ROHM

STRUCTURE Silicon monolithic integrated circuits

PRODUCT SERIES 3-in-1 motor driver for standard VTR

TYPE **BD6909EFV**

FUNCTION
- VTR capstan motor driver (180°, 3-phase full-wave pseudo linear drive system)
- VTR cylinder motor driver (Sensorless 3-phase full-wave soft switching drive system)
- VTR loading motor driver

○Absolute maximum ratings (Ta=25℃)

Parameter	Symbol	Limit	Unit
Applied voltage (control block)	VCC	7	V
Applied voltage (capstan block)	C.VM	15	V
Applied voltage (drum loading block)	DL.VM	15	V
Applied voltage	VG	20	
Power dissipation	Pd	※1	※1
Operating temperature range	Topr	-20～+75	℃
Storage temperature range	Tstg	-55～+150	℃
Maximum output current (capstan block)	Iomax1	1000※2	mA
Maximum output current (drum block)	Iomax2	800※2	mA
Maximum output current (loading block)	Iomax3	1000※2	mA
Junction temperature	Tjmax	+150	℃

※1 1-layer board (Copper foil on the back 0mm x 0mm) 1.60W. Derating in done at 12.8mW/℃ for operating above Ta=25℃.
2-layer board (Copper foil on the back 15mm x 15mm) 1.95W. Derating in done at 15.6.0mW/℃ for operating above Ta=25℃.
3-layer board (Copper foil on the back 70mm x 70mm) 3.60W. Derating in done at 28.8mW/℃ for operating above Ta=25℃.
4-layer board (Copper foil on the back 70mm x 70mm) 4.70W. Derating in done at 37.6mW/℃ for operating above Ta=25℃.

※2 Do not, however exceed Pd, ASO and Tjmax=150℃.

○Recommended operating conditions (Ta= -20～+75℃)

Parameter	Symbol	Min	Typ	Max	Unit
Supply voltage	VCC	4.5	5	5.5	V
	C.VM	9	12	13.5	V
	DL.VM	9	12	13.5	V
	VG	VM+3	17	19	V
UIN, VIN, WIN in-phase input voltage range	VBEMFD	0	-	VM	V
COM input in-phase voltage range	VCOMD	0	-	VM-2.5	V
Hall amp in-phase input voltage range	VCH	1.5	-	VCC-1.5	V
PG amp in-phase input voltage range	VPD	1.5	-	VCC-1.5	V
FG amp in-phase input voltage range	VFD	1.5	-	VCC-1.5	V

This product described in this specification isn't judged whether it applies to COCOM regulations.
Please confirm in case of export.
This product isn't designed for protection against radioactive rays.

○Electrical characteristics (Unless otherwise specified, Ta=25℃, VCC=5V, VG=17V, C.VM=12V, DL.VM=12V)

Parameter	Symbol	Limit			Unit	Conditions
		Min.	Typ.	Max.		
[Overall]						
Vcc total supply current	Icc	-	16	22	mA	
[Capstan block]						
Hall input						
Hall input conversion offset	C.Heofs	-6	-	6	mV	
Torque reference						
Torque reference start voltage	C.VEC	2.35	2.5	2.65	V	
Torque reference input gain	C.Gio	0.64	0.77	0.90	A/V	RNF=0.5Ω
Output idling voltage	C.ECidle	-	-	10	mV	EC=GND
Torque limit current	C.ITL	0.85	0.97	1.1	A	RNF=0.5Ω
Forward/Reverse rotation selection						
Forward rotation reference voltage range	C.VEDF	-	-	2.2	V	
Reverse rotation reference voltage range	C.VEDR	2.8	-	-	V	
Output						
High output voltage	C.VOH	0.7	0.9	1.1	V	Io=-0.8A
Low output voltage 1	C.VOL1	1.28	1.8	2.3	V	Io=0.8A, RNF=0.5Ω,EC＜4.5V
Low output voltage 2	C.VOL2	-	1.16	1.9	V	Io=0.8A, RNF=0.5Ω,EC=Vcc
Low-side saturation prevention off voltage	C.Voff	4.4	4.6	-	V	
FG Amp						
FG input current	C.IFG-	-65	-43	-21	μA	
FG amp gain	C.GFG1	28	35	-	dB	f=500Hz
FG amp gain 2	C.GFG2	28	35	-	dB	f=30KHz
DC bias voltage	C.VBG	2.4	2.5	2.6	V	C.FG-=C.FGOUT
High FG output voltage	C.VFGH	-	0.3	0.6	V	Io=-0.2mA, versus Vcc voltage
Low FG output voltage	C.VFGL	-	0.1	0.5	V	Io=1mA
Hys Amp						
Hysteresis width	C.Vhys	32	46	60	mV	
Low hysteresis output voltage	C.VhysL	-	0.2	0.4	V	Io=1mA
Output pull-up resistance	C.Rhys	15	20	25	kΩ	
[Drum]						
Output						
High-side output saturation voltage	D.VOH	-	0.4	0.8	V	Io=-400mA
Low-side output saturation voltage	D.VOL	-	0.3	0.6	V	Io=400mA
Torque reference						
EC input bias current	D.IEC	-	0.5	2	μA	
Torque reference start voltage	D.VECR	2.35	2.5	2.65	V	
Torque reference I/O gain	D.Gio	0.69	0.95	1.23	A/V	Gain when EC=2.6V to 2.7V Output: (U, V, W)=(H, L, M) R_{RNF}=0.5Ω
Soft switch						
CT1, CT2 charge current	D.ICTD	-50	-35	-25	μA	
CT1, CT2 discharge current	D.ICTI	27	40	56	μA	
High CT1, CT2 clamp voltage	D.VCTH	4.4	4.7	-	V	
Low CT1, CT2 clamp voltage	D.VCTL	0.8	1.0	1.2	V	
Startup control logic						
CST charge current	D.ICSTO	-16	-11.5	-4.9	μA	
CST discharge current	D.ICSTI	1.6	4.7	7.8	μA	
High CST clamp voltage	D.VCSTH	2.4	2.8	3.2	V	
Low CST clamp voltage	D.VCSTL	0.88	1.1	1.32	V	

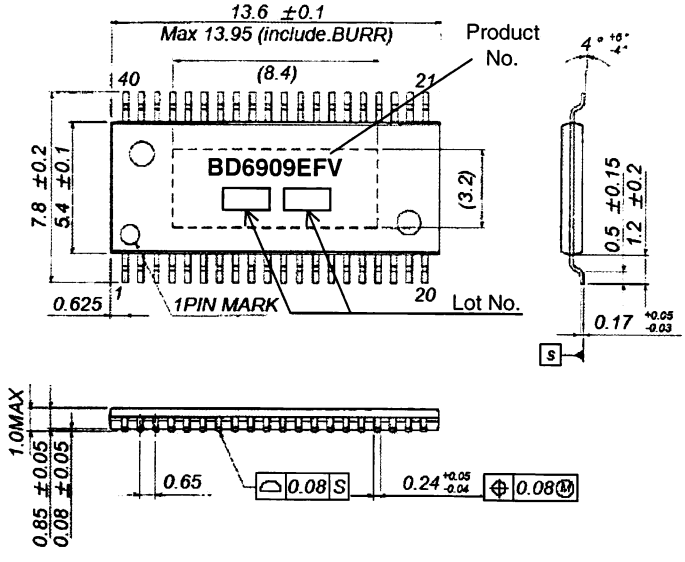
※Source currents are treated as negative while sinking currents are treated as positive.

○Electrical characteristics (Unless otherwise specified, VCC=5V, VG=17V, C.VM=12V, DL.VM=12V)

Parameter	Symbol	Limit			Unit	Conditions
		Min.	Typ.	Max.		
PG Amp						
Input bias current	DIPG-	-	0.1	0.25	μA	PG-=GND
DC bias voltage	D.VBP	2.25	2.5	2.75	V	D.PG-=D.PGOUT
Voltage gain 1	D.AV1	17.5	18.8	-	dB	f=1KHz
High output voltage	D.VOHP	3.4	3.75	-	V	IOH=-1mA
Low output voltage	D.VOLP	-	1.2	1.6	V	IOL=1mA
HYS Amp						
Hysteresis width	D.VHYSP	-125	-100	-75	mV	
PFG pin						
High output voltage	D.VPFGH	4.5	-	-	V	IO=-30μA
Medium output voltage	D.VPFGM	2.25	-	2.75	V	IO=±10μA
Low output voltage	D.VPFGL	-	-	0.5	V	IO=30μA
[Loading block]						
High level LIN input	L.VLINH	4.0	-	-	V	Loading: Forward rotation
Medium level LIN input	L.VLINM	2.3	-	2.7	V	Loading: Brake
Low level LIN input	L.VLINL	-	-	1.0	V	Loading: Reverse rotation
LIN sinking current	L.ILIN	-	150	215	μA	LIN=VCC
LIN source current	L.ILOUT	-	-150	-215	μA	LIN=GND
LIN bias current	L.VLINB	2.35	2.5	2.65	V	
Output saturation voltage	L.VCE	0.33	0.66	0.95	V	Io=400mA, total of output transistor high-side and low-side voltage

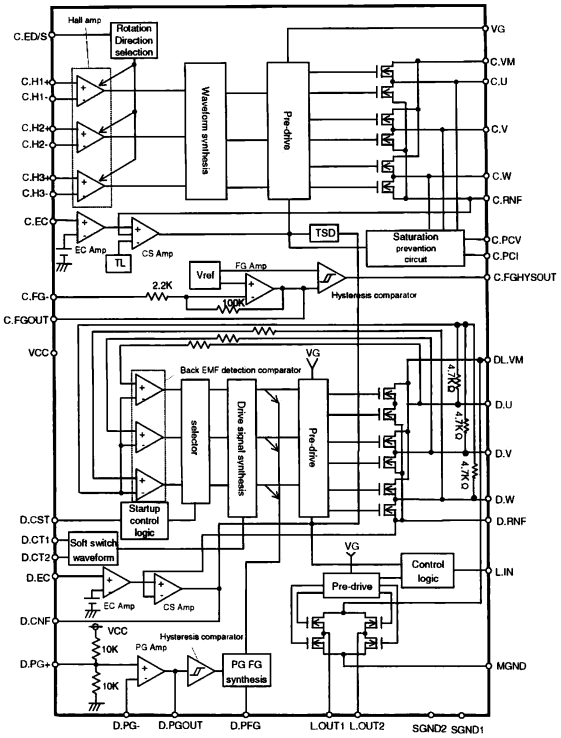
※Source currents are treated as negative while sinking currents are treated as positive.

○Package outline



HTSSOP-B40 (Unit:mm)

○Block diagram



○Pin No. / Pin name

Pin No.	Pin name	Pin No.	Pin name
1	L.OUT1	21	C.ED/S
2	L.OUT2	22	C.FGOUT
3	D.W	23	C.PCV
4	D.RNF	24	C.FGHYSOUT
5	D.V	25	C.FG-
6	D.U	26	VCC
7	DL.VM	27	C.PCI
8	D.PG+	28	SGND2
9	D.PG-	29	C.H3-
10	D.PGOUT	30	C.H3+
11	VG	31	C.H1-
12	D.PFG	32	C.H1+
13	D.EC	33	C.H2-
14	L.IN	34	C.H2+
15	D.CNF	35	C.VM
16	SGND1	36	C.U
17	D.CT2	37	C.V
18	D.CT1	38	C.RNF
19	D.CST	39	C.W
20	C.EC	40	MGND

○Operation Notes

(1) Absolute maximum ratings

Use of the IC in excess of absolute maximum ratings such as the applied voltage 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. The implementation of a physical safety measure such as a fuse should be considered when use of the IC in a special mode where the absolute maximum ratings may be exceeded is anticipated.

(2) Power supply lines

Regenerated current may flow as a result of the motor's back electromotive force. Insert capacitors between the power supply and ground pins to serve as a route for regenerated current. Determine the capacitance in full consideration of all the characteristics of the electrolytic capacitor, because the electrolytic capacitor may loose some capacitance at low temperatures. 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) Ground potential

Ensure a minimum GND pin potential in all operating conditions.

(4) Setting of heat

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.

(5) Actions in strong magnetic field

Use caution when using the IC in the presence of a strong magnetic field as doing so may cause the IC to malfunction.

(6) ASO

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

(7) Thermal shutdown circuit

This IC incorporates a TSD (thermal shutdown) circuit (TSD circuit). If the temperature of the chip reaches the following temperature, the motor coil output will be opened.The thermal shutdown circuit (TSD circuit) is designed only to shut the IC off to prevent runaway thermal operation. It is not designed to protect the IC or guarantee its operation. Do not continue to use the IC after operating this circuit or use the IC in an environment where the operation of this circuit is assumed.

TSD on temperature [°C] (typ.)	Hysteresis temperature [°C] (typ.)
170	20

(8) Ground Wiring Pattern

When using both small signal and large current GND patterns, it is recommended to isolate the two ground patterns, placing a single ground point at the application's reference point 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.

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