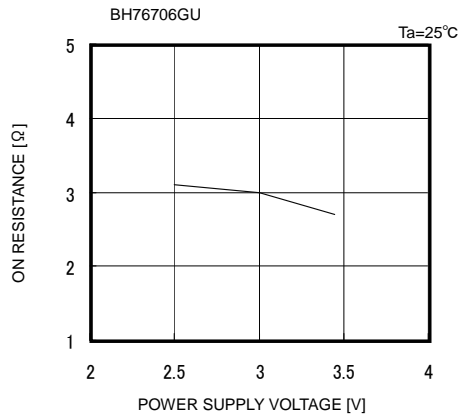


Fig. 57 Output Pin Shunt Switch On Resistance vs Supply Voltage

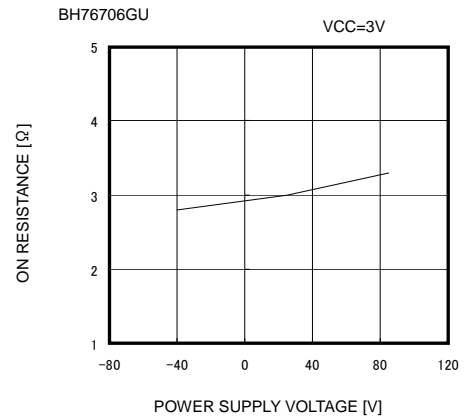


Fig. 58 Output Pin Shunt Switch On Resistance vs Ambient Temperature

● Performing separate electrostatic damage countermeasures

When adding an externally attached electrostatic countermeasure element to the output pin, connect a varistor in the position shown in Fig. 59 (if connected directly to the output pin, the IC could oscillate depending on the capacity of the varistor). For this IC, since the output waveform is GND-referenced and swings positive and negative, a normal Zener diode cannot be used.

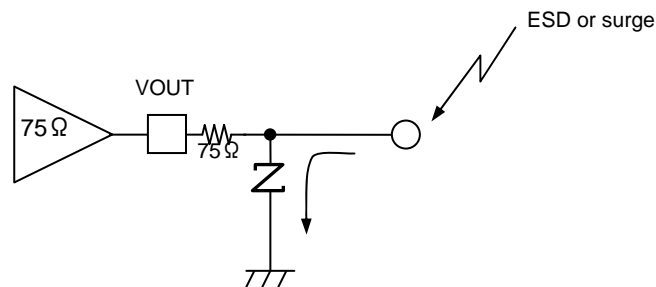


Fig.59 Using Externally Attached Varistor

●Selection of order type

B

H

7

6

9

0

6

G

U

—

E

2

Part. No.

BH76906GU  
BH76909GU  
BH76912GU  
BH76916GU  
BH76706GU

Tape and Reel information

VCSP85H1

<Dimension>

(Unit:mm)

|                   |   |
|-------------------|---|
| Tape              | Embossed carrier tape   |
| Quantity          | 3000pcs   |
| Direction of feed | E2<br>(The direction is the 1pin of product is at the upper left when you hold reel on the left hand and you pull out the tape on the right hand) |

Reel

1pin

Direction of feed

※When you order , please order in times the amount of package quantity.

# Notice

## Precaution on using ROHM Products

- Our Products are designed and manufactured for application in ordinary electronic equipments (such as AV equipment, OA equipment, telecommunication equipment, home electronic appliances, amusement equipment, etc.). If you intend to use our Products in devices requiring extremely high reliability (such as medical equipment <sup>(Note 1)</sup>, transport equipment, traffic equipment, aircraft/spacecraft, nuclear power controllers, fuel controllers, car equipment including car accessories, safety devices, etc.) and whose malfunction or failure may cause loss of human life, bodily injury or serious damage to property ("Specific Applications"), please consult with the ROHM sales representative in advance. Unless otherwise agreed in writing by ROHM in advance, ROHM shall not be in any way responsible or liable for any damages, expenses or losses incurred by you or third parties arising from the use of any ROHM's Products for Specific Applications.

(Note1) Medical Equipment Classification of the Specific Applications

| JAPAN     | USA       | EU         | CHINA     |
|-----------|-----------|------------|-----------|
| CLASS III | CLASS III | CLASS II b | CLASS III |
| CLASS IV  |           | CLASS III  |           |

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  - Installation of protection circuits or other protective devices to improve system safety
  - Installation of redundant circuits to reduce the impact of single or multiple circuit failure
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  - Use of our Products in any types of liquid, including water, oils, chemicals, and organic solvents
  - Use of our Products outdoors or in places where the Products are exposed to direct sunlight or dust
  - Use of our Products in places where the Products are exposed to sea wind or corrosive gases, including Cl<sub>2</sub>, H<sub>2</sub>S, NH<sub>3</sub>, SO<sub>2</sub>, and NO<sub>2</sub>
  - Use of our Products in places where the Products are exposed to static electricity or electromagnetic waves
  - Use of our Products in proximity to heat-producing components, plastic cords, or other flammable items
  - Sealing or coating our Products with resin or other coating materials
  - Use of our Products without cleaning residue of flux (even if you use no-clean type fluxes, cleaning residue of flux is recommended); or Washing our Products by using water or water-soluble cleaning agents for cleaning residue after soldering
  - Use of the Products in places subject to dew condensation
- The Products are not subject to radiation-proof design.
- Please verify and confirm characteristics of the final or mounted products in using the Products.
- In particular, if a transient load (a large amount of load applied in a short period of time, such as pulse. is applied, confirmation of performance characteristics after on-board mounting is strongly recommended. Avoid applying power exceeding normal rated power; exceeding the power rating under steady-state loading condition may negatively affect product performance and reliability.
- De-rate Power Dissipation (Pd) depending on Ambient temperature (Ta). When used in sealed area, confirm the actual ambient temperature.
- Confirm that operation temperature is within the specified range described in the product specification.
- ROHM shall not be in any way responsible or liable for failure induced under deviant condition from what is defined in this document.

## Precaution for Mounting / Circuit board design

- When a highly active halogenous (chlorine, bromine, etc.) flux is used, the residue of flux may negatively affect product performance and reliability.
- In principle, the reflow soldering method must be used; if flow soldering method is preferred, please consult with the ROHM representative in advance.

For details, please refer to ROHM Mounting specification

## Precautions Regarding Application Examples and External Circuits

1. If change is made to the constant of an external circuit, please allow a sufficient margin considering variations of the characteristics of the Products and external components, including transient characteristics, as well as static characteristics.
2. You agree that application notes, reference designs, and associated data and information contained in this document are presented only as guidance for Products use. Therefore, in case you use such information, you are solely responsible for it and you must exercise your own independent verification and judgment in the use of such information contained in this document. ROHM shall not be in any way responsible or liable for any damages, expenses or losses incurred by you or third parties arising from the use of such information.

## Precaution for Electrostatic

This Product is electrostatic sensitive product, which may be damaged due to electrostatic discharge. Please take proper caution in your manufacturing process and storage so that voltage exceeding the Products maximum rating will not be applied to Products. Please take special care under dry condition (e.g. Grounding of human body / equipment / solder iron, isolation from charged objects, setting of ionizer, friction prevention and temperature / humidity control).

## Precaution for Storage / Transportation

1. Product performance and soldered connections may deteriorate if the Products are stored in the places where:
  - [a] the Products are exposed to sea winds or corrosive gases, including Cl<sub>2</sub>, H<sub>2</sub>S, NH<sub>3</sub>, SO<sub>2</sub>, and NO<sub>2</sub>
  - [b] the temperature or humidity exceeds those recommended by ROHM
  - [c] the Products are exposed to direct sunshine or condensation
  - [d] the Products are exposed to high Electrostatic
2. Even under ROHM recommended storage condition, solderability of products out of recommended storage time period may be degraded. It is strongly recommended to confirm solderability before using Products of which storage time is exceeding the recommended storage time period.
3. Store / transport cartons in the correct direction, which is indicated on a carton with a symbol. Otherwise bent leads may occur due to excessive stress applied when dropping of a carton.
4. Use Products within the specified time after opening a humidity barrier bag. Baking is required before using Products of which storage time is exceeding the recommended storage time period.

## Precaution for Product Label

QR code printed on ROHM Products label is for ROHM's internal use only.

## Precaution for Disposition

When disposing Products please dispose them properly using an authorized industry waste company.

## Precaution for Foreign Exchange and Foreign Trade act

Since our Products might fall under controlled goods prescribed by the applicable foreign exchange and foreign trade act, please consult with ROHM representative in case of export.

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- Поставка сложных, дефицитных, либо снятых с производства позиций;
- Оперативные сроки поставки под заказ (от 5 рабочих дней);
- Экспресс доставка в любую точку России;
- Помощь Конструкторского Отдела и консультации квалифицированных инженеров;
- Техническая поддержка проекта, помощь в подборе аналогов, поставка прототипов;
- Поставка электронных компонентов под контролем ВП;
- Система менеджмента качества сертифицирована по Международному стандарту ISO 9001;
- При необходимости вся продукция военного и аэрокосмического назначения проходит испытания и сертификацию в лаборатории (по согласованию с заказчиком);
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ВЧ соединители, коаксиальные кабели,  
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