UTC A9849 LINEAR INTEGRATED CIRCUIT

3-phase motor driver for CD-ROMs

DESCRIPTION

The UTC A9849 is ICs developed for CD-ROM spindle motor drives. These ICs possess a short brake and reverserotation brake for two types of brake functions, and also contain FG output and rotation direction detection (FR) circuits,making them high-functionality and high-performance ICs.

FEATURES

* Three-phase, full-wave, pseudo-linear drive system.
* Built-in power save and thermal shutdown functions.
* Built-in current limiter and Hall bias circuits.
* Built-in FG output.
* Built-in rotation direction detector.
* Built-in reverse rotation prevention circuit.
* Built-in short brake pin.

APPLICATION

* CD-ROM, CD-R, CD-RW, DVD-ROM, and DVD-RAM

ABSOLUTE MAXIMUM RATINGS(Ta =25°C)

PARAMETER	SYMBOL	VALUE	UNIT
Applied Voltage (with 5V Power Supply)	Vcc	7	V
Applied Voltage (motor Power Supply1)	V_{M1}	16	V
Applied Voltage (motor Power Supply2)	V_{M2}	16	V
Power Dissipation	Pd	2200(note1)	mW
Operating Temperature	Topr	-20 ~ 75	°C
Storage Temperature	Tstg	-55 ~ 15 (Note 2)	°C
Output Current	Io	1300 (Note 3)	mA

Note 1:Reduced by 17.6mW for increase for Ta of 1°C over 25°C

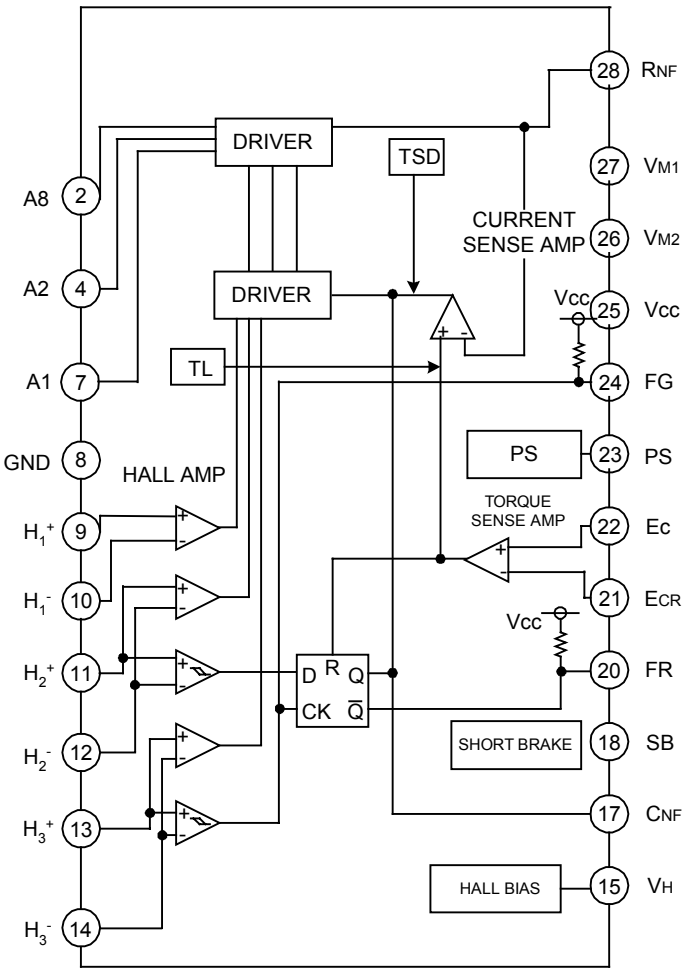
Note 2:Tj should not exceed 150°C

Note 3:Tj should not exceed Pd or ASO value.

RECOMMENDED OPERATING CONDITIONS(Ta =25°C)

PARAMETER	SYMBOL	MIN	MAX	UNIT
Power Supply Voltage	Vcc	4.25	5.5	V
	V_{M1}	3.0	15	V
	V_{M2}	3.0	15	V

BLOCK DIAGRAM



PIN DESCRIPTIONS

PIN NO.	PIN NAME	FUNCTOIN
2	A3	Output
4	A2	Output
7	A1	Output
8	GND	GND
9	$H1^+$	Hall Signal Input
10	$H1^-$	Hall Signal Input
11	$H2^+$	Hall Signal Input
12	$H2^-$	Hall Signal Input
13	$H3^+$	Hall Signal Input
14	$H3^-$	Hall Signal Input
15	V_H	Hall Bias
17	C_{NF}	For connection of phase compensation capacitor
18	SB	Short brake
20	FR	Rotation direction detection
21	E_{CR}	Output voltage control reference
22	E_C	Output voltage control
23	PS	Power save
24	FG	FG signal output
25	Vcc	Power Supply
26	V_{M2}	Motor Power Supply 2
27	V_{M1}	Motor Power Supply 1
28	R_{NF}	For connection of output current detection resistor
FIN	-	SUB GND

INPUT/OUTPUT CIRCUIT

(1) Power save

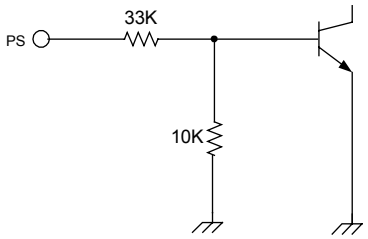


Fig.1

(2) Torque command input

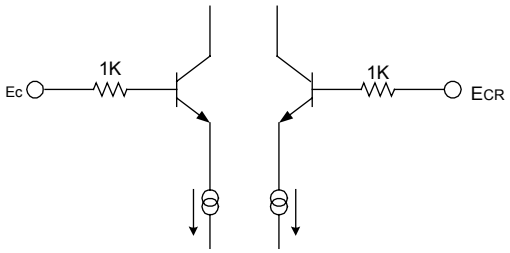


Fig.2

(3) Torque output (A1,A2,and A3)

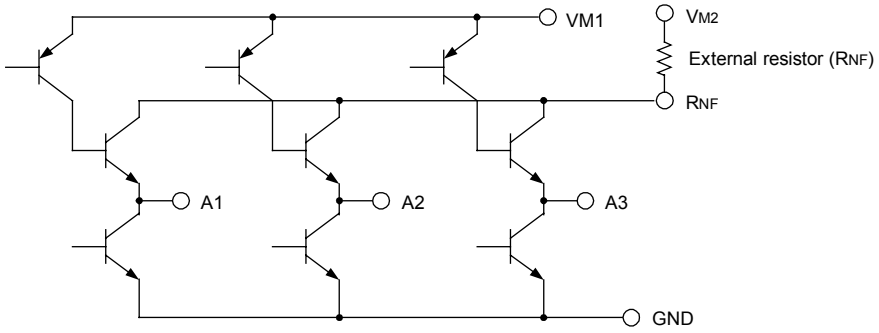


Fig.3

(4) Hall input (H1+,H1-,H2+,H2-,H3+,H3-)

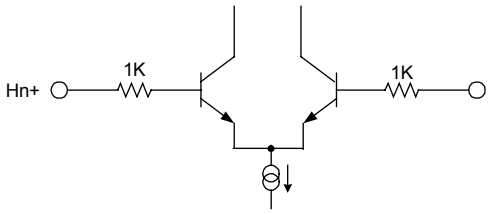


Fig.4

Note: Resistance values are typical values.

(5) Hall Bias

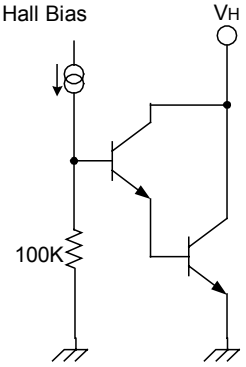


Fig.5

(6) FG output

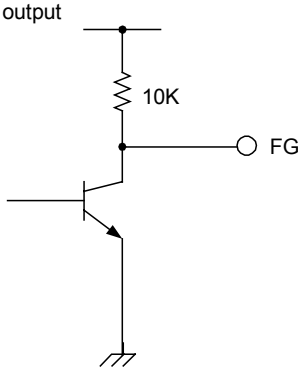


Fig.6

(7) FR output

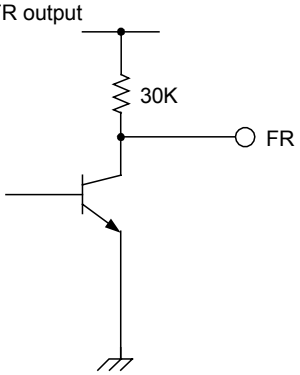


Fig.7

(8) Short brake

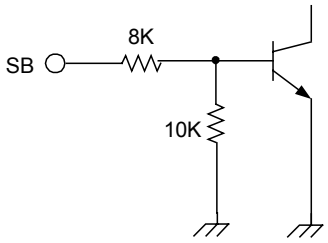


Fig.8

Note: Resistance values are typical values.

ELECTRICAL CHARACTERISTICS

(Ta =25°C ,V_{CC}=5V,V_{M1}=12V,V_{M2}=12V,UNLESS OTHERWISE NOTED.)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP.	MAX	UNIT
Total device						
Circuit current 1	Icc1	In the power save ON state		0	0.2	mA
Circuit current 2	Icc2	In the power save OFF state		4.1	6.5	mA
Power save						
ON voltage range	V_{PSON}				1.5	V
OFF voltage range	V_{PSOFF}		3.5			V
Hall bias						
Hall bias voltage	V_{HB}	I_{HB}=10mA	0.5	0.9	1.5	V
Hall amplifier						
Input bias current	I_{HA}			0.7	3.0	μA
Same phase input voltage range	V_{HAR}		1.5		4.0	V
Minimum input level	V_{INH}		50			mVp-p
H3 hysteresis levle	V_{HYS}		10	20	40	mV
Torque command						
Input Voltage range	E_C		1.0		4.0	V
"-"offset voltage	E_{COFF-}	E_{CR}=2.5V	-80	-50	-20	mV
"+"offset voltage	E_{COFF+}	E_{CR}=2.5V	20	50	80	mV
Input Bias Current	E_{CIN}	E_{CR}= E_C		0.5	2.0	μA
I/O gain	G_{EC}	E_C=1.5V,2.0V	0.41	0.51	0.61	A/V
FG						
FG Output high level voltage	V_{FGH}	I_{FG}= -20μA	4.5	4.8		V
FG Output low level voltage	V_{FGL}	I_{FG}=3mA	0	0.25	0.4	V
Duty (reference value)	DU			50		%
Rotation detection						
FR output high level voltage	V_{FRH}	V_{FRH}= -20μA	4.1	4.4		V
FR output low level voltage	V_{FRL}	I_{FR}= 3A	0	0.25	0.4	V
Output						
Output saturation high level voltage	V_{OH}	I_O= -600mA		1.0	1.5	V
Output saturation low level voltage	V_{OL}	I_O= 600mA		0.4	0.8	V
Pre-drive current	I_{VML}	E_C=0V output open		35	70	mA
Output limit current	I_{TL}		560	700	840	mA
Short brake						
On voltage range	V_{SBON}		3.5			V
OFF voltage range	V_{SBOFF}				1.5	V

* Not designed forradiation resistance.

Circuit operation

(1) Hall input to coil output

The phase relationship between the Hall input signals and the output current and voltage is shown in Fig.9. The motor position data input via the Hall pins is amplified by the Hall amplifier, and formed into waveforms by the matrix block.These signals are input to the output driver that supplies the drive current to the motor coils.

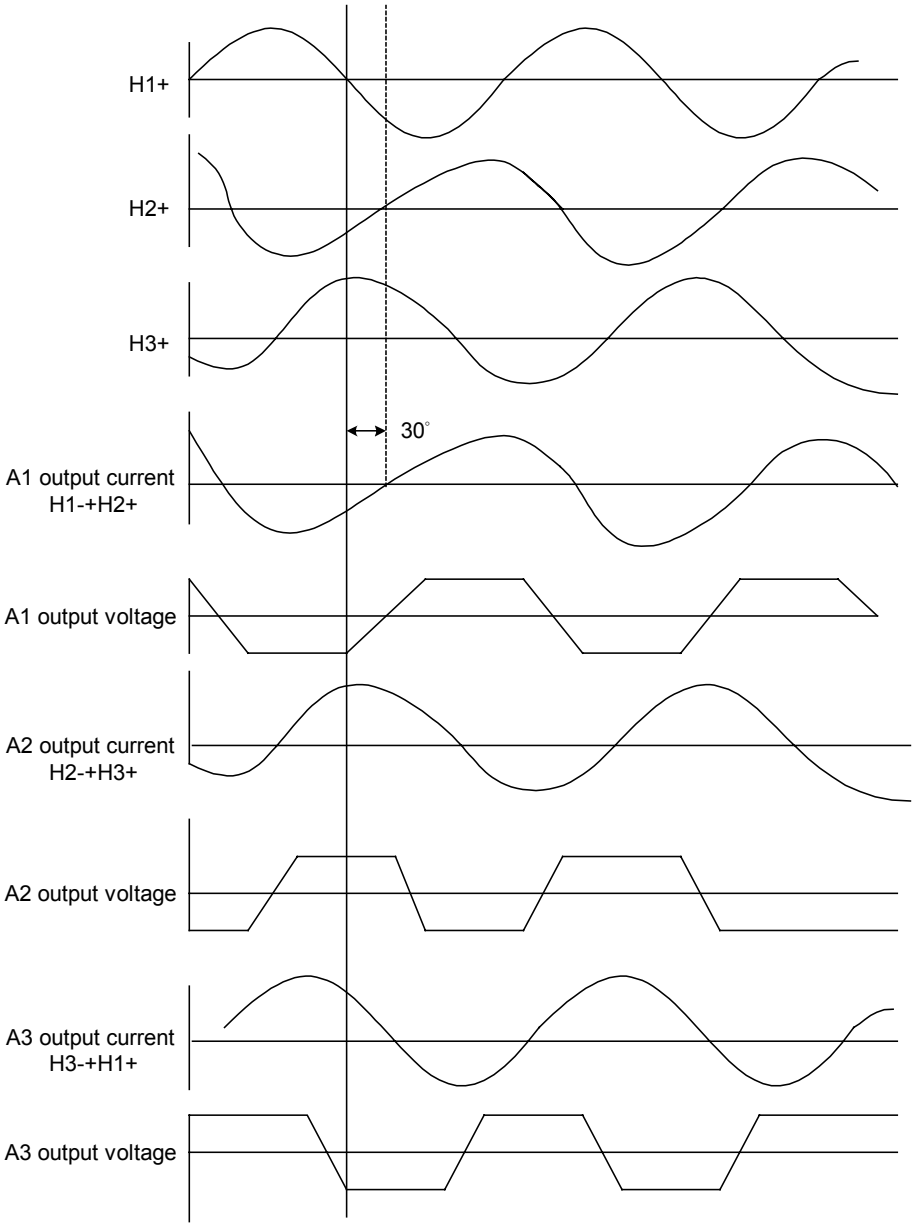


Fig.9

(2) Torque command
The R_{NF} pin voltage with respect to the torque command (E_C) is as follows:

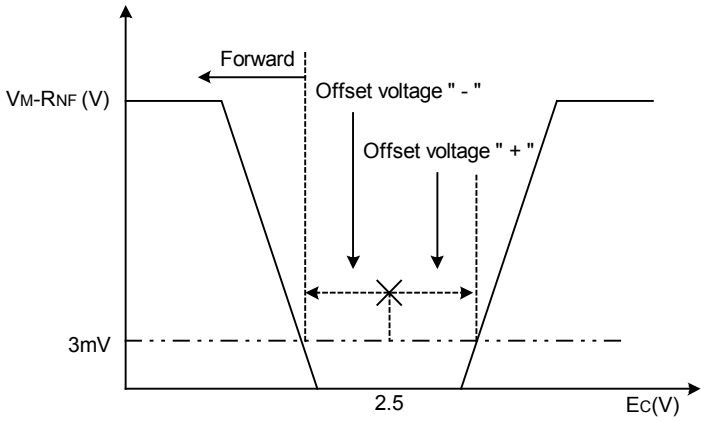


Fig.10

The I / O gain (G_{EC}) from the E_C pin to the RNF pin (output current) is determined by the R_{NF} detector resistor.

$G_{EC} = 0.255 / R_{NF}$ [A / V]

The torque limit current ITL is given by:

$I_{TL} = 0.35 / R_{NF}$ [A]

	ROTATION DIRECTION
Ec<ECR	FORWARD
Ec>ECR	REVERSE*

*Stops after detecting reverse

(3) Reverse rotation detection function

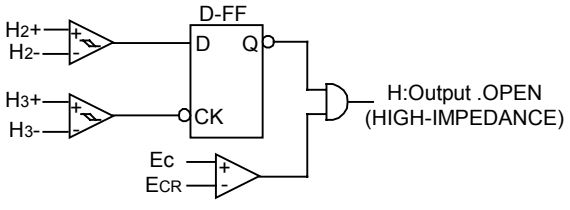


Fig.11

	FR SIGNAL OUTPUT PIN
FORWARD	L
REVERSE	H

The reverse detection circuit construction is shown in Fig.11.
1) Forward ($E_C < E_{CR}$)
The phase relationship between the Hall input signals H2+ and H3+ becomes as shown in Fig.9, and the reverse rotation detection circuit does not operate.
2) Reverse ($E_C > E_{CR}$)
The phase relationship between the signals H2+ and H3+ is opposite that for forward operation, and the reverse rotation detection circuit operates. The output goes OFF, and becomes open circuit.
(4) Short brake
When 3.5V or more is applied to the short brake pin, the upper-side output transistors of all go off, and the lowerside output transistors go on. Short braking operates regardless of the torque command signal.
(5) Other circuits
When 3.5V or more is applied to the power save pin, all circuits are on. When 1.5V or less is applied, the IC enters power save mode. Also, the Hall bias pins turn on and off with the power save pin.

Application example

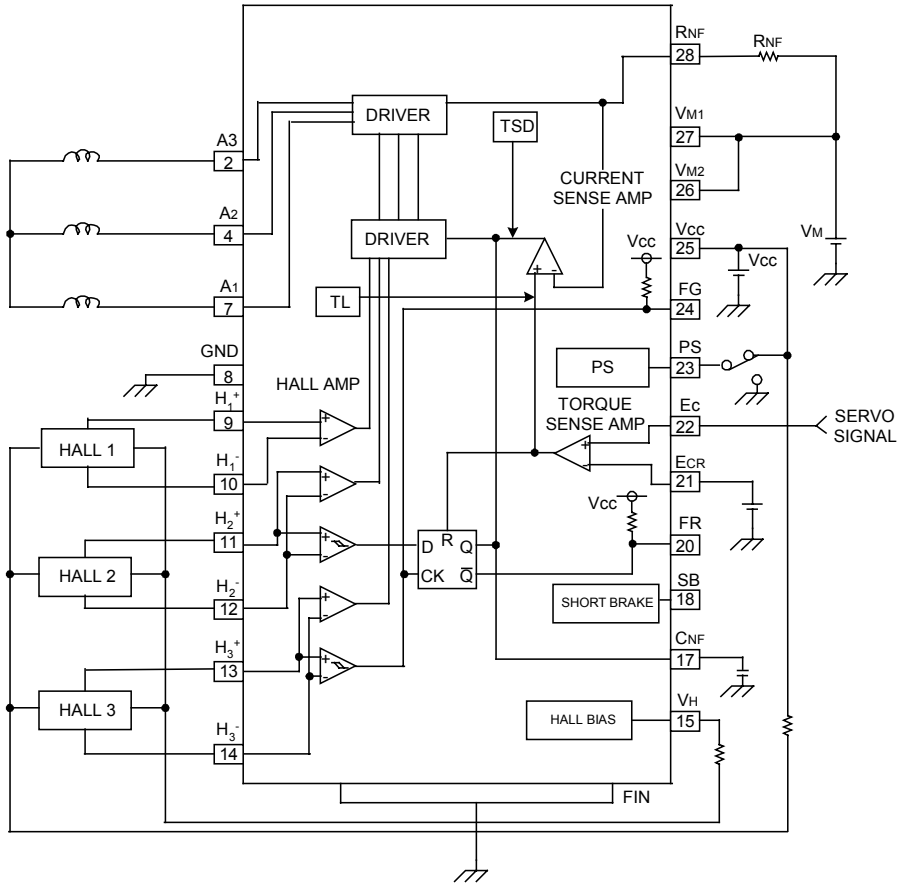


Fig.12

*Operation notes

(1) Power save

The power save input is an I / O circuit like the own shown in Fig.1.

The thermal derating characteristics of the power save pin is –8mV / °C, and the resistance will fluctuate between

±30% so be careful of the input voltage range.

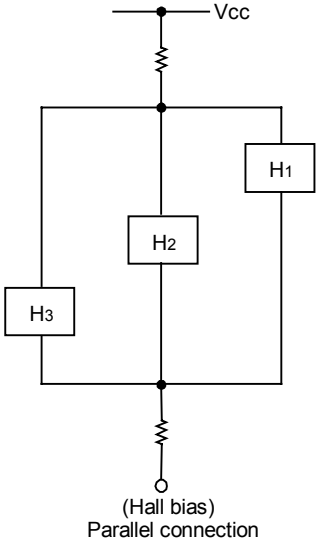
(2) Hall input

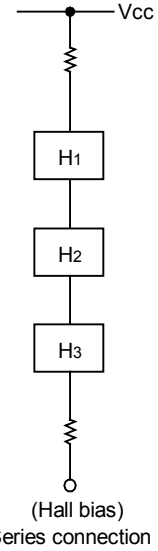
The input circuit shown in Fig.4 is used for the Hall inputs.

The Hall elements can be connected either in series or in parallel.

(3) Thermal shutdown (TSD)

When the junction temperature reaches 175°C, the A1, A2, and A3 coil outputs go open circuit. The thermal shutdown has approximately 15°C of hysteresis.





ELECTRICAL CHARACTERISTIC CURVES

Figure.14 Package Derating Characteristics

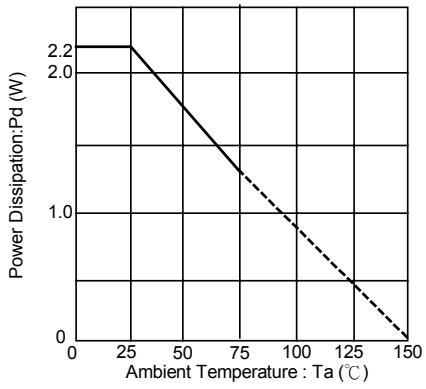


Figure.15 Power Supply Current vs.Power Supply Voltage

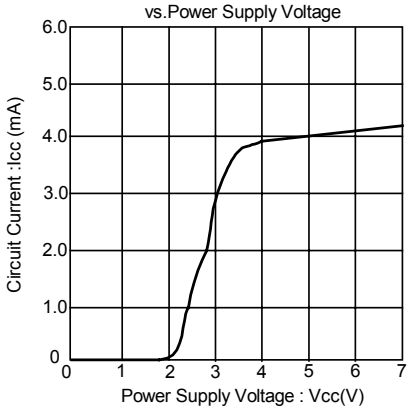


Figure.16 Upper-side Output Saturation Voltage vs.Output Current

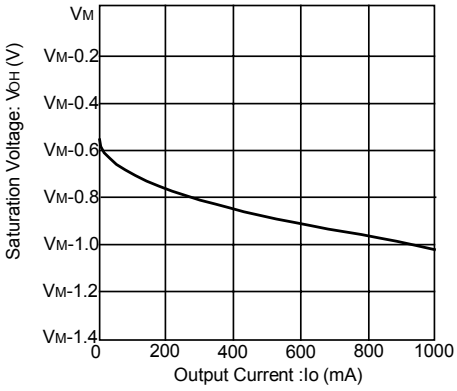


Figure.17 Low -side Output Saturation Voltage vs.Output Current