

D/A Converter Series for Electronic Adjustments

Standard 8bit

10ch-12ch Type D/A Converters

BH2223FV, BH2221FV



●Description

BH2223FV and BH2221FV are high performance 8bit R-2R-type D/A converters with 10 and 12 channels outputs, respectively. A built-in RESET function ensures that the output voltage at all channels is Low during power up. And a broad power supply voltage range (2.7V - 5.5V) provides design flexibility.

●Features

- 1) Built-in RESET function
- 2) High speed output response characteristics
- 3) 3-line serial interface
- 4) Broad power supply voltage range: 2.7V- 5.5V
to

●Applications

DVCs, DSCs, DVDs, CD-Rs, CD-RWs

●Lineup

| Parameter | BH2223FV | BH2221FV |
|----------------------------------|-------------|-------------|
| Power source voltage range | 2.7 to 5.5V | 2.7 to 5.5V |
| Number of channels | 10ch | 12ch |
| Current consumption | 1.6mA | 1.8mA |
| Differential non linearity error | ±1.0LSB | ±1.0LSB |
| Integral non linearity error | ±1.5LSB | ±1.5LSB |
| Output current performance | ±1.0mA | ±1.0mA |
| Settling time | 100µs | 100µs |
| Data transfer frequency | 10MHz | 10MHz |
| Input method | CMOS | CMOS |
| Data latch method | LD method | LD method |
| Package | SSOP-B16 | SSOP-B20 |

● Absolute Maximum Ratings (Ta=25°C)

| Parameter | Symbol | Limits | Unit | Remarks |
|---------------------------|--------|-------------|------|----------|
| Power source voltage | VCC | -0.3 to 7.0 | V | |
| Terminal voltage | VIN | -0.3 to VCC | V | |
| Storage temperature range | TSTG | -55 to 125 | °C | |
| Power dissipation | PD | 650*1 | mW | BH2221FV |
| | | 450*2 | mW | BH2223FV |

*1 Derated at 6.5mW/°C at Ta>25°C

*2 Derated at 4.5mW/°C at Ta>25°C

*3 These products are not robust against radiation

● Recommended Operating Conditions (Ta=25°C)

| Parameter | Symbol | Limits | | | Unit | Remarks |
|------------------------------|--------|--------|------|------|------|---------|
| | | MIN. | TYP. | MAX. | | |
| VCC power source voltage | VCC | 2.7 | - | 5.5 | V | - |
| VDD power source voltage | VDD | 2.7 | - | VCC | V | - |
| Terminal input voltage range | VIN | 0 | - | VCC | V | - |
| Analog output current | IO | -1.0 | 0 | 1.0 | mA | - |
| Action temperature range | TOPR | -20 | - | 85 | °C | - |
| Serial clock frequency | FSCLK | - | 1.0 | 10.0 | MHz | - |
| Limit load capacity | CL | - | - | 0.1 | µF | - |

● Electrical Characteristics (Unless otherwise specified, VCC=3.0V, VDD=3.0V, RL=OPEN, CL=0pF, Ta=25°C)

| Parameter | Symbol | Limits | | | Unit | Conditions |
|------------------------------------|--------|---------|------|--------|------|-------------------------|
| | | MIN. | TYP. | MAX. | | |
| <Current consumption> | | | | | | |
| VCC system | ICC | - | 0.6 | 1.5 | mA | CLK=1MHz, 80H setting |
| VDD system | IDD | - | 1.0 | 2.0 | mA | |
| <Logic interface> | | | | | | |
| L input voltage | VIL | GND | - | 0.2VCC | V | |
| H input voltage | VIH | 0.8VCC | - | VCC | V | |
| Input current | IIN | -10 | - | 10 | µA | |
| <Buffer amplifier> | | | | | | |
| Output zero scale voltage | ZS1 | GND | - | 0.1 | V | 00H setting, at no load |
| | ZS2 | GND | - | 0.3 | V | 00H setting, IOH=1.0mA |
| Output full scale voltage | FS1 | VCC-0.1 | - | VCC | V | FFH setting, at no load |
| | FS2 | VCC-0.3 | - | VCC | V | FFH setting, IOL=1.0mA |
| <D/A converter precision> | | | | | | |
| Differential non linearity error | DNL | -1.0 | - | 1.0 | LSB | Input code 02H to FDH |
| Integral non linearity error | INL | -1.5 | - | 1.5 | LSB | Input code 02H to FDH |
| VCC power source voltage rise time | trVCC | 100 | - | - | µs | VCC=0→2.7V |
| Power ON reset release voltage | VPOR | - | 1.9 | - | V | |

●Timing Chart (VCC = 3.0V, VDD = 3.0V, RL = OPEN, CL = 0pF, Ta = 25°C, unless otherwise specified.)

| Parameter | Symbol | Limits | | | Unit | Conditions |
|----------------------|--------|--------|------|------|------|------------------|
| | | MIN. | TYP. | MAX. | | |
| CLK L level time | tCLKL | 50 | - | - | ns | |
| CLK H level time | tCLKH | 50 | 0 | 0 | ns | |
| DI setup time | tsDI | 20 | - | - | ns | |
| DI hold time | thDI | 40 | - | - | ns | |
| LD setup time | tsLD | 50 | - | - | ns | |
| LD hold time | thLD | 50 | - | - | ns | |
| LD H level time | tLDH | 50 | - | - | ns | |
| Output settling time | tOUT | - | - | 100 | μs | CL=50pF, RL=10kΩ |

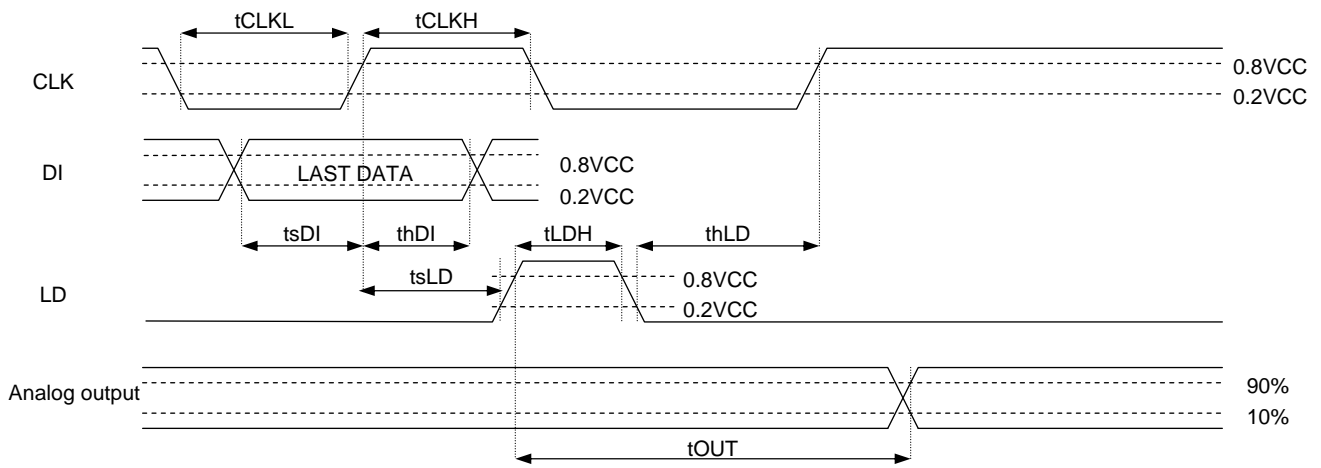


Fig.1

(BH2223FV)

| Terminal | Terminal | Function |
|----------|----------|-----------------------------|
| 1 | AO2 | Analog output terminal |
| 2 | AO3 | |
| 3 | AO4 | |
| 4 | AO5 | |
| 5 | AO6 | |
| 6 | AO7 | |
| 7 | AO8 | |
| 8 | AO9 | |
| 9 | VCC | Power source terminal |
| 10 | AO10 | Analog output terminal |
| 11 | NC | Not connected yet |
| 12 | LD | Serial data load input |
| 13 | CLK | Serial clock input terminal |
| 14 | DI | Serial data input terminal |
| 15 | AO1 | Analog output terminal |
| 16 | GND | Ground terminal |

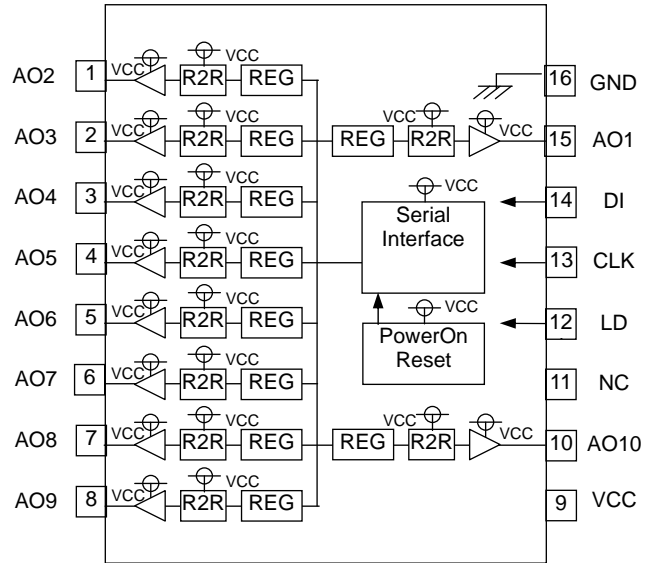


Fig.2

(BH2221FV)

| Terminal | Terminal | Function |
|----------|----------|--|
| 1 | NC | Not connected yet |
| 2 | AO3 | Analog output terminal |
| 3 | AO4 | |
| 4 | AO5 | |
| 5 | AO6 | |
| 6 | AO7 | |
| 7 | AO8 | |
| 8 | AO9 | |
| 9 | AO10 | |
| 10 | VDD | D/A converter standard power source terminal |
| 11 | VCC | Power source terminal |
| 12 | AO11 | Analog output terminal |
| 13 | AO12 | |
| 14 | NC | Not connected yet |
| 15 | LD | Serial data |
| 16 | CLK | Serial clock input terminal |
| 17 | DI | Serial data input terminal |
| 18 | AO1 | Analog output terminal |
| 19 | AO2 | |
| 20 | GND | Ground terminal |

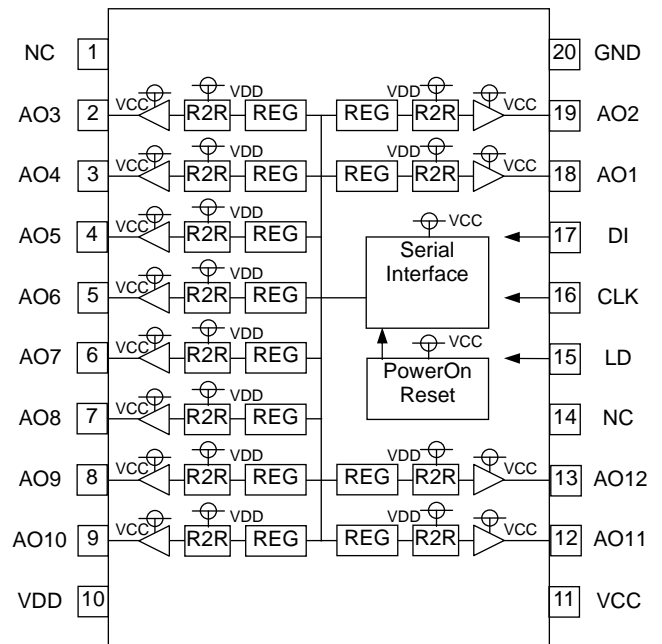


Fig.3

●Equivalent Circuit

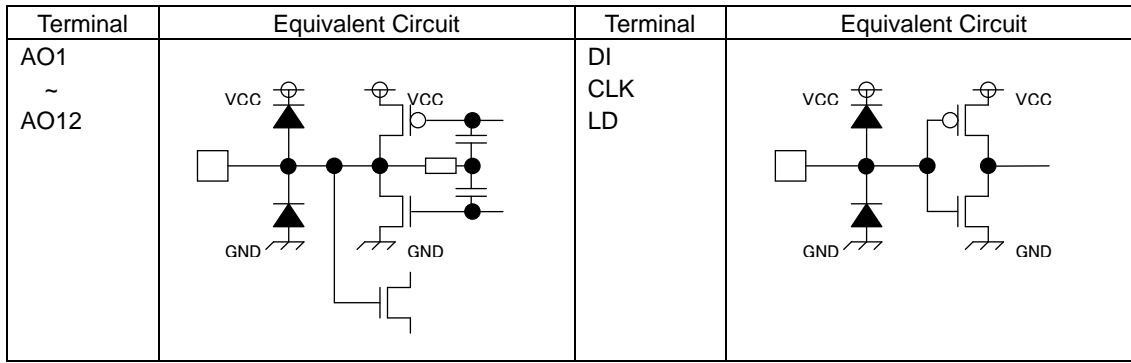


Fig.4 Equivalent Circuit

●Operation Description

Command Transmission

The Control command consists of 3 lines of 12bit serial input data (MSB first).

Data is read at the rising edge of the CLK, and output data is determined in LD High area and held in the LD Low area.

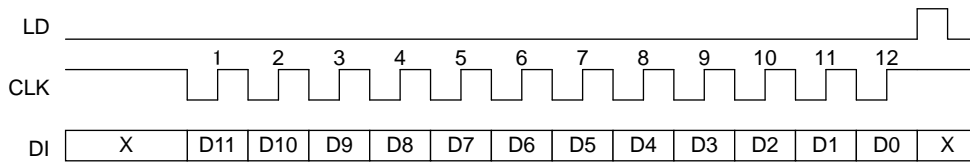


Fig.5

Data Settings

| D0 | D1 | D3 | D3 | D4 | D5 | D6 | D7 | Setting |
|----|----|----|----|----|----|----|----|--------------------------|
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | GND |
| 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (VCC or VDD-GND)/256x1 |
| 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | (VCC or VDD-GND)/256x2 |
| 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | (VCC or VDD-GND)/256x3 |
| 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | (VCC or VDD-GND)/256x4 |
| ~ | | | | | | | | ~ |
| 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | (VCC or VDD-GND)/256x254 |
| 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | (VCC or VDD-GND)/256x255 |

Channel Settings

| D8 | D9 | D10 | D11 | BH2223FV | BH2221FV |
|----|----|-----|-----|-----------------|-----------------|
| 0 | 0 | 0 | 0 | Inconsequential | Inconsequential |
| 0 | 0 | 0 | 1 | AO1 | AO1 |
| 0 | 0 | 1 | 0 | AO2 | AO2 |
| 0 | 0 | 1 | 1 | AO3 | AO3 |
| 0 | 1 | 0 | 0 | AO4 | AO4 |
| 0 | 1 | 0 | 1 | AO5 | AO5 |
| 0 | 1 | 1 | 0 | AO6 | AO6 |
| 0 | 1 | 1 | 1 | AO7 | AO7 |
| 1 | 0 | 0 | 0 | AO8 | AO8 |
| 1 | 0 | 0 | 1 | AO9 | AO9 |
| 1 | 0 | 1 | 0 | AO10 | AO10 |
| 1 | 0 | 1 | 1 | Inconsequential | AO11 |
| 1 | 1 | 0 | 0 | Inconsequential | AO12 |
| 1 | 1 | 0 | 1 | Inconsequential | Inconsequential |
| 1 | 1 | 1 | 0 | Inconsequential | Inconsequential |
| 1 | 1 | 1 | 1 | Inconsequential | Inconsequential |

● Electrical Characteristics Curves

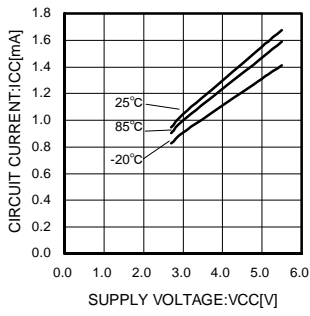


Fig.6 VCC system current consumption

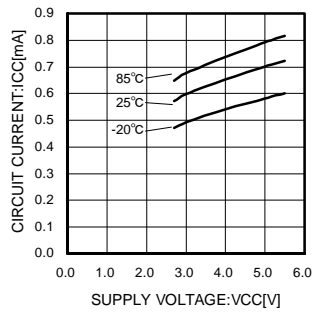


Fig.7 VDD system current consumption

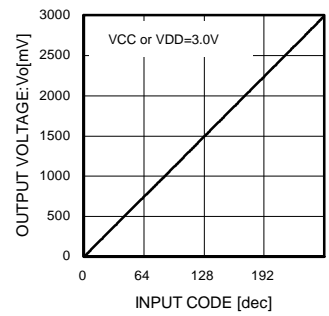


Fig.8 Output voltage characteristic

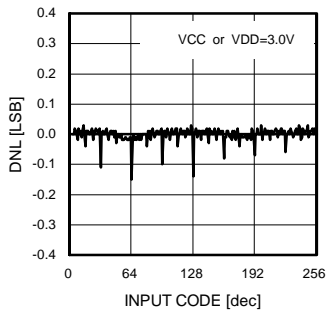


Fig.9 Differential non linearity error

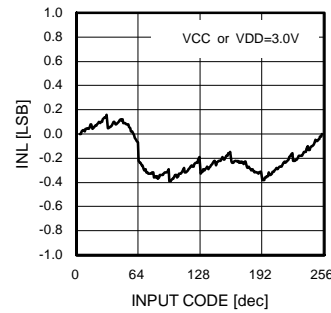


Fig.10 Integral non linearity error

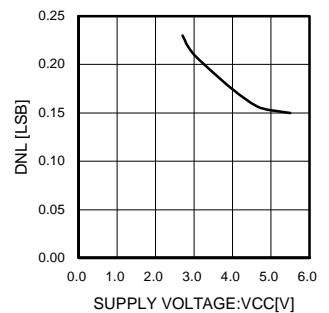


Fig.11 Power source voltage to differential non linearity error

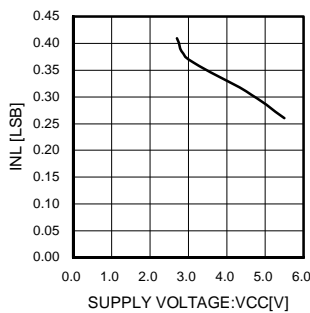


Fig.12 Power source voltage to integral non linearity error

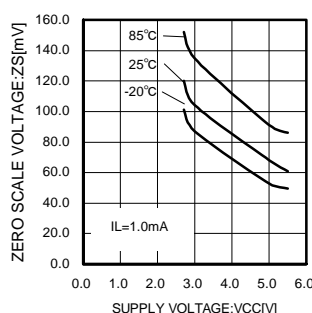


Fig.13 Output zero scale voltage

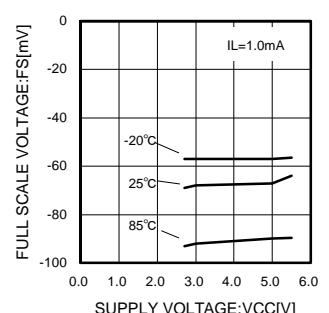


Fig.14 Output full scale voltage

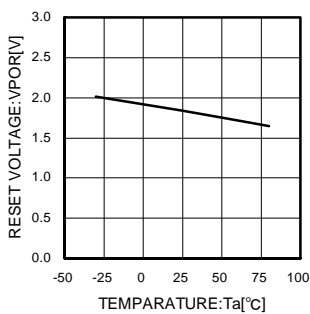


Fig.15 Reset release voltage

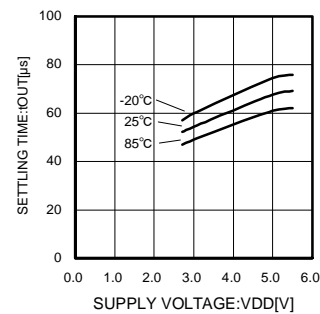


Fig.16 Settling time

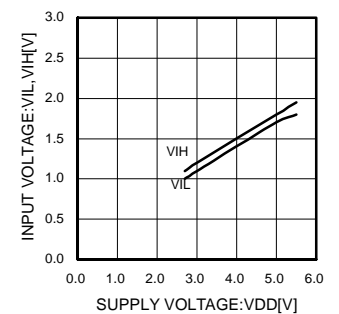


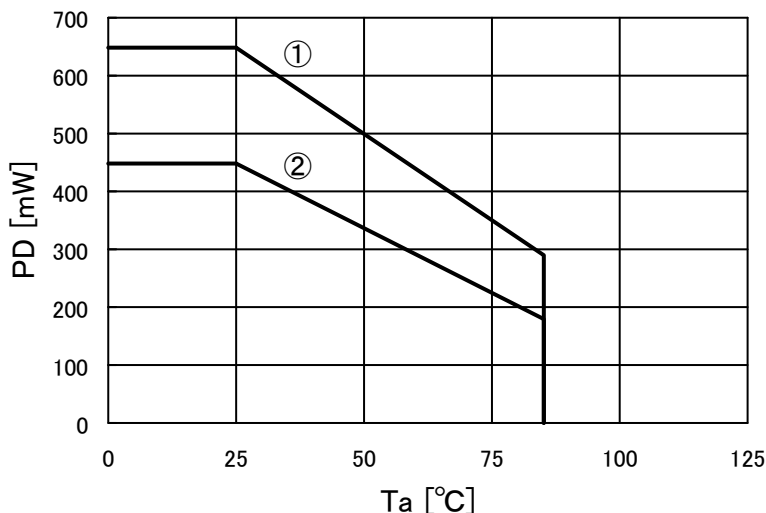
Fig.17 Input voltage

● Operation Notes

- (1) Numbers and data in entries are representative design values and are not guaranteed values of the items.
- (2) Although we are confident in recommending the sample application circuits, carefully check their characteristics further when using them. When modifying externally attached component constants before use, determine them so that they have sufficient margins by taking into account variations in externally attached components and the Rohm LSI, not only for static characteristics but also including transient characteristics.
- (3) Absolute maximum ratings
Operating or testing the device over the maximum specifications may damage the part itself as well as peripheral components. Therefore, please ensure that the specifications are not exceeded.
- (4) GND potential
Ensure that the GND terminal is at the lowest potential under all operating conditions.
- (5) Thermal design
Use a thermal design that allows for a sufficient margin regarding power dissipation (Pd) under actual operating conditions.
- (6) Terminal shorts and mis-mounting
Incorrect orientation or misalignment of the IC when mounting to the PCB may damage part. Short-circuits caused by the introduction of foreign matter between the output terminals or across the output and power supply or GND may also result in destruction.
- (7) Operation in a strong magnetic field
Operation in a strong electromagnetic field may cause malfunction.
- (8) Power source voltage
Set the power source voltage so that $VCC \geq VDD$.
- (9) Reset Function
The power on reset circuit, which initializes internal settings, may malfunction during abrupt power ons. Therefore, set the time constant so as to satisfy the power source rise time.

● Thermal Derating Curve

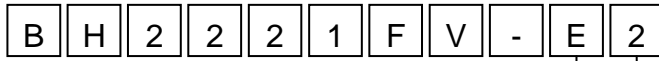
- ① SSOP-B20(BH2221FV)
- ② SSOP-B16(BH2223FV)



Mounted on a 70x70x1.6mm FR4 glass epoxy board (copper foil area 3% or below)

Fig.18

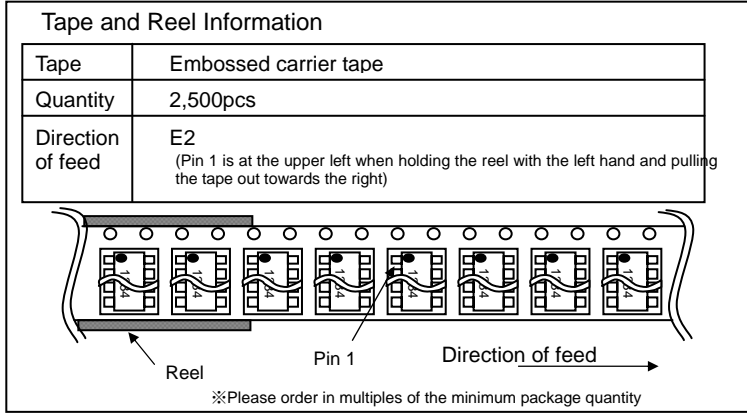
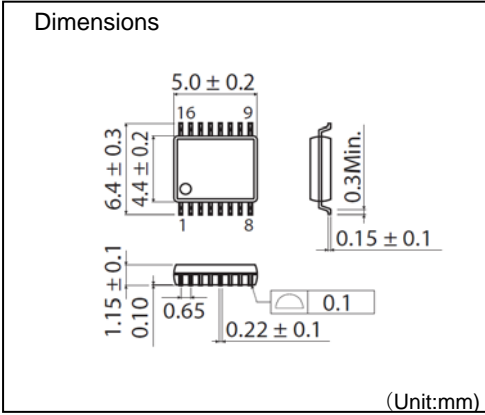
●Part Number Explanation



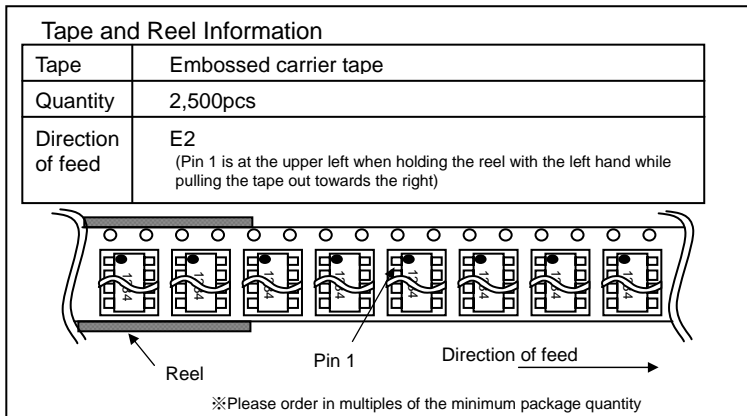
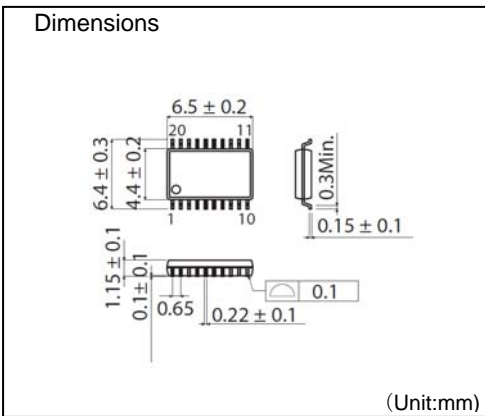
ROHM Part No.
BH2221FV
BH2223FV

Package and forming specification

SSOP-B16



SSOP-B20



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