

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

○ 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.

○ 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 Law of Japan so that a verification work is required before exporting it.

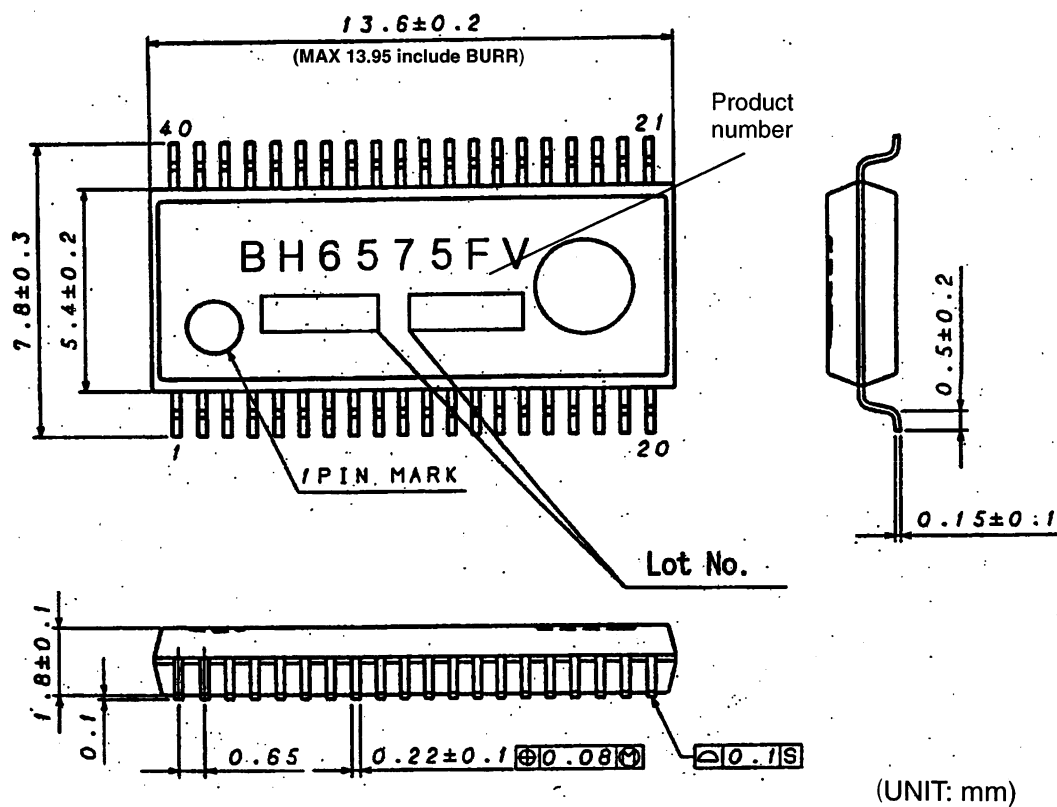
Not designed for radiation resistance.

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

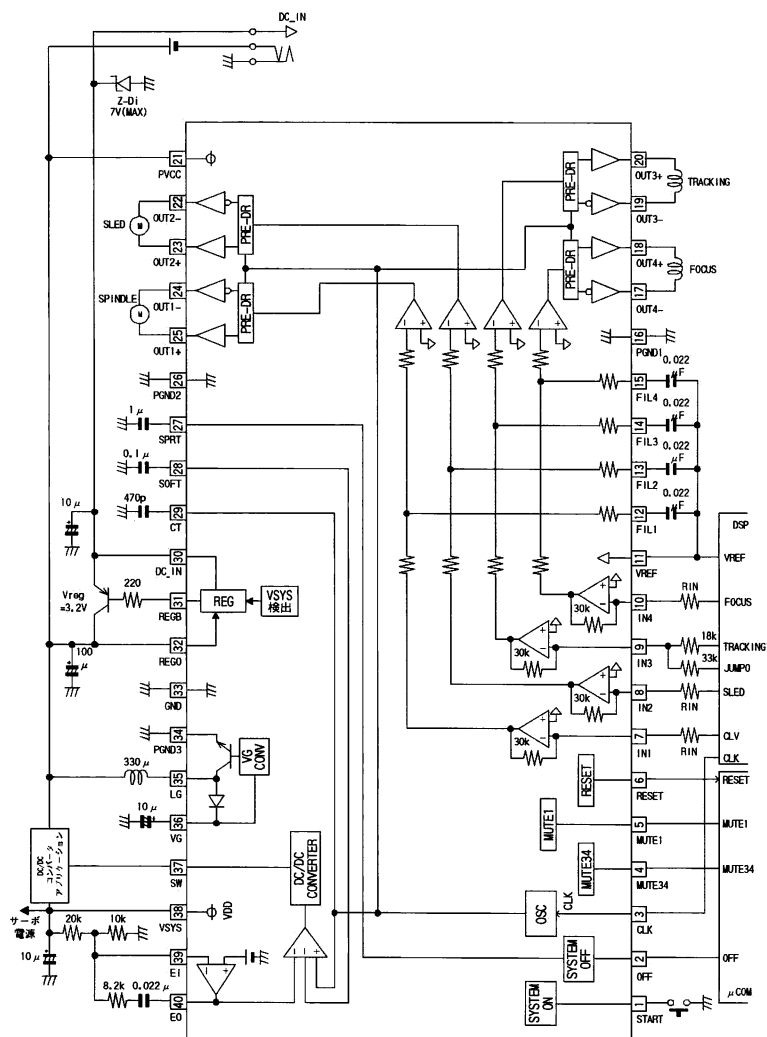
Parameter	Symbol	MIN	TYP	MAX	Unit	Condition
<Whole Circuitry>						
REGO Standby Current	IREGOST	-	-	3	uA	VSYS=0V
VG Standby Current	IVGST	-	-	3	uA	VSYS=0V
REGO Consumption Current	IREGO	-	0.42	0.95	mA	
DC_IN Consumption Current	IDC_N	-	1.4	3.0	mA	DC_N=5V
VSYS Consumption Current	IVSYS	-	4.2	8.5	mA	
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=100uA
EO Terminal Output Voltage L	VEOL	-	-	0.4	V	IEO=-60uA
<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	uA	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	uA	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

○ OUTLINE DIMENSIONS, SYMBOLS



○ APPLICATION CIRCUIT DIAGRAM



Resistance unit: [Ω]

○ 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

○ 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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