STRUCTURE Silicon monolithic integrated circuits

PRODUCTSERIES 3-phase brushless motor driver

TYPE **BD67922EFV**

FUNCTION
- 3-phase MOS direct PWM driver
- Built-in PLL control circuit
- Built-in over current protection circuit

○Absolute maximum ratings (Ta=25℃)

Item	Symbol	Limit	Unit
Supply voltage	V_{CC}	-0.2～+36.0	V
LD, FG applied voltage	$V_{LD, FG}$	-0.2～+6.5	V
HB applied voltage	V_{HB}	-0.2～+6.5	V
Hall signal input voltage	V_{HALL}	-0.2～+6.5	V
Input voltage for CLK pin	V_{CLK}	-0.2～+6.5	V
Input voltage for control pin (SS, SB)	V_{IN}	-0.2～+6.5	V
Power dissipation	Pd	1.45※1	W
		4.70※2	W
Output current	I_{OUT}	2300※3	mA
Operating temperature range	T_{opr}	-25～+85	℃
Storage temperature range	T_{stg}	-55～+150	℃
Junction temperature	T_{jmax}	+150	℃

※1 70mm×70mm×1.6mm glass epoxy board. Derating in done at 11.6mW/℃ for operating above Ta=25℃.
※2 4-layer recommended board. Derating in done at 37.6mW/℃ for operating above Ta=25℃.
※3 Do not, however exceed Pd, ASO, and T_{jmax}=150℃.

○Recommend operating conditions (Ta= -25～+85℃)

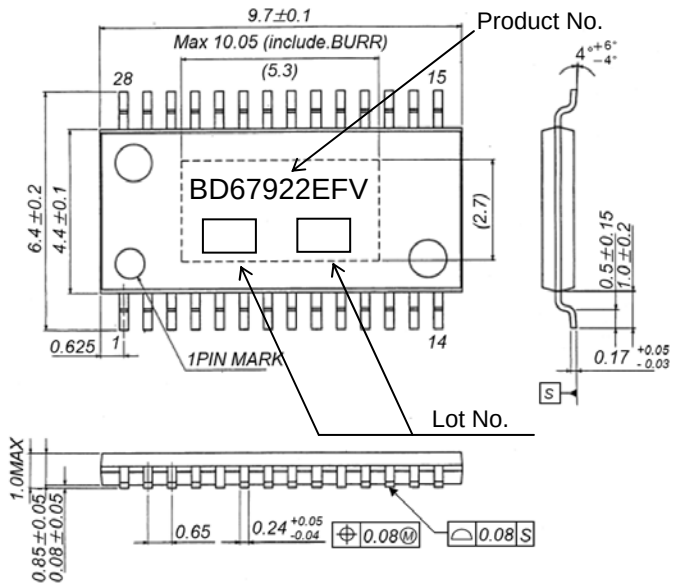
Item	Symbol	Min.	Typ.	Max.	Unit
Supply voltage	V_{CC}	19	24	28	V
5V constant voltage output current	I_{REG}	-20	-	0	mA
HB pin current	I_{HB}	0	-	20	mA
LD, FG pin supply voltage	$V_{LD, FG}$	0	-	5.5	V
LD, FG pin current	$I_{LD, FG}$	0	-	15	mA

This product isn't designed for protection against radioactive rays.

○Electrical characteristics (Unless otherwise specified, Ta=25℃, V_{CC}=24V)

Item	Symbol	Limit			Unit	Conditions
		Min.	Typ.	Max.		
Whole						
Circuit current 1	I_{CC1}	-	4.0	9.0	mA	SS=L output ON mode
Circuit current 2	I_{CC2}	-	1.5	2.3	mA	SS=H output OFF mode
VREG output						
Output voltage	V_{REG}	4.65	5.00	5.35	V	
Output (U, V, W)						
Output on resistance	R_{ON}	-	1.35	1.76	Ω	I_{OUT}=1.0A Sum of upper and lower
Lower side diode forward voltage	V_{D1}	0.70	1.10	1.55	V	I_{OUT}=-1.0A
Upper side diode forward voltage	V_{D2}	0.70	1.10	1.55	V	I_{OUT}=1.0A
Output leak current	I_{LEAK}	-	-	10	μA	
Hall comparator Input (HUP, HUN, HVP, HVN, HWP, HWN)						
Common mode input voltage range	V_{ICM}	1.5	-	3.5	V	
Hysteresis width	ΔV_{IN}	15	24	42	mV	Sum of upper and lower
LD, FG output						
Low level output voltage	V_{OD}	-	0.15	0.50	V	$I_{LD, FG}$=10mA
PD output						
High level output voltage	V_{PDH}	4.5	4.9	-	V	I_{PD}=-100μA
Low level output voltage	V_{PDL}	-	0.2	0.3	V	I_{PD}=100μA
Integral amplifier						
EO High level output voltage	V_{EOH}	3.5	4.1	-	V	I_{EO}=-500μA
EO Low level output voltage	V_{EOL}	-	0.9	1.5	V	I_{EO}=500μA
EI input current	I_{EI}	-2.0	-0.1	-	μA	V_{EI}=0V
Current limit circuit						
Drive gain during starting mode	G_H	1.2	1.5	1.8	times	
Drive gain during steady mode	G_L	0.4	0.5	0.6	times	
Limiter voltage	V_{CL}	0.45	0.50	0.55	V	
CLK input						
External input frequency	F_{CLK}	-	-	10	kHz	
High level input voltage	V_{CLKH}	3.0	-	-	V	
Low level input voltage	V_{CLKL}	-	-	1.5	V	
Low level input current	I_{CLKL}	-75	-50	-25	μA	V_{CLK}=0V
Control input (SS, SB)						
High level input voltage	V_{INH}	3.0	-	-	V	
Low level input voltage	V_{INL}	-	-	1.5	V	
Low level input current	I_{INL}	-75	-50	-25	μA	V_{IN}=0V
OSC						
OSC oscillating frequency	F_{OSC}	130	200	270	kHz	C_{OSC} =220pF
OSC High voltage	V_{OSCH}	1.6	2.0	2.4	V	
OSC Low voltage	V_{OSCL}	1.2	1.5	1.8	V	
PROCLK						
CLK cycle for protection circuit	T_{PCLK}	13	20	27	msec	C_{PCLK}=0.1μF
Hall bias						
Hall bias voltage	V_{HB}	0.70	0.85	1.00	V	I_{HB}=10mA

○Package outline

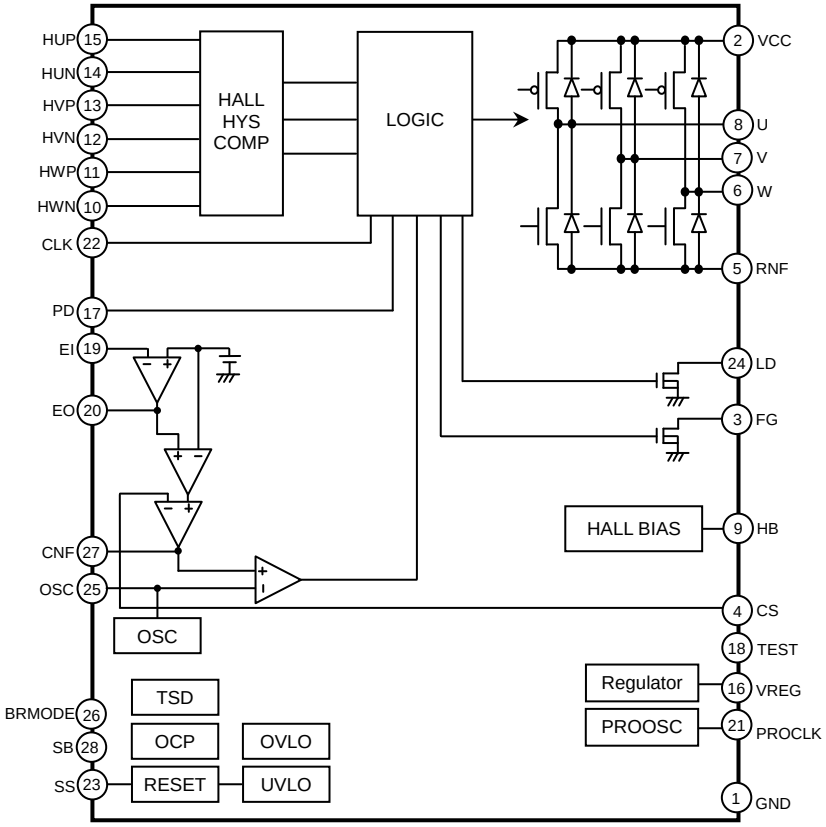


HTSSOP-B28 (Unit: mm)

○Pin No. / Pin name

Pin No.	Pin name	Pin No.	Pin name
1	GND	15	HUP
2	VCC	16	VREG
3	FG	17	PD
4	CS	18	TEST
5	RNF	19	EI
6	W	20	EO
7	V	21	PROCLK
8	U	22	CLK
9	HB	23	SS
10	HWN	24	LD
11	HWP	25	OSC
12	HVN	26	BRMODE
13	HVP	27	CNF
14	HUN	28	SB

○Block diagram



○Operation Notes

(1) Absolute maximum ratings

An excess in the absolute maximum ratings, such as supply voltage, temperature range of operating conditions, etc., can break down the devices, thus making impossible to identify breaking mode, such as a short circuit or an open circuit. If any over rated values will expect to exceed the absolute maximum ratings, consider adding circuit protection devices, such as fuses.

(2) Power supply lines

As return of current regenerated by back EMF of motor happens, take steps such as putting capacitor between power supply and GND as an electric pathway for the regenerated current. Be sure that there is no problem with each property such as emptied capacity at lower temperature regarding electrolytic capacitor to decide capacity value. If the connected power supply does not have sufficient current absorption capacity, regenerative current will cause the voltage on the power supply line to rise, which combined with the product and its peripheral circuitry may exceed the absolute maximum ratings. It is recommended to implement a physical safety measure such as the insertion of a voltage clamp diode between the power supply and GND pins.

(3) GND potential

The potential of GND pin must be minimum potential in all operating conditions.

(4) Metal on the backside (Define the side where product markings are printed as front)

The metal on the backside is shorted with the backside of IC chip therefore it should be connected to GND. Be aware that there is a possibility of malfunction or destruction if it is shorted with any potential other than GND.

(5) Thermal design

Use a thermal design that allows for a sufficient margin in light of the power dissipation (Pd) in actual operating conditions. This IC exposes its frame of the backside of package. Note that this part is assumed to use after providing heat dissipation treatment to improve heat dissipation efficiency. Try to occupy as wide as possible with heat dissipation pattern not only on the board surface but also the backside.

(6) Actions in strong electromagnetic field

The IC is not designed for using in the presence of strong electromagnetic field. Be sure to confirm that no malfunction is found when using the IC in a strong electromagnetic field.

(7) ASO

When using the IC, set the output transistor so that it does not exceed absolute maximum ratings or ASO.

(8) Thermal shutdown circuit

The IC has a built-in thermal shutdown circuit (TSD circuit). If the chip temperature becomes Tjmax=150℃, and higher, coil output to the motor will be open. The TSD circuit is designed only to shut the IC off to prevent runaway thermal operation. It is not designed to protect or indemnify peripheral equipment. Do not use the TSD function to protect peripheral equipment.

(9) Ground Wiring Pattern

When using both large current and small signal GND patterns, it is recommended to isolate the two ground patterns, placing a single ground point at the ground potential of application so that the pattern wiring resistance and voltage variations caused by large currents do not cause variations in the small signal ground voltage. Be careful not to change the GND wiring pattern of any external components, either.

(10) Mounting errors and Inter-pin short

When attaching to a printed circuit board, pay attention to the direction of the IC and displacement. Improper attachment may lead to destruction of the IC. There is also possibility of destruction from short-circuits which can be caused by foreign matter entering between pins.

(11) TEST pin

Be sure to connect TEST pin to GND.

Notes

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