Structure : Silicon Monolithic Integrated Circuit
Product Name : Power control and power driver for portable equipment

Device Name : **BH6575FV**

Features :

- Low power consumption
- Low ON resistance
- SSOP-B40 package

<Power Control Part>

- Step-up DC/DC converter (External Tr required)
- Power MOS step-up circuit (With a built-in switching Tr)
- Step-down regulator circuit
- Reset circuit

<Driver Part>

- Incorporating four channels of power MOS and H-bridge drivers
- Supporting analog input
- Direct PWM driving method

O ABSOLUTE MAXIMUM RATINGS (Ta=25°C)

| Parameter | Symbol | Limits | Unit |
|---|---|---|---|
| H-bridge Power Supply Voltage | PVCC | 7 | V |
| Battery Power Supply Voltage | REGO | 7 | V |
| System Power Supply Voltage | VSYS | 7 | V |
| AC Adaptor Power Supply Voltage | DC.IN | 7 | V |
| Pre Driver Power Supply Voltage | VG | 7 | V |
| Power Dissipation | Pd | 1000*1 | mW |
| Operating Temperature Range | Topr | -30 to 85 | °C |
| Storage Temperature Range | Tstg | -55 to 150 | °C |

*1 When mounted on PCB board (glass/epoxy board with the size: 70 mm×70 mm, the thickness: 1.6 mm).
Over Ta=25°C, derating at the rate of 8.0mW/°C.

O RECOMMENDED OPERATING CONDITIONS

| Parameter | Symbol | MIN | TYP | MAX | Unit |
|---|---|---|---|---|---|
| H-bridge Power Supply Voltage | PVCC | 1.5 | 2.4 | 4.5 | V |
| Battery Power Supply Voltage | REGO | 1.5 | 2.4 | 4.5 | V |
| System Power Supply Voltage | VSYS | 2.0 | 2.5 | 4.5 | V |
| AC Adaptor Power Supply Voltage | DC.IN | 3.0 | 4.5 | 6.5 | V |
| Pre Driver Power Supply Voltage *2 | VG | 5.0 | 6.0 | 6.9 | V |
| Ambient Temperature | Ta | -10 | 25 | 70 | °C |

*2) When supplied externally without using the built-in step-up circuit

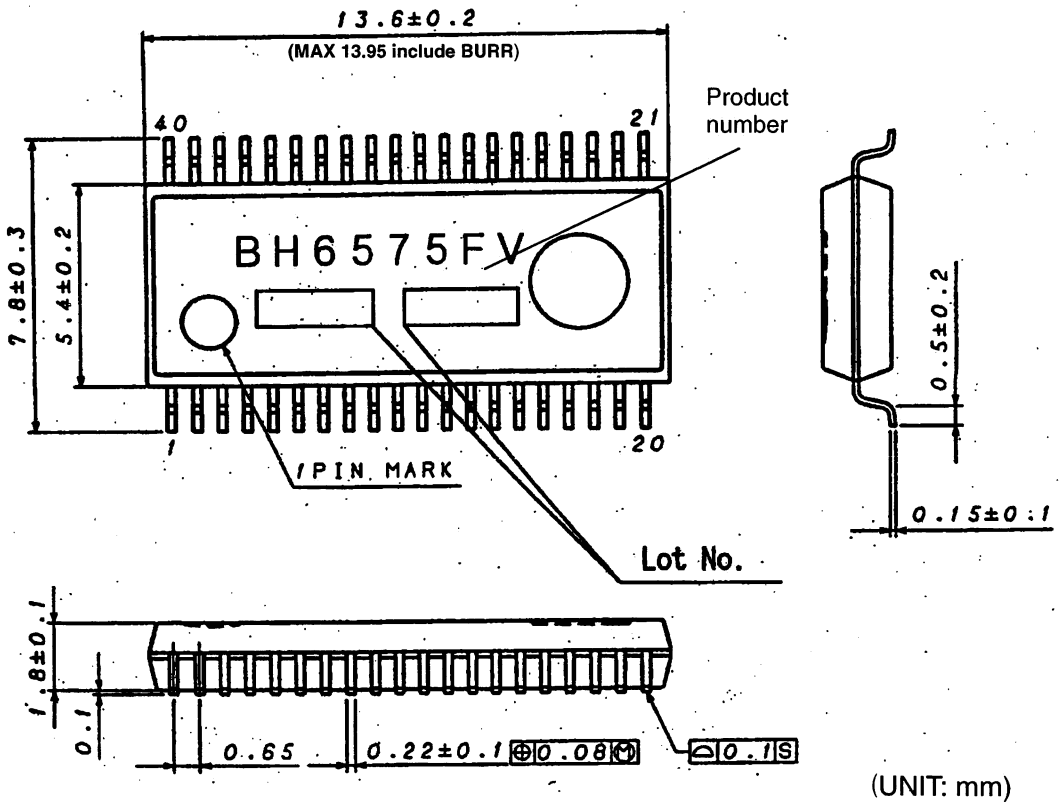
This product has not been checked for the strategic materials (or service) defined in the Foreign Exchange and Foreign Trade Control Low of Japan so that a verification work is required before exporting it.
Not designed for radiation resistance.

○ ELECTRIC CHARACTERISTICS 1 (Ta=25°C, PVCC=REGO=2.4V, VSYS=2.5V, VG=6V, VREF=1.25V, unless otherwise noted.)

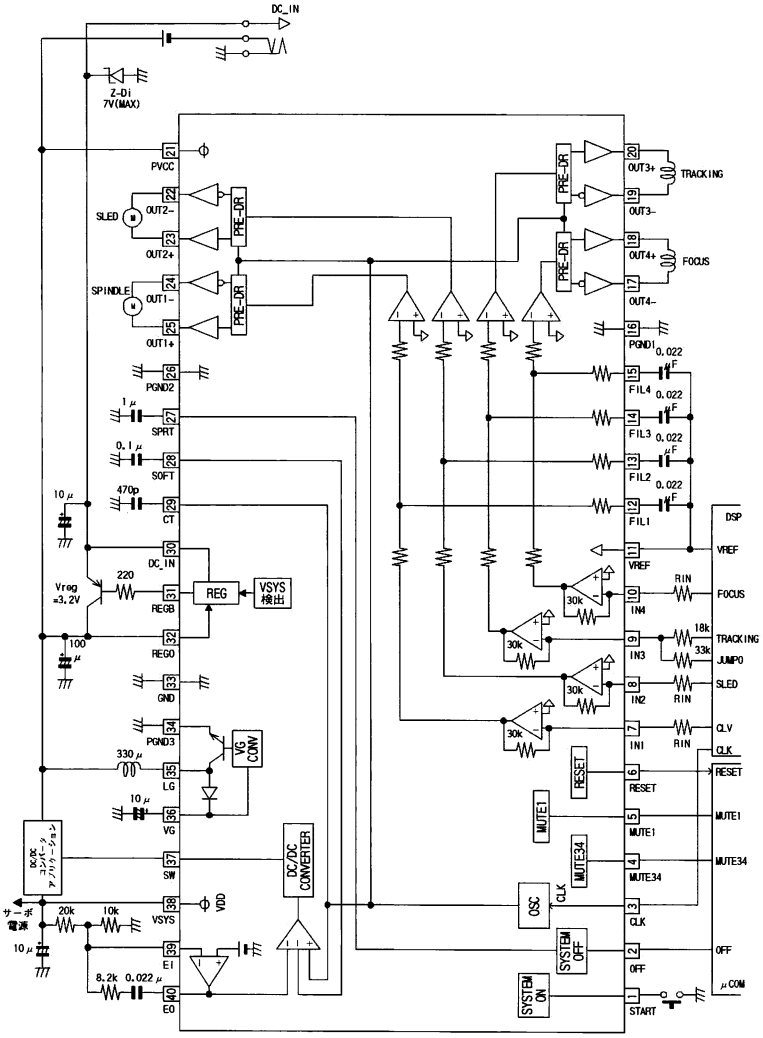
| Parameter | Symbol | MIN | TYP | MAX | Unit | Condition |
|---|---|---|---|---|---|---|
| <Whole Circuitry> | | | | | | |
| REGO Standby Current | IREGOST | - | - | 3 | uA | VSYS=0V |
| VG Standby Current | IVGST | - | - | 3 | uA | VSYS=0V |
| REGO Consumption Current | IREGO | - | 0.42 | 0.95 | mA | |
| DC_IN Consumption Current | IDC_N | - | 1.4 | 3.0 | mA | DC_N=5V |
| VSYS Consumption Current | IVSYS | - | 4.2 | 8.5 | mA | |
| VG Consumption Current | IVG | - | 0.35 | 0.7 | mA | CT=470pF,fCLK=88.2KHz,VIN=1.49V |
| LG Terminal Leak Current | ILGLK | - | - | 3 | uA | LG=6V,VSYS=0V |
| <PWM Driver> | | | | | | |
| Output ON Resistance | RON | - | 1.9 | 4 | Ω | Sum of ON resistances (top + bottom) |
| Output Offset Voltage | Voo | -50 | 0 | 50 | mV | |
| Voltage Gain | GVC | 11.5 | 14.0 | 16.5 | dB | RIN=30KΩ |
| Input Dead Band Width 12 (one side) | VDB12 | 2 | 20 | 40 | mV | CH1,2 |
| Input Dead Band Width 34 (one side) | VDB34 | 0 | 5 | 15 | mV | CH3,4 |
| <Control Terminal Threshold> | | | | | | |
| MUTE1 ON Level Input Voltage | VMON1 | 1.5 | - | - | V | |
| MUTE1 OFF Level Input Voltage | VMOFF1 | - | - | 0.5 | V | |
| MUTE34 ON Level Input Voltage | VMON34 | - | - | 0.5 | V | |
| MUTE34 OFF Level Input Voltage | VMOFF34 | 1.5 | - | - | V | |
| <Step-up/Step-down Converter> | | | | | | |
| EI Terminal Threshold Voltage | VEITH | 0.85 | 0.90 | 0.95 | V | |
| EO Terminal Output Voltage H | VEOTH | 1.1 | 1.3 | - | V | IEO=100μA |
| EO Terminal Output Voltage L | VEOL | - | - | 0.4 | V | IEO=-60μA |
| <Short Protection Part> | | | | | | |
| SPRT Terminal Current (Normal) | VSPRTN | - | - | 0.2 | V | |
| SPRT Terminal Voltage 1 EO = H | ISPRT1 | 3.8 | 5.8 | 8.8 | uA | |
| SPRT Terminal Voltage 2 (at OFF) | ISPRT2 | 7.5 | 11.5 | 17.5 | uA | |
| SPRT Terminal Impedance | RSPRT | 210 | 300 | 390 | KΩ | |
| SPRT Terminal Threshold Voltage | VSPRTTH | 0.4 | 0.5 | 0.6 | V | |
| <Soft Start Part> | | | | | | |
| SOFT Terminal Output Voltage | VSOFT | 0.65 | 1.1 | 1.55 | V | |
| SOFT Terminal Current | ISOFT | 3 | 6 | 9 | uA | SOFT=0V |
| SOFT Terminal Impedance | RSOFT | 140 | 200 | 260 | KΩ | |
| <Interface Part> | | | | | | |
| OFF Terminal ON Threshold Voltage | VOFFTH1 | - | - | VSYS-1.5 | V | |
| OFF Terminal OFF Threshold Voltage | VOFFTH2 | VSYS-0.6 | - | - | V | |
| OFF Terminal Bias Current | IOFF | 30 | 60 | 90 | uA | OFF=0V |
| START Terminal ON Threshold Voltage | VSTATH1 | - | - | REGO-1.0 | V | |
| START Terminal ON Threshold Voltage | VSTATH2 | REGO-0.3 | - | - | V | |
| START Terminal Bias Current | ISTART | 10 | 14 | 18 | uA | VSYS=0V,START=0V |
| CLK Terminal Threshold Voltage H | VCLKTHH | 1.5 | - | - | V | CT=470pF,fCLK=88.2KHz |
| CLK Terminal Threshold Voltage L | VCLKTHL | - | - | 0.5 | V | CT=470pF,fCLK=88.2KHz |
| CLK Terminal Bias Current | ICLK | 13 | 18 | 23 | uA | VCLK=2.5V |

| Parameter | Symbol | MIN | TYP | MAX | Unit | Condition |
|---|---|---|---|---|---|---|
| <Starter Circuit> | | | | | | |
| LG Terminal Oscillation Frequency | fLG | 75 | 100 | 125 | KHz | VG=LG=5V |
| LG Terminal Maximum Pulse Duty | tLGMAX | 72 | 80 | 88 | % | VG=LG=5V |
| LG Terminal Output Voltage L | VLGL | - | 0.1 | 0.2 | V | VG=LG=5V |
| VG Terminal Starter Detection Voltage | VVGSTTH | 3.2 | 4.0 | 4.8 | V | VG=3V→5V sweep |
| LG Terminal Threshold Voltage | VVGTH | 5.1 | 6.0 | 6.9 | V | LG=5V |
| <DC/DC Converter> | | | | | | |
| SW Terminal Output Voltage H | VSWH | 1.3 | 1.8 | - | V | CT=0 2V, ISW=5mA,EI=0, 7V, VSPRT=0V |
| SW Terminal Output Voltage L | VSWL | - | 0.5 | 1.0 | V | CT=2V, ISW=1mA |
| SW Terminal Starter Frequency | tSWSTA | 75 | 100 | 125 | KHz | VSYS=1, 6V, VG=5V |
| SW Terminal Oscillation Frequency 1 (free-running) | fSW1 | 36 | 48 | 60 | KHz | EI=0, 7V, CT=470pF,VSPRT=0V |
| SW Terminal Oscillation Frequency 2 (synchronizing) | fSW2 | - | 88.2 | - | KHz | EI=0, 7V, fCLK=88,2KHz,VSPRT=0V |
| SW Terminal Starter Duty | DSWSTA | 15 | 30 | 45 | % | VSYS=1, 6V, VG=5V |
| Maximum Duty at Free-running | DSW1 | 80 | 90 | 95 | % | EI=0, 7V, CT=470pF,VSPRT=0V |
| CLK Maximum Duty at Synchronizing | DSW2 | 80 | 90 | 95 | % | EI=0, 7V, CT=470pF,VSPRT=0V |
| <Triangular Wave Generator Circuit> | | | | | | |
| CT Terminal Threshold Voltage H | CTTHH | 0.7 | 0.8 | 0.9 | V | CT=0, 7V→1V sweep |
| CT Terminal Threshold Voltage L | CTTHL | 0.34 | 0.4 | 0.46 | V | CT=0, 5V→0.2V sweep |
| CT Terminal Sink Current | ICTS IN | 80 | 92 | 104 | uA | CT=1.0V |
| CT Terminal Output Current Ratio | HCT | 6.5 | 8 | 9.5 | - | Sink current / source current |
| <VSYS Circuitry> | | | | | | |
| Discharge Reset Voltage | VDIS | 1.40 | 1.51 | 1.62 | V | |
| Starter→Normal Switching Voltage | VSTN | 1.65 | 1.75 | 1.85 | V | VSYS=1.5V→2V sweep |
| Normal→Starter Switching Voltage | VNST | 1.57 | 1.67 | 1.77 | V | VSYS=2V→1.5V sweep |
| Starter→Normal Switching Hysteresis Width | VSTNHIS | 40 | 80 | 120 | mV | VSTN-VNST |
| <Reset> | | | | | | |
| EI Terminal Reset Voltage Threshold Ratio | HRST | 80 | 85 | 90 | % | Ratio to EI Terminal Threshold Voltage |
| RESET Terminal Output Voltage | VOREST | - | - | 0.5 | V | IRESET=1mA |
| RESET Terminal Leak Current | ILKRESET | - | - | 2 | μA | VRESET=2.5V |
| <Regulator Circuitry> | | | | | | |
| Regulator Output Voltage | VREG | 2.9 | 3.2 | 3.5 | V | REGD=OPEN, DC=IN=6V |
| REGB Terminal Output Voltage | VOREGB | - | - | 1.4 | V | DC_IN=6V, IREG=10mA |
| REGB Terminal Leak Current | ILKREGB | - | - | 3 | μA | REGO=3,, 5V, DC_IN=6V, REGB=6V |
| REGB Terminal Limit Current | ILKREGB | 10 | 15 | 20 | mA | DC_IN=6V |
| DC_IN Reduced-Voltage Mute ON Voltage | VDC_INLV | - | - | 1.3 | V | DC_IN specified |
| DC_IN Reduced Voltage Mute OFF Voltage | VDC_INDF | 1.9 | - | - | V | DC_IN specified |

O OUTLINE DIMENSIONS, SYMBOLS



## O APPLICATION CIRCUIT DIAGRAM




Resistance unit: [Ω]

## O PIN Description

| No. | Pin name | Description | No. | Pin name | Description |
|---|---|---|---|---|---|
| 1 | START | DC/DC converter startup terminal | 21 | PVCC | Power part power supply terminal |
| 2 | OFF | DC/DC converter OFF terminal | 22 | OUT2- | CH2 negative output terminal |
| 3 | CLK | External clock input terminal | 23 | OUT2+ | CH2 positive output terminal |
| 4 | MUTE34 | CH3, 4 mute terminal | 24 | OUT1- | CH1 negative output terminal |
| 5 | MUTE1 | CH1 mute terminal | 25 | OUT1+ | CH1 positive output terminal |
| 6 | RESET | Reset output terminal | 26 | PGND2 | Power part ground 2 |
| 7 | IN1 | CH1 input terminal | 27 | SPRT | Power OFF time constant setting terminal |
| 8 | IN2 | CH2 input terminal | 28 | SOFT | Soft start setting terminal |
| 9 | IN3 | CH3 input terminal | 29 | CT | Triangular wave output terminal |
| 10 | IN4 | CH4 input terminal | 30 | DC.IN | AC adaptor power supply terminal |
| 11 | VREF | Reference voltage input terminal | 31 | REGB | Tr. for regulator driving terminal |
| 12 | FIL1 | CH1 filter terminal | 32 | REGO | Battery power supply terminal |
| 13 | FIL2 | CH2 filter terminal | 33 | GND | Pre part ground |
| 14 | FIL3 | CH3 filter terminal | 34 | PGND3 | Power part ground 3 |
| 15 | FIL4 | CH4 filter terminal | 35 | LG | VG step-up coil driving terminal |
| 16 | PGND1 | Power part ground 1 | 36 | VG | Power MOS driving circuit power supply terminal |
| 17 | OUT4- | CH4 negative output terminal | 37 | SW | Step-up transistor driving terminal |
| 18 | OUT4+ | CH4 positive output terminal | 38 | VSYS | Control circuit power supply terminal |
| 19 | OUT3- | CH3 negative output terminal | 39 | EI | DC/DC converter error amp input terminal |
| 20 | OUT3+ | CH3 positive output terminal | 40 | EO | DC/DC converter error amp input terminal |

O CAUTIONS ON USE

(1) In principle, a voltage below the IC sub-potential must not be applied to any terminals.
Due to a counter electromotive force of the external choke coil or the like, if the output drops to the IC sub-potential (GND) or less, an operation margin needs to be reconsidered.
(2) When the power supply voltage (PreVcc) has dropped to 3.8V (typ.) or less, the output current will be muted while the reset output will become 'L' and, when PreVcc has recovered to 4.0V (typ.), the driver part circuit will be initiated to set the reset output to 'H.'
(3) Short-circuits between output pin-VCC, output pin-GND, or output terminals (load short) must be avoided. Make sure that the ICs are installed on the board in proper directions.
(4) While using an AC adaptor, if a voltage of 7V or above might be applied to the DC-IN terminal, connect Z-Di to the terminal to reduce the voltage to less than 7V.
To protect the IC, applying the voltage of 7.5V (typ.) or above to the DC-IN terminal will initiate charging SPRT. (SPRT current: 11.5μA)
Applying (REGO - 1.0) V or less to the START terminal and applying (VSYS - 1.5) V to the OFF terminal must not be performed at the same time.
(5) About absolute maximum ratings
Exceeding the absolute maximum ratings, such as the applied voltage or the operating temperature range, may cause permanent device damage. As these cases cannot be limited to the broken short mode or the open mode, if a special mode where the absolute maximum ratings may be exceeded is assumed, it is recommended to take mechanical safety measures such as attaching fuses.
(6) About power supply lines
As a measure against the back current regenerated by a counter electromotive force of the motor, a capacitor to be used as a regenerated-current path can be installed between the power supply and GND and its capacitance value should be determined after careful check that any problems, for example, a leak capacitance of the electrolytic capacitor at low temperature, are not found in various characteristics.
(7) About GND potential
The electric potential of the GND terminal must be kept lowest in the circuitry at any operation states.
(8) About thermal design
With consideration of the power dissipation (Pd) under conditions of actual use, a thermal design provided with an enough margin should be done.
(9) About operations in a strong electric field
When used in a strong electric field, note that a malfunction may occur.
(10) ASO
When using this IC, the output Tr must be set not to exceed the values specified in the absolute maximum ratings and ASO.
(11) Thermal shutdown circuit
This IC incorporates a thermal shutdown circuit (TSD circuit). When the chip temperature reaches the value shown below, the coil output to the motor will be set to open.
The thermal shutdown circuit is designed only to shut off the IC from a thermal runaway and not intended to protect or guarantee the entire IC functions.
Therefore, users cannot assume that the TSD circuit once activated can be used continuously in the subsequent operations.

| TSD ON Temperature [°C] (typ.) | Hysteresis Temperature [°C] (typ.) |
|---|---|
| 175 | 25 |

(12) About earth wiring patterns
When a small signal GND and a large current GND are provided, it is recommended that the large current GND pattern and the small signal GND pattern should be separated and grounded at a single point of the reference point of the set in order to prevent the voltage of the small signal GND from being affected by a voltage change caused by the resistance of the pattern wiring and the large current.
Make sure that the GND wiring patterns of the external components will not change, too.
(13) This IC is a monolithic IC which has a $P^+$ isolations and P substrate to isolate elements each other.
This P layer and an N layer in each element form a PN junction to construct various parasitic elements.
Due to the IC structure, the parasitic elements are inevitably created by the potential relationship.
Activation of the parasitic elements can cause interference between circuits and may result in a

malfunction or, consequently, a fatal damage. Therefore, make sure that the IC must not be used under conditions that may activate the parasitic elements, for example, applying the lower voltage than the ground level (GND, P substrate) to the input terminals.
In addition, do not apply the voltage to input terminals without applying the power supply voltage to the IC. Also while applying the power supply voltage, the voltage of each input terminal must not be over the power supply voltage, or within the guaranteed values in the electric characteristics.

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