

System Lens Driver Series for Mobile Phone Cameras

Parallel Interface Type Lens Drivers for Voice Coil Motor



BD6883GUL, BH6453GUL, BD6886GUL, BD6369GUL

No.12015EAT02

●Description

The BD6883GUL, and the BH6453GUL motor driver provide 1 Constant-Current Driver Half-bridge, and 1 Constant-Voltage Driver Half-bridge channel. The BD6886GUL, and the BD6369GUL motor driver provide 1 Constant-Voltage Driver H-bridge channel. These lens drivers are offered in an ultra-small functional lens system for use in an auto focus system using a Voice Coil motor.

●Features

1) BD6883GUL Characteristics

- 1) Ultra-small chip size package; 1.1mm × 1.6mm × 0.55mm
- 2) Low ON-Resistance Power CMOS output; on high side PMOS typ.0.65Ω, on low side NMOS typ.0.40Ω
- 3) ESD resistance (Human Body Model); 8kV
- 4) Built-in ±5% high-precision Constant-Voltage Driver (phase compensation capacitor-free design)
- 5) Built-in UVLO (Under Voltage Locked Out: UVLO)
- 6) Built-in TSD (Thermal Shut Down) circuit
- 7) Standby current consumption: 0μA Typ.

2) BH6453GUL Characteristics

- 1) Ultra-small chip size package; 1.5mm × 0.9mm × 0.55mm
- 2) Low ON-Resistance Power CMOS output; on high side PMOS typ.1.2Ω, on low side NMOS typ.0.4Ω
- 3) ESD resistance (Human Body Model); 8kV
- 4) Built in resistor for output current detect (phase compensation capacitor-free design)
- 5) 1.8V can be put into each control input terminal
- 6) Built-in UVLO (Under Voltage Locked Out: UVLO)
- 7) Built-in TSD (Thermal Shut Down) circuit
- 8) Standby current consumption: 0μA Typ.

3) BD6886GUL, BD6369GUL Characteristics

- 1) Ultra-small chip size package; 2.1mm × 2.1mm × 0.55mm
- 2) Low ON-Resistance Power CMOS output; on high and low sides in total typ.0.80Ω
- 3) ESD resistance (Human Body Model); 8kV
- 4) Built-in ±5% high-precision Constant-Voltage Driver (phase compensation capacitor-free design)
- 5) Control Input mode selection function
- 6) Built-in UVLO (Under Voltage Locked Out: UVLO)
- 7) Built-in TSD (Thermal Shut Down) circuit
- 8) Standby current consumption: 0μA Typ.

● Absolute Maximum Ratings (Ta=+25°C)

| Parameter | Symbol | Limit | | | | Unit |
|--|--------|----------------------------|----------------------------|----------------------------|----------------------------|------|
| | | BD6883GUL | BH6453GUL | BD6886GUL | BD6369GUL | |
| Power supply voltage | VCC | -0.5 to +6.5 | -0.5 to +4.5 | -0.5 to +6.5 | -0.5 to +6.5 | V |
| Motor power supply voltage | VM | - | - | -0.5 to +6.5 | -0.5 to +6.5 | V |
| Control input voltage | VIN | -0.5 to VCC+0.5 | -0.5 to VCC+0.5 | -0.5 to VCC+0.5 | -0.5 to VCC+0.5 | V |
| Input voltage for Constant-Voltage setting | VLIM | -0.5 to VCC+0.5 | - | -0.5 to VM+0.5 | -0.5 to VM+0.5 | V |
| Input voltage for Constant-Current setting | CLIM | - | -0.5 to VCC+0.5 | - | - | V |
| Power dissipation | Pd | 510 ^{*1} | 430 ^{*2} | 730 ^{*3} | 730 ^{*3} | mW |
| Operating temperature range | Topr | -25 to +85 | -25 to +85 | -25 to +85 | -25 to +85 | °C |
| Junction temperature | Tjmax | +150 | +125 | +150 | +150 | °C |
| Storage temperature range | Tstg | -55 to +150 | -55 to +125 | -55 to +150 | -55 to +150 | °C |
| H-bridge output current | Iout | -200 to +200 ^{*4} | -300 to +300 ^{*5} | -200 to +200 ^{*4} | -500 to +500 ^{*4} | mA |

^{*1} Reduced by 4.08mW/°C over 25°C, when mounted on a glass epoxy board (50mm × 58mm × 1.75mm; 8 layers).

^{*2} Reduced by 4.30mW/°C over 25°C, when mounted on a glass epoxy board (50mm × 58mm × 1.75mm; 8 layers).

^{*3} Reduced by 5.84mW/°C over 25°C, when mounted on a glass epoxy board (50mm × 58mm × 1.75mm; 8 layers).

^{*4} Must not exceed Pd, ASO, or Tjmax of 150°C.

^{*5} Must not exceed Pd, ASO, or Tjmax of 125°C.

● Operating Conditions

| Parameter | Symbol | Limit | | | | Unit |
|--|--------|----------------------------|----------------------------|----------------------------|----------------------------|------|
| | | BD6883GUL | BH6453GUL | BD6886GUL | BD6369GUL | |
| Power supply voltage | VCC | +2.5 to +5.5 | +2.3 to +3.6 | +2.5 to +5.5 | +2.5 to +5.5 | V |
| Motor power supply voltage | VM | - | - | +2.5 to +5.5 | +2.5 to +5.5 | V |
| Control input voltage | VIN | 0 to VCC | 0 to VCC | 0 to VCC | 0 to VCC | V |
| Input voltage for Constant-Voltage setting | VLIM | 0 to VCC | - | 0 to VM | 0 to VM | V |
| Input voltage for Constant-Current setting | CLIM | - | 0 to VCC | - | - | V |
| H-bridge output current | Iout | -150 to +150 ^{*6} | -200 to +200 ^{*6} | -150 to +150 ^{*6} | -400 to +400 ^{*6} | mA |

^{*6} Must not exceed Pd or ASO.

● Power Dissipation Reduction

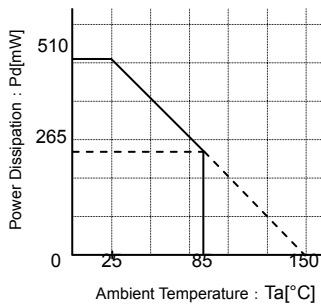


Fig.1 BD6883GUL Power Dissipation Reduction

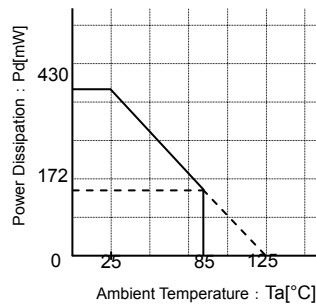


Fig.2 BH6453GUL Power Dissipation Reduction

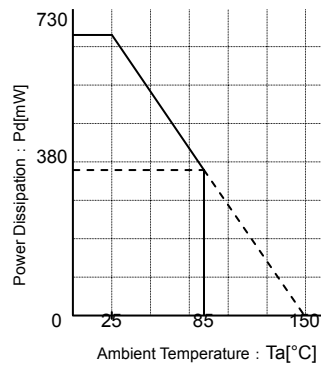


Fig.3 BD6886GUL Power Dissipation Reduction

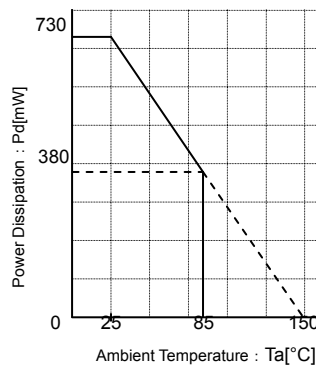


Fig.4 BD6369GUL Power Dissipation Reduction

●Electrical Characteristics

1) BD6883GUL Electrical Characteristics (Unless otherwise specified, Ta=25°C, VCC=3.0V)

| Parameter | Symbol | Limit | | | Unit | Conditions |
|--|--------|------------|------------|------------|------|--|
| | | Min | Typ | Max | | |
| Overall | | | | | | |
| Circuit current during standby operation | ICCST | - | 0 | 10 | μA | PS=0V |
| Circuit current | ICC | - | 0.9 | 1.4 | mA | PS=3V, VLIM=3V with no signal and load |
| Control input (VIN=IN, PS) | | | | | | |
| High level input voltage | VINH | 2.0 | - | VCC | V | |
| Low level input voltage | VINL | 0 | - | 0.7 | V | |
| High level input current | IINH | 15 | 30 | 60 | μA | VINH=3V, pull-down resistor typ.100kΩ |
| Low level input current | IINL | -1 | 0 | - | μA | VINL=0V |
| Input for Constant-Voltage setting | | | | | | |
| Input current | IVLIM | -1.5 | -0.5 | - | μA | VLIM=0V |
| UVLO | | | | | | |
| UVLO voltage | VUVLO | 1.6 | - | 2.4 | V | |
| Constant-Voltage Drive block | | | | | | |
| PMOS Output ON-Resistance | RONP | - | 0.65 | 0.80 | Ω | Io=-150mA |
| NMOS Output ON-Resistance | RONN | - | 0.40 | 0.60 | Ω | Io=+150mA |
| Output high-level voltage | VOH | 1.9 × VLIM | 2.0 × VLIM | 2.1 × VLIM | V | VLIM=1V with 10Ω load |
| Output AC characteristic | | | | | | |
| Turn-on time | ton | - | 1.5 | 5 | μs | Io=-150mA, 10Ω load |
| Turn-off time | toff | - | 0.1 | 2 | μs | Io=-150mA, 10Ω load |
| Rise time | tr | - | 1.5 | 8 | μs | Io=-150mA, 10Ω load |
| Fall time | tf | - | 0.05 | 1 | μs | Io=-150mA, 10Ω load |

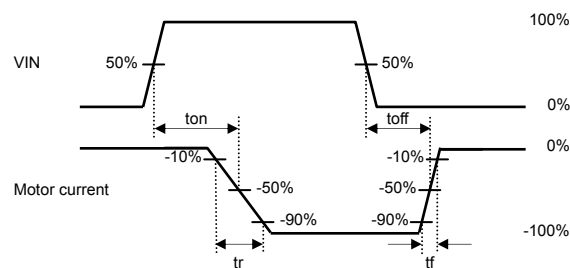


Fig.5 BD6883GUL I/O Switching Waveform
(The direction flowing into IC is plus)

2) BH6453GUL Electrical Characteristics (Unless otherwise specified, Ta=25°C, VCC=3.0V)

| Parameter | Symbol | Limit | | | Unit | Conditions |
|--|--------|-------|------|------|------|---|
| | | Min | Typ | Max | | |
| Overall | | | | | | |
| Circuit current during standby operation | ICCST | - | 0 | 5 | μA | PS=0V |
| Circuit current | ICC | - | 0.9 | 1.3 | mA | PS=3V, IN=3V, no load |
| Control input (VIN=IN, PS) | | | | | | |
| High-level input voltage | VINH | 1.5 | - | VCC | V | |
| Low-level input voltage | VINL | 0 | - | 0.5 | V | |
| High-level input current | IINH | 15 | 30 | 60 | μA | VINH=3V, pull down resistance typ.100kΩ |
| Low-level input current | IINL | -1 | 0 | - | μA | VINL=0V |
| UVLO | | | | | | |
| UVLO voltage | VUVLO | 1.6 | - | 2.2 | V | |
| Constant-Current Drive block | | | | | | |
| PMOS Output ON-Resistance | RONP | - | 1.2 | 1.5 | Ω | Io=-200mA |
| NMOS Output ON-Resistance | RONN | - | 0.35 | 0.50 | Ω | Io=+200mA |
| Offset current | Iofs | 0 | 1 | 5 | mA | CLIM=0V |
| Output current | Iout | 180 | 200 | 220 | mA | CLIM=0.8V, RL=10Ω |

Drive system of Constant-Current

$$I_{\text{SINK}}[\text{A}] = \frac{\text{CLIM}[\text{V}]}{2 \times 2.0(\text{Typ.})[\Omega]}$$

$\left\{ \begin{array}{l} I_{\text{SINK}}: \text{VCC-OUT current} \\ \text{CLIM}: \text{VCC-OUT current setting voltage} \\ R_{\text{RNF}}: \text{VCC-OUT current detection resistance} \end{array} \right.$

3) BD6886GUL, BD6369GUL Electrical Characteristics (Unless otherwise specified, Ta=25°C, VCC=3.0V, VM=5.0V)

| Parameter | Symbol | Limit | | | Unit | Conditions |
|--|--------|------------|------------|------------|------|--|
| | | Min | Typ | Max | | |
| Overall | | | | | | |
| Circuit current during standby operation | ICCST | - | 0 | 10 | μA | PS=0V |
| Circuit current 1 | ICC | - | 0.9 | 1.4 | mA | PS=3V, with no signal |
| Circuit current 2 | IM | - | 0.4 | 0.65 | mA | PS=3V, VLIM=5V, no load |
| Control input (VIN=INA, INB, SEL, PS) | | | | | | |
| High-level input voltage | VINH | 2.0 | - | VCC | V | |
| Low-level input voltage | VINL | 0 | - | 0.7 | V | |
| High-level input current | IINH | 15 | 30 | 60 | μA | VINH=3V |
| Low-level input current | IINL | -1 | 0 | - | μA | VINL=0V |
| Pull-down resistor | RIN | 50 | 100 | 200 | kΩ | |
| Input for Constant-Voltage setting | | | | | | |
| Input current | IVLIM | -1.5 | -0.5 | - | μA | VLIM=0V |
| UVLO | | | | | | |
| UVLO voltage | VUVLO | 1.6 | - | 2.4 | V | |
| Constant-Voltage Drive block | | | | | | |
| Output ON-Resistance | RON | - | 0.80 | 1.20 | Ω | Io= ± 150mA on high and low sides in total |
| Output high-level voltage | VOH | 1.9 × VLIM | 2.0 × VLIM | 2.1 × VLIM | V | VLIM=1V with 10Ω load |
| Output AC characteristic | | | | | | |
| Turn-on time | ton | - | 1.5 | 5 | μs | Io= ± 150mA with 10Ω load |
| Turn-off time | toff | - | 0.1 | 2 | μs | Io= ± 150mA with 10Ω load |
| Rise time | tr | - | 2 | 8 | μs | Io= ± 150mA with 10Ω load |
| Fall time | tf | - | 0.05 | 1 | μs | Io= ± 150mA with 10Ω load |

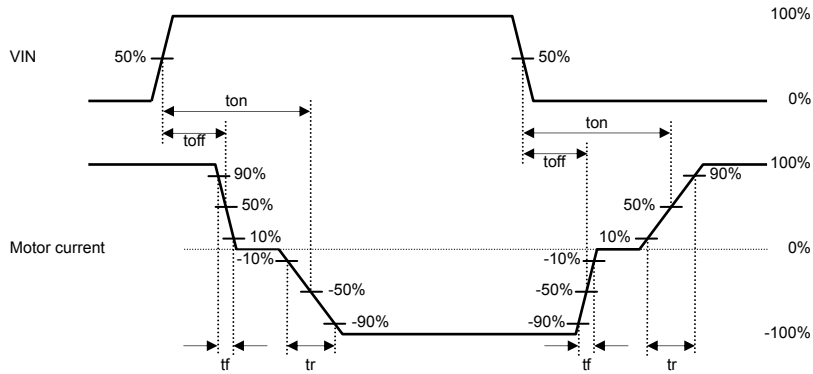


Fig.6 BD6886GUL, BD6369GUL I/O Switching Waveform

●Electrical Characteristic Diagrams

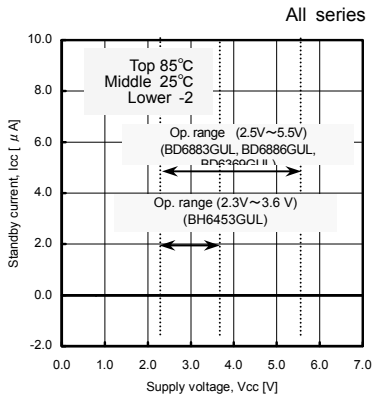


Fig.7 Standby Current (All series)

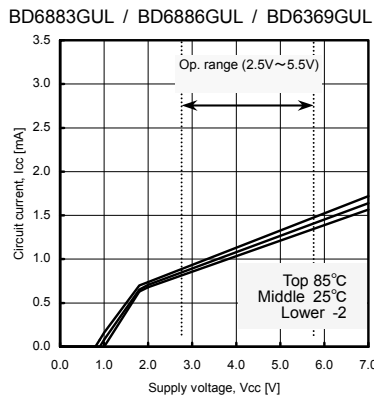


Fig.8 Circuit Current (BD6883GUL/BD6886GUL/BD6369GUL)

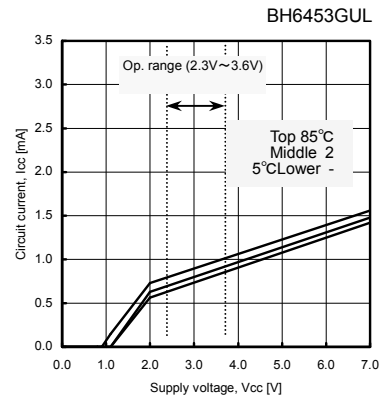


Fig.9 Circuit Current (BH6453GUL)

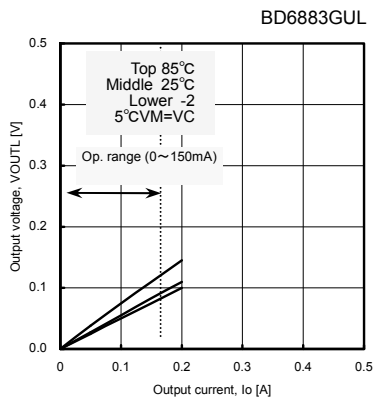


Fig.10 NMOS Output Voltage (BD6883GUL)

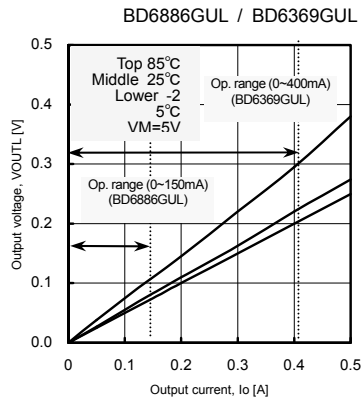


Fig.11 NMOS Output Voltage (BD6886GUL / BD6369GUL)

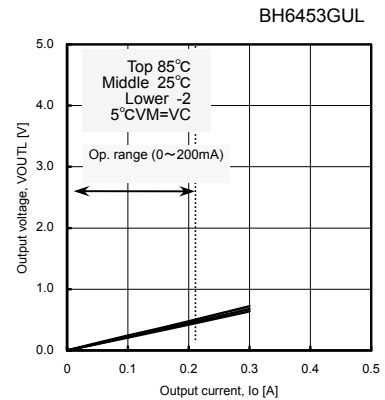


Fig.12 NMOS Output Voltage (BH6453GUL)

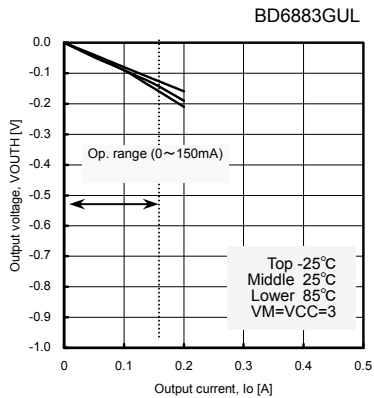


Fig.13 PMOS Output Voltage (BD6883GUL)

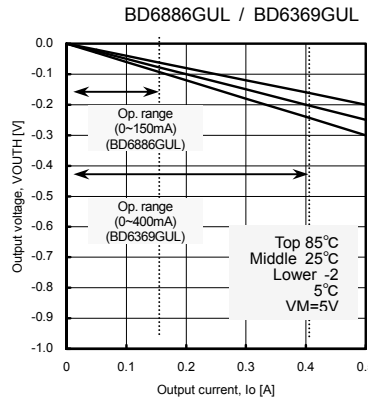


Fig.14 PMOS Output Voltage (BD6886GUL / BD6369GUL)

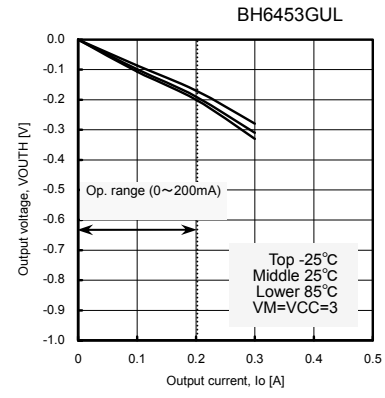


Fig.15 PMOS Output Voltage (BH6453GUL)

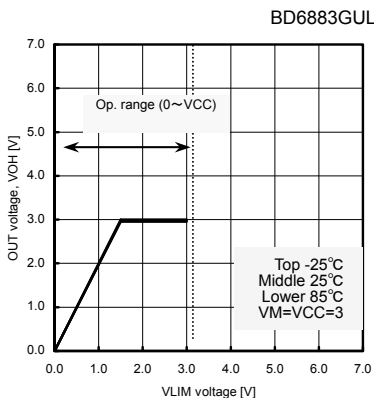


Fig.16 Output High-Level Voltage (BD6883GUL)

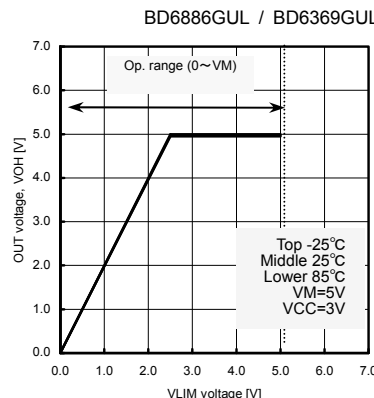


Fig.17 Output High-Level Voltage (BD6886GUL / BD6369GUL)

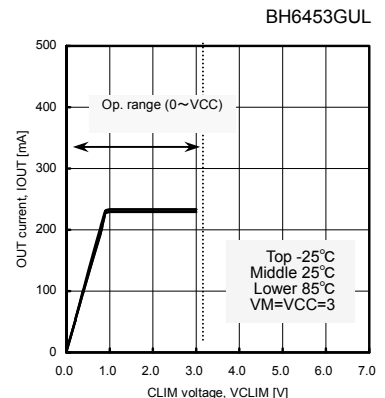


Fig.18 Current Limit Output Voltage (BH6453GUL)

● Block Diagram, Application Circuit Diagram, Pin Arrangement, Pin Function Table

1) BD6883GUL Block Diagram, Application Circuit Diagram, Pin Arrangement, Pin Function Table

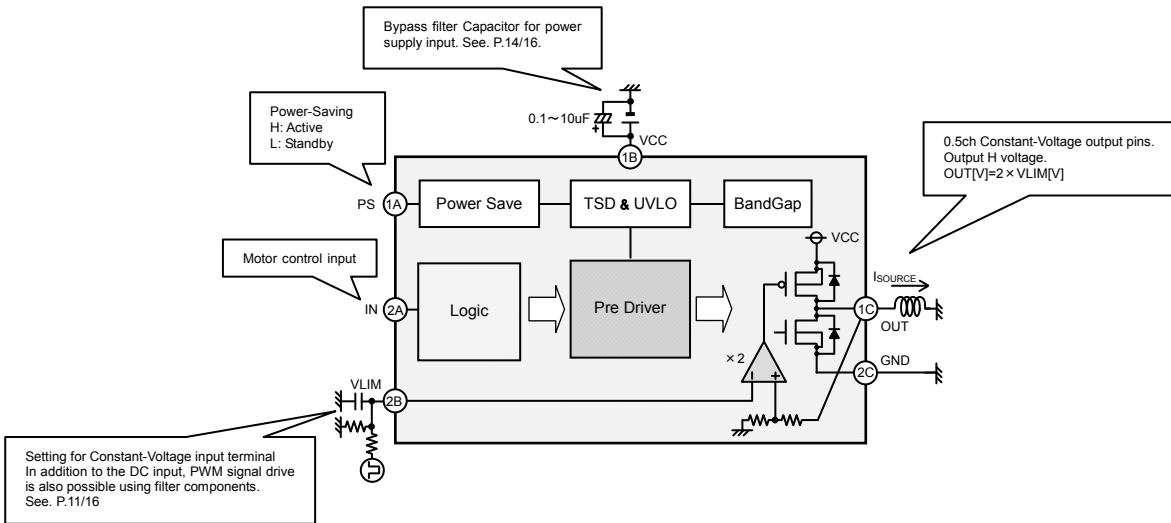


Fig.19 BD6883GUL Block Diagram, Application Circuit Diagram

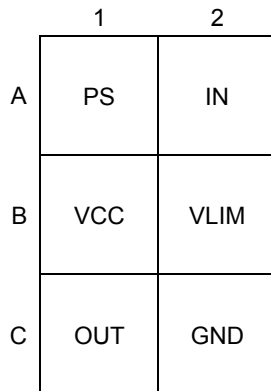


Fig.20 BD6883GUL Pin Arrangement (Top View)

BD6883GUL Pin Function Table

| No. | Pin Name | Function | No. | Pin Name | Function |
|-----|----------|-------------------|-----|----------|---------------------------------------|
| 1A | PS | Power-saving pin | 2B | VLIM | Output high-level voltage setting pin |
| 2A | IN | Control input pin | 1C | OUT | Half-bridge output pin |
| 1B | VCC | Power supply pin | 2C | GND | Ground pin |

2) BH6453GUL Block Diagram, Application Circuit Diagram, Pin Arrangement, Pin Function Table

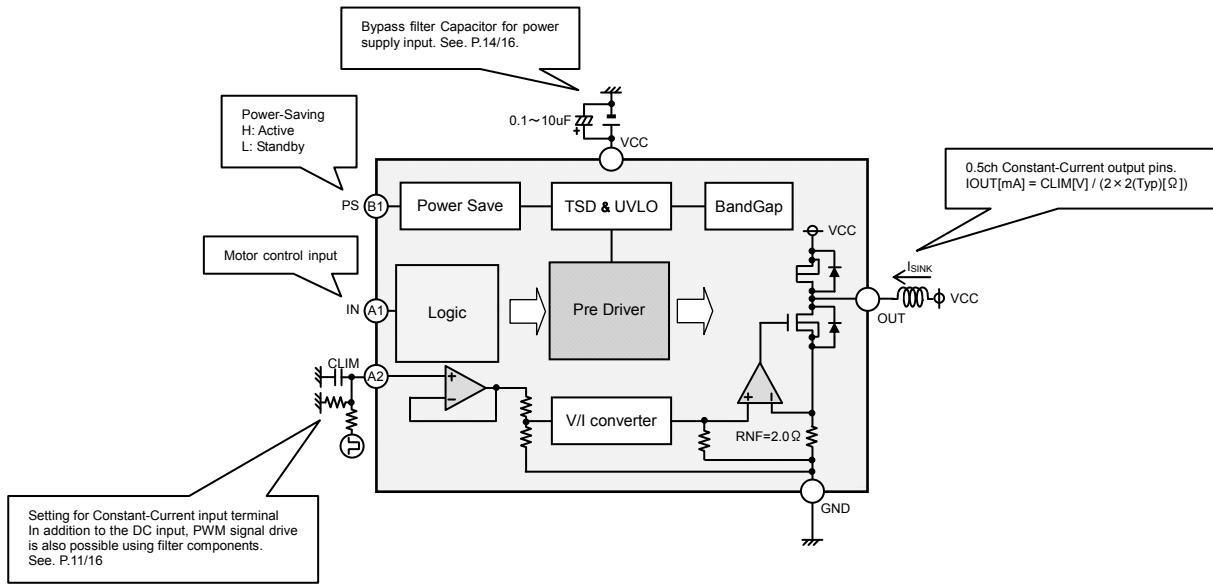


Fig.21 BH6453GUL Block Diagram, Application Circuit Diagram

| | | | |
|---|----|------|-----|
| | 1 | 2 | 3 |
| A | IN | CLIM | GND |
| B | PS | VCC | OUT |

Fig.22 BH6453GUL Pin Arrangement (Top View)

BH6453GUL Pin Function Table

| No. | Pin Name | Function | No. | Pin Name | Function |
|-----|----------|----------------------------|-----|----------|------------------------|
| 1A | IN | Control input pin | 1B | PS | Power-saving pin |
| 2A | CLIM | Output current setting pin | 2B | VCC | Power supply pin |
| 3A | GND | Ground pin | 3B | OUT | Half-bridge output pin |

3) BD6886GUL, BD6369GUL Block Diagram, Application Circuit Diagram, Pin Arrangement, Pin Function Table

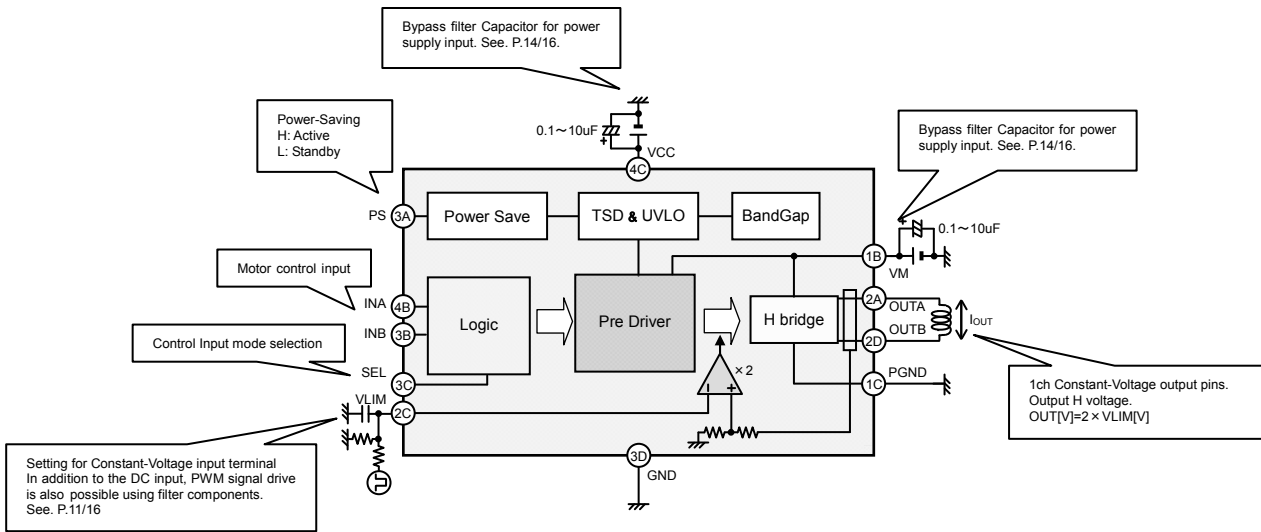


Fig.23 BD6886GUL, BD6369GUL Block Diagram, Application Circuit Diagram

| | | | | |
|---|------|------------|-----|------|
| | 1 | 2 | 3 | 4 |
| A | N.C. | OUTA | PS | N.C. |
| B | VM | INDEX POST | INB | INA |
| C | PGND | VLIM | SEL | VCC |
| D | N.C. | OUTB | GND | N.C. |

Fig.24 BD6886GUL, BD6369GUL Pin Arrangement (Top View)

BD6886GUL, BD6369GUL Pin Function Table

| No. | Pin Name | Function | No. | Pin Name | Function |
|-----|----------|------------------------|-----|----------|---------------------------------------|
| 1A | N.C. | N.C. | 1C | PGND | Motor ground pin |
| 2A | OUTA | H-bridge output pin A | 2C | VLIM | Output high-level voltage setting pin |
| 3A | PS | Power-saving pin | 3C | SEL | Control input mode selection pin |
| 4A | N.C. | N.C. | 4C | VCC | Power supply pin |
| 1B | VM | Motor power supply pin | 1D | N.C. | N.C. |
| 2B | | | 2D | OUTB | H-bridge output pin B |
| 3B | INB | Control input pin B | 3D | GND | Ground pin |
| 4B | INA | Control input pin A | 4D | N.C. | N.C. |

●Function Explanation

1) Power-saving function (all series)

When the L voltage is applied the PS pin, the IC's inside circuit stop, and when 0V applied, the circuit current became 0μA(Typ.), especially.

When the IC drive, serial input while the PS pin applied H voltage. (See the electrical characteristics; P.3, 4, 5/16)

2) Control Input Pin

(I) IN pin (BD6883GUL, BH6453GUL)

The IN pin is used to program and control the motor drive modes.

(See the electrical characteristics; P.3, 4/16, and the I/O Truth Table; P12/16)

(II) INA, INB, SEL pins (BD6886GUL, BD6369GUL)

The INA and INB are used to program and control the motor drive modes.

When the L voltage is applied to the SEL pin, the I/O logic can be set to EN (Enable)/IN mode, and when the H voltage is applied to the one, the I/O logic can be set to IN/IN mode. (See the electrical characteristics; P5/16, and the I/O Truth Table; P12/16)

3) H-bridge and Half-bridge on the output stage (ALL series)

Specify maximum current applied to the H-bridge and Half-bridge within the operating range, in consideration of power dissipation. (See the Operating Conditions; P.2/16)

4) Drive system of Linear Constant-Voltage H-bridge (BD6883GUL, BD6886GUL, and BD6369GUL)

To set up the output H voltage, when the voltage input to the VLIM pin, the output H voltage is two times as high as the voltage.

(I) BD6883GUL
The output H voltage $VOH [V] = 2.0 \times VLIM [V]$ (When $VLIM [V] > \frac{VCC [V]}{2}$, Output H voltage is about VCC voltage)①

(II) BD6886GUL, BD6369GUL
The output H voltage $VOH [V] = 2.0 \times VLIM [V]$ (When $VLIM [V] > \frac{VM [V]}{2}$, Output H voltage is about VM voltage)②

For example, the output voltage is $2.0V \pm 5\%$, if 1.0V is applied to the VLIM pin.

If the VLIM pin is shorted to the VM pin (or the same voltage level as the VM is applied), you can be used as a Full-ON Drive H-bridge.

5) Drive system of Linear Constant-Current H-bridge (BH6453GUL)

To detect the output current and the output current settings

The BH6453GUL built in resistor for output current detect. The output current is kept constant by comparing it with the CLIM voltage. In addition, impress a highly accurate voltage form the outside of IC to the CLIM terminal, when you do the output current setting accuracy or more good.

$$\text{Output current } I_{\text{SINK}} [A] = \frac{\text{CLIM [V]}}{2 \times 2(\text{Typ}) [\Omega]} \quad \dots\dots\textcircled{3}$$

If the CLIM pin applied 0.8V, Output current is 200mA $\pm 10\%$.

7) Setting of PWM signal input VLIM and CLIM terminals (all series)

It is also possible to compose filters outside the IC, change an input voltage for output voltage and output current setting terminals such as VLIM and CLIM terminals by the DUTY control using a PWM signal, etc., and use them as set values for control. In this case, however, ensure the smoothing of the signals, heeding the constant number of the low-pass filter as stated below. A cutoff frequency F_C (-3dB attenuation frequency) of the low-pass filter in Fig25 is calculated by the formula mentioned below.

$$\text{Cutoff frequency } F_C [\text{Hz}] = \frac{1}{2\pi C_{IN} (R_{INA} // R_{INB})} [\text{Hz}] \quad \dots\dots ④$$

Set the cutoff frequency F_C at 1/100 or below of the PWM frequency F_{PWM} .

For example, if the cutoff frequency F_C is set at 1/100 of F_{PWM} when the PWM frequency $F_{PWM}=50[\text{kHz}]$, according to the formula above:

$$\text{Cutoff frequency } F_C [\text{Hz}] = \frac{1}{2\pi C_{IN} (R_{INA} // R_{INB})} = \frac{1}{100} \times F_{PWM} = \frac{50 \times 10^3}{100} [\text{Hz}] \quad \dots\dots ⑤$$

When $C_{IN}=0.1[\mu\text{F}]$, according to the formula above:

$$R_{INA} // R_{INB} = 3.2[\text{k}\Omega] \quad \dots\dots ⑥$$

Where, an effective value of PWM signal as a DC current, according to crest values V_{MAX} and ON DUTY [%] = $\frac{\text{ON time}}{\text{ON time} + \text{OFF time}}$ is as follows:

$$V_{PWM} [\text{V}] = V_{MAX} [\text{V}] \times \text{ON DUTY} [\%] \quad \dots\dots ⑦$$

An actual voltage V_{LIM} input to terminals that specify output current and voltages, such as VLIM and CLIM terminals is as follows according to resistance potential division of R_{INA} and R_{INB} :

$$V_{LIM} [\text{V}] = \frac{R_{INB}}{R_{INA} + R_{INB}} \times V_{PWM} [\text{V}] \quad \dots\dots ⑧$$

For example, when an PWM signal with crest values $V_{MAX}=3[\text{V}]$ and DUTY [%]=5[%] is input, a V_{LIM} value according to the formula above is:

$$V_{LIM} [\text{V}] = \frac{R_{INB}}{R_{INA} + R_{INB}} \times 3[\text{V}] \times 50[\%] \quad \dots\dots ⑨$$

(I) BD6883GUL, BD6886GUL, and BD6369GUL

Where, to specify an output voltage $VOH=2[\text{V}]$, a value $VLIM=1.0[\text{V}]$ according to the formula in the previous page. And then, according to the formula above, $VLIM=1.0[\text{V}]$.

$$VLIM=1.0[\text{V}] = V_{LIM} = \frac{R_{INB}}{R_{INA} + R_{INB}} \times 3[\text{V}] \times 50[\%]$$

Therefore, $R_{INA}=0.5R_{INB}$

⑩

According to ⑥ and ⑩, $R_{INA}=4.8\text{k}\Omega$, $R_{INB}=9.6\text{k}\Omega$.

(II) BH6453GUL

Where, to specify an output current $I_{SINK}=100[\text{mA}]$, the following formula is derived according to the formula in the previous page ③, $CLIM=0.4[\text{V}]$, and according to the formula above ⑨:

$$CLIM=0.4[\text{V}] = V_{LIM} = \frac{R_{INB}}{R_{INA} + R_{INB}} \times 3[\text{V}] \times 50[\%]$$

$$R_{INA} = 2.75R_{INB} \quad \dots\dots ⑪$$

According to ⑥ and ⑪: $R_{INA}=11.9\text{k}\Omega$, $R_{INB}=4.3\text{k}\Omega$

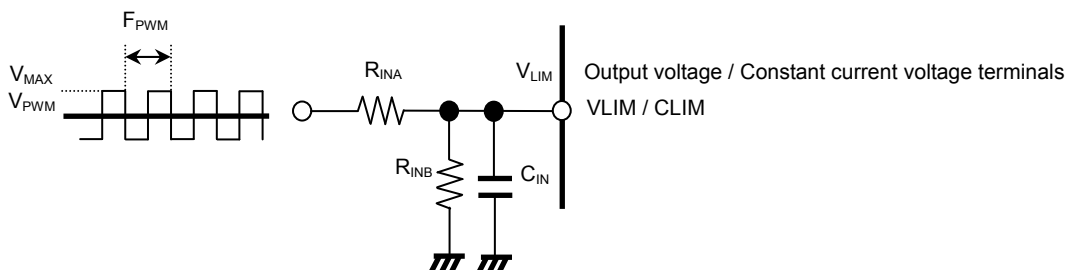


Fig.25 Example PWM signal input

● I/O Truth Table

BD6883GUL I/O Truth Table

| MODE | INPUT | | OUTPUT | OUTPUT MODE |
|------|-------|----|-----------------|-------------|
| | PS | IN | OUT | |
| - | H | L | L | Sink |
| | | H | H | Source |
| - | L | X | Z ^{*7} | Standby |

L: Low, H: High, X: Don't care, Z: Hi impedance

Sink is a direction of current flowing into the driver, and Source is a direction of current flowing out the driver.

When it is sink, which drive FULL ON.

*⁷Z at the Constant-Voltage driver output L voltage for connect feedback resistance (20kΩ Typ.) for output H voltage setting between OUT pin and GND.
But output Power MOS is OFF condition.

BH6453GUL I/O Truth Table

| MODE | INPUT | | OUTPUT | OUTPUT MODE |
|------|-------|----|--------|-------------|
| | PS | IN | OUT | |
| - | H | H | L | Sink |
| | | L | H | Source |
| - | L | X | Z | Standby |

L: Low, H: High, X: Don't care, Z: Hi impedance

Sink is a direction of current flowing into the driver, and Source is a direction of current flowing out the driver.

When it is source, which drive FULL ON.

BD6886GUL, BD6369GUL I/O Truth Table

| MODE | INPUT | | | | OUTPUT | | OUTPUT MODE | |
|-------|-------|-----|-----|-----|-----------------|-----------------|------------------|------------------|
| | PS | SEL | INA | INB | OUTA | OUTB | | |
| EN/IN | H | L | L | X | Z ^{*7} | Z ^{*7} | Standby | |
| | | | H | L | H | L | Forward rotation | |
| | | | H | H | L | H | Reverse rotation | |
| IN/IN | | H | H | L | L | L | L | Brake |
| | | | | L | H | L | H | Reverse rotation |
| | | | | H | L | H | L | Forward rotation |
| - | L | X | H | H | Z ^{*8} | Z ^{*8} | Standby | |
| | | | X | X | Z ^{*8} | Z ^{*8} | Standby | |

L: Low, H: High, X: Don't care, Z: Hi impedance

At forward rotation, current flows from OUTA to OUTB. At reverse rotation, current flows from OUTB to OUTA.

*⁸Z at the Constant-Voltage driver output L voltage for connect feedback resistance (20kΩ Typ.) for output H voltage setting between OUT pin and GND.
But output Power MOS is OFF condition.

● I/O Circuit Diagram

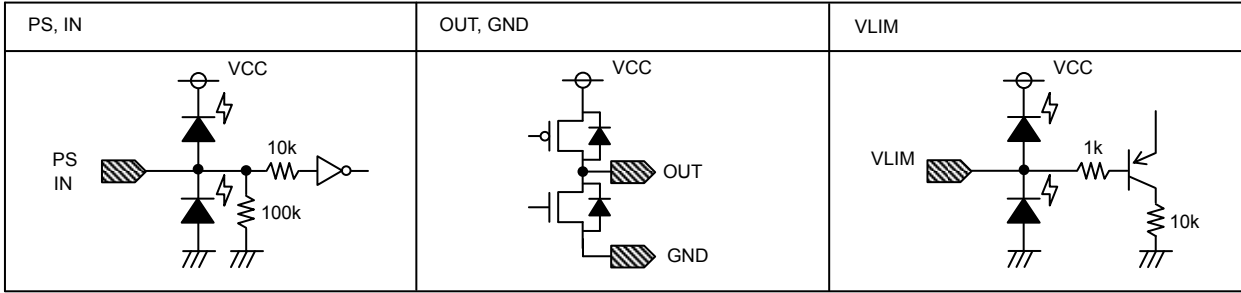


Fig.26 BD6883GUL I/O Circuit Diagram (Resistance values are typical ones.)

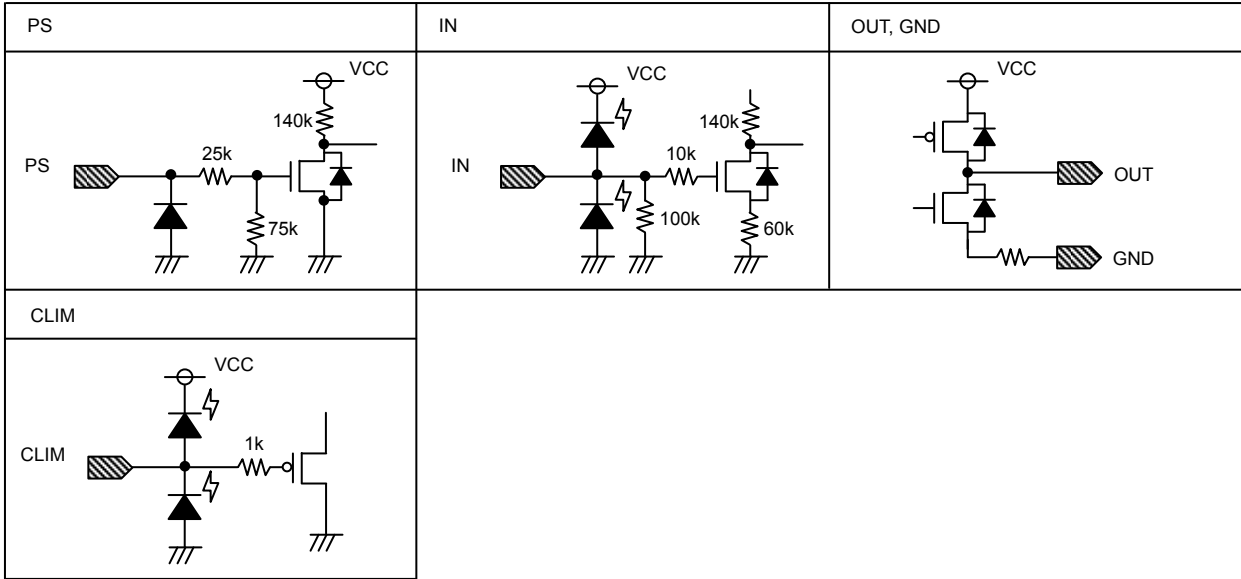


Fig.27 BH6453GUL I/O Circuit Diagram (Resistance values are typical ones.)

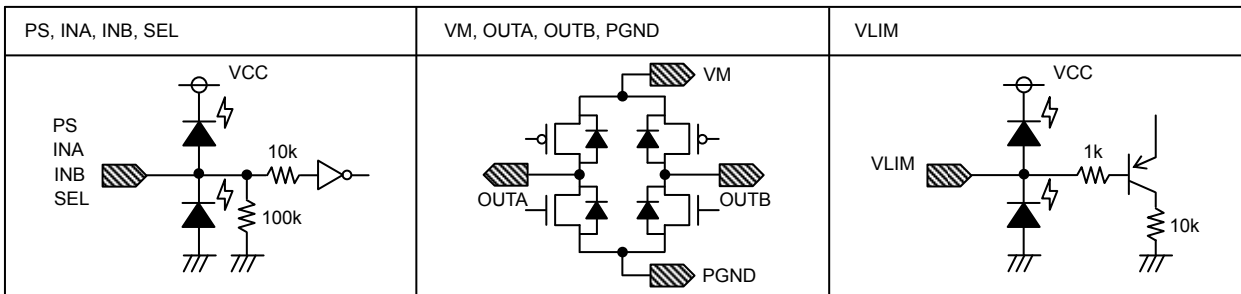


Fig.28 BD6886GUL, BD6369GUL I/O Circuit Diagram (Resistance values are typical ones.)

● Operation Notes

- 1) Absolute maximum ratings
Use of the IC in excess of absolute maximum ratings, such as the applied voltage (VCC, VM) or operating temperature range (Topr), may result in IC damage. Assumptions should not be made regarding the state of the IC (short mode or open mode) when such damage is suffered. A physical safety measure, such as a fuse, should be implemented when using the IC at times where the absolute maximum ratings may be exceeded.
- 2) Storage temperature range (Tstg)
As long as the IC is kept within this range, there should be no problems in the IC's performance. Conversely, extreme temperature changes may result in poor IC performance, even if the changes are within the above range.
- 3) Power supply and wiring
Be sure to connect the power terminals outside the IC. Do not leave them open. Because a return current is generated by a counter electromotive force of the motor, take necessary measures such as putting a Capacitor between the power source and the ground as a passageway for the regenerative current. Be sure to connect a Capacitor of proper capacitance (0.1 μ F to 10 μ F) between the power source and the ground at the foot of the IC, and ensure that there is no problem in properties of electrolytic Capacitors such as decrease in capacitance at low temperatures. When the connected power source does not have enough current absorbing capability, there is a possibility that the voltage of the power source line increases by the regenerative current and exceeds the absolute maximum rating of this product and the peripheral circuits.
Therefore, be sure to take physical safety measures such as putting a zener diode for a voltage clamp between the power source and the ground.
- 4) Ground terminal and wiring
The potential at GND terminals should be made the lowest under any operating conditions. Ensure that there are no terminals where the potentials are below the potential at GND terminals, including the transient phenomena. The motor ground terminals PGND, and the small signal ground terminal GND are not interconnected with one another inside the IC. It is recommended that you should isolate the large-current RNF pattern and PGND pattern from the small-signal GND pattern, and should establish a one-point grounding at a reference point of the set, to avoid fluctuation of small-signal GND voltages caused by voltage changes due to pattern wire resistances and large currents. Also prevent the voltage variation of the ground wiring patterns of external components. Use short and thick power source and ground wirings to ensure low impedance.
- 5) Thermal design
Use a proper thermal design that allows for a sufficient margin of the power dissipation (Pd) at actual operating conditions.
- 6) Pin short and wrong direction assembly of the device.
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 positive and ground power supply terminals are reversed. The IC may also be damaged if pins are shorted together or are shorted to other circuit's power lines.
- 7) Avoiding strong magnetic field
Malfunction may occur if the IC is used around a strong magnetic field.
- 8) ASO
Ensure that the output transistors of the motor driver are not driven under excess conditions of the absolute maximum ratings and ASO.
- 9) TSD (Thermal Shut Down) circuit
If the junction temperature (Tjmax) reaches 175°C (but the BH6453GUL is 150°C), the TSD circuit will operate, and the coil output circuit of the motor will open. There is a temperature hysteresis of approximately 25°C (but the BH6453GUL is 20°C). The TSD circuit is designed only to shut off the IC in order to prevent runaway thermal operation. It is not designed to protect the IC or guarantee its operation. The performance of the IC's characteristics is not guaranteed and it is recommended that the device is replaced after the TSD is activated.

- 10) Testing an application board
 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 and storing the IC.

- 11) Regarding the input pin of the IC
 This monolithic IC contains P⁺ isolation and P substrate layers between adjacent elements 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, the P-N junction operates as a parasitic diode.

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

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

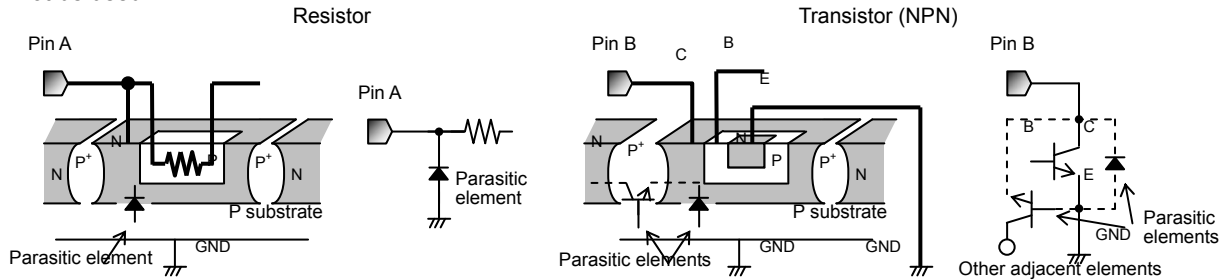


Fig.29 Example of Simple IC Architecture

●Selecting a Model Name when Ordering

B X 6 X X X G U L

E 2

Rohm model name

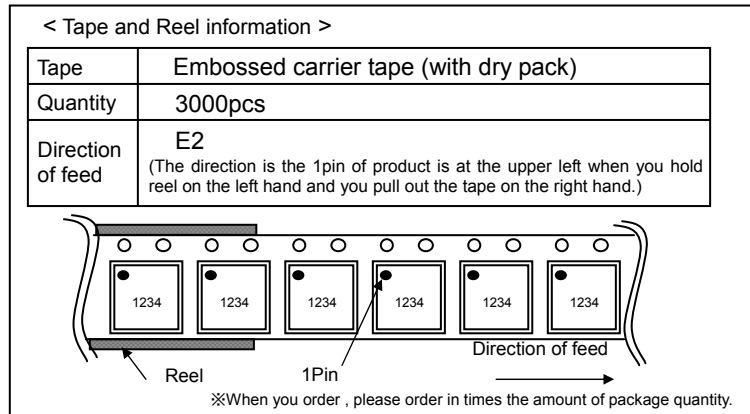
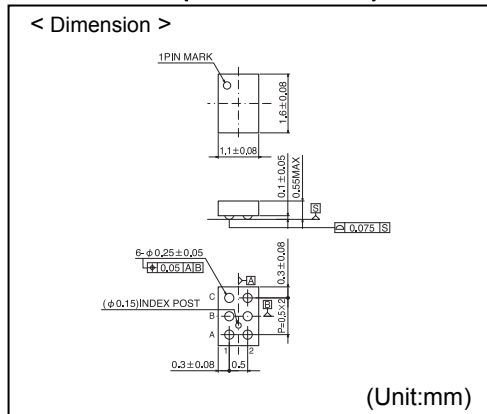
Package

Packaging and forming specification
E2: Embossed tape and reel

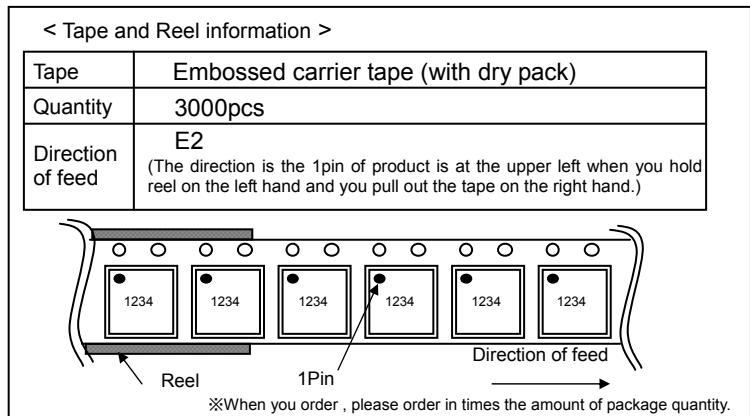
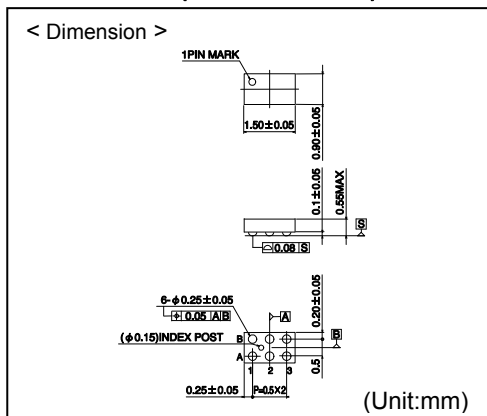
6883 : Constant voltage 0.5ch
6453 : Constant current 0.5ch
6886 : Constant voltage 1ch
6369 : Constant voltage 1ch

GUL : VCSP50L1 (BD6883)
GUL : VCSP50L1 (BH6453)
GUL : VCSP50L2 (BD6886)
GUL : VCSP50L2 (BD6369)

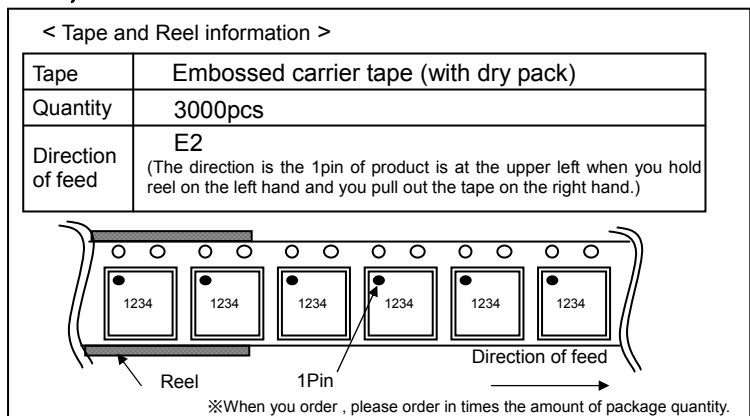
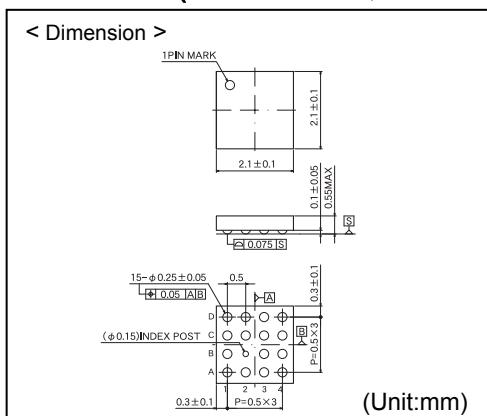
VCSP50L1 (BD6883GUL)



VCSP50L1 (BH6453GUL)



VCSP50L2 (BD6886GUL, BD6369GUL)



Notes

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