Ordering number : EN5976A

Monolithic Digital IC

LB1995

Three-Phase Brushless Motor Driver for CD-ROM Spindle Drive

Overview

The LB1995 is a three-phase brushless motor driver especially suited for CD-ROM spindle motor drives.

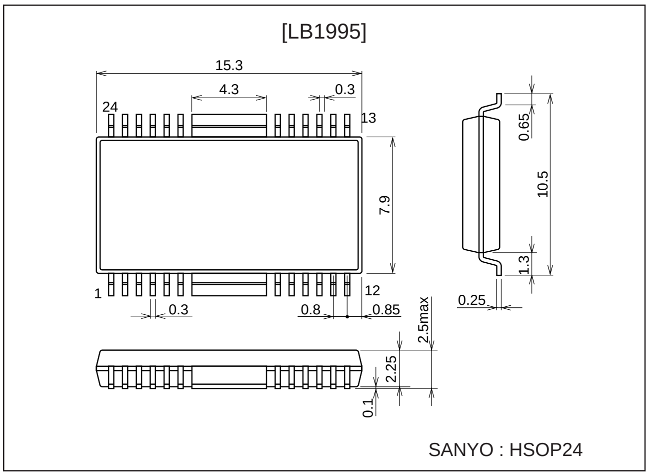
Functions

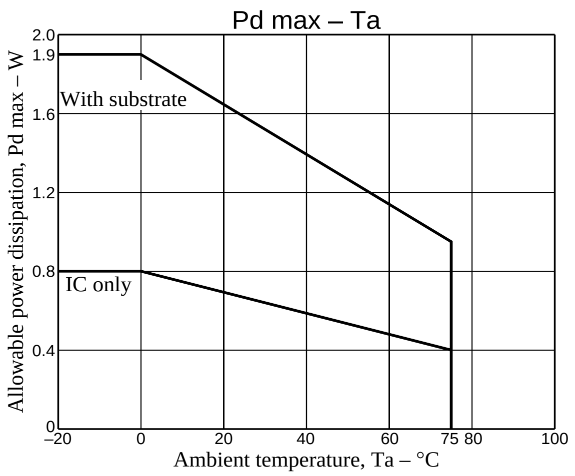
- Current linear drive
- Control V type amplifier with single side control switching pin
- Separate power supply for output upper side bias circuit allows low output saturation by boosting this power supply only (useful for 5V power supply types).
- Upper side current detection technique reduces loss voltage of current detection resistor. Voltage effect of this resistor reduces internal current drain of IC.
- Built-in short braking circuit
- Built-in reverse blocking circuit
- Hall FG output
- Built-in S/S function
- Built-in current limiter circuit
- Built-in Hall power supply
- Built-in thermal shutdown circuit

Package Dimensions

unit: mm

3227-HSOP24





- Any and all SANYO products described or contained herein do not have specifications that can handle applications that require extremely high levels of reliability, such as life-support systems, aircraft's control systems, or other applications whose failure can be reasonably expected to result in serious physical and/or material damage. Consult with your SANYO representative nearest you before using any SANYO products described or contained herein in such applications.
- SANYO assumes no responsibility for equipment failures that result from using products at values that exceed, even momentarily, rated values (such as maximum ratings, operating condition ranges, or other parameters) listed in products specifications of any and all SANYO products described or contained herein.

SANYO Electric Co.,Ltd. Semiconductor Company
TOKYO OFFICE Tokyo Bldg., 1-10, 1 Chome, Ueno, Taito-ku, TOKYO, 110-8534 JAPAN

Specifications

Maximum Ratings at Ta = 25°C

Parameter	Symbol	Conditions	Ratings	Unit
Power supply voltage	$V_{CC}1$ max		7.0	V
	$V_{CC}2$ max		14.4	V
	$V_{CC}3$ max		14.4	V
Applied output voltage	V_O max		14.4	V
Applied intput voltage	V_{IN} max		$V_{CC}1$	V
Output current	I_O max		1.3	A
Allowable power dissipation	Pd max	IC only	0.8	W
		with substrate (114.3 × 76.1 × 1.6 mm³, glass exposy)	1.9	W
Operating temperature	Topr		–20 to +75	˚C
Storage temperature	Tstg		–55 to +150	˚C

Operating Conditions at Ta = 25°C

Parameter	Symbol	Conditions	Ratings	Unit
Power supply voltage	$V_{CC}1$		4 to 6	V
	$V_{CC}2$	$\geq V_{CC}1$	4 to 13.6	V
	$V_{CC}3$		4 to 13.6	V

Sample Application at Ta = 25°C

Parameter	Symbol	Conditions	Ratings	Unit
12V type	$V_{CC}1$	Regulated voltage	4 to 6	V
	$V_{CC}2 = V_{CC}3$	Unregulated voltage	4 to 13.6	V
5V type	$V_{CC}1 = V_{CC}3$	Regulated voltage	4 to 6	V
	$V_{CC}2$	Boost-up voltage or regulated voltage (Note)	4 to 13.6	V

Note: When boost-up voltage is used at $V_{CC}2$, output can be set to low-saturation.

Electrical Characteristics at Ta = 25°C, $V_{CC}1$ = 5V, $V_{CC}2$ = $V_{CC}3$ = 12V

Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
[Power supply current]						
Power supply current	$I_{CC}1$	$V_C = V_{CREF}$		8		mA
	$I_{CC}2$	$V_C = V_{CREF}$		0		mA
	$I_{CC}3$	$V_C = V_{CREF}$		150	250	µA
Output idle current	$I_{CC}1OQ$	$V_{S/S}$ = 0V			200	µA
	$I_{CC}2OQ$	$V_{S/S}$ = 0V			30	µA
	$I_{CC}3OQ$	$V_{S/S}$ = 0V			30	µA
[Output]						
Saturation voltage, upper side 1	$V_{OU}1$	I_O = –0.5A, $V_{CC}1$ = 5V, $V_{CC}2$ = $V_{CC}3$ = 12V		1.0		V
lower side 1	$V_{OD}1$	I_O = 0.5A, $V_{CC}1$ = 5V, $V_{CC}2$ = $V_{CC}3$ = 12V		0.3		V
Saturation voltage, upper side 2	$V_{OU}2$	I_O = –0.5A, $V_{CC}1$ = $V_{CC}3$ = 5V, $V_{CC}2$ = 12V		0.3		V
lower side 2	$V_{OD}2$	I_O = 0.5A, $V_{CC}1$ = $V_{CC}3$ = 5V, $V_{CC}2$ = 12V		0.3		V
Current limiter setting voltage	V_{CL}	R_{RF} = 0.43Ω		0.37		V
[Hall amplifier]						
Common mode input voltage range	V_{HCOM}		1.2		V_{CC}–1.0	V
Input bias current	I_{HIB}			1		µA
Minimum Hall input level	V_{HIN}		60			mV_{P-P}
[S/S pin]						
High level voltage	$V_{S/SH}$		2.0		$V_{CC}1$	V
Low level voltage	$V_{S/SL}$				0.7	V
Input current	$I_{S/SI}$	$V_{S/S}$ = 5V			200	µA
Leak current	$I_{S/SL}$	$V_{S/S}$ = 0V	–30			µA
[Control]						
V_C pin input current	I_{VC}	$V_C = V_{CREF}$ = 2.5V		1		µA
V_{CREF} pin input current	I_{VCREF}	$V_C = V_{CREF}$ = 2.5V		1		µA
Voltage gain	GV_{CO}	$\Delta V_{RF}/\Delta V_C$		0.25		times
Startup voltage	V_{CTH}	V_{CREF} = 2.5V	2.35		2.65	V
Startup voltage width	ΔV_{CTH}	V_{CREF} = 2.5V	50		150	mV
[Hall power supply]						
Hall power supply voltage	V_H	I_H = 5 mA		0.8		V
Allowable current	I_H		20			mA
[Thermal shutdown]						
Operating temperature	T_{TSD}	Design target value	150	180	210	°C
Hysterisis	ΔT_{TSD}	Design target value		15		°C
[Short braking]						
Brake pin at High level	V_{BRH}		4		5	V
Brake pin at Low level	V_{BRL}		0		1	V
[Control switching]						
CC pin at High level	V_{CCH}		4		5	V
CC pin at Low level	V_{CCL}		0		1	V

Note:

- During S/S OFF (standby), the Hall comparator is at High.
- Design target values are not measured.

Truth Table

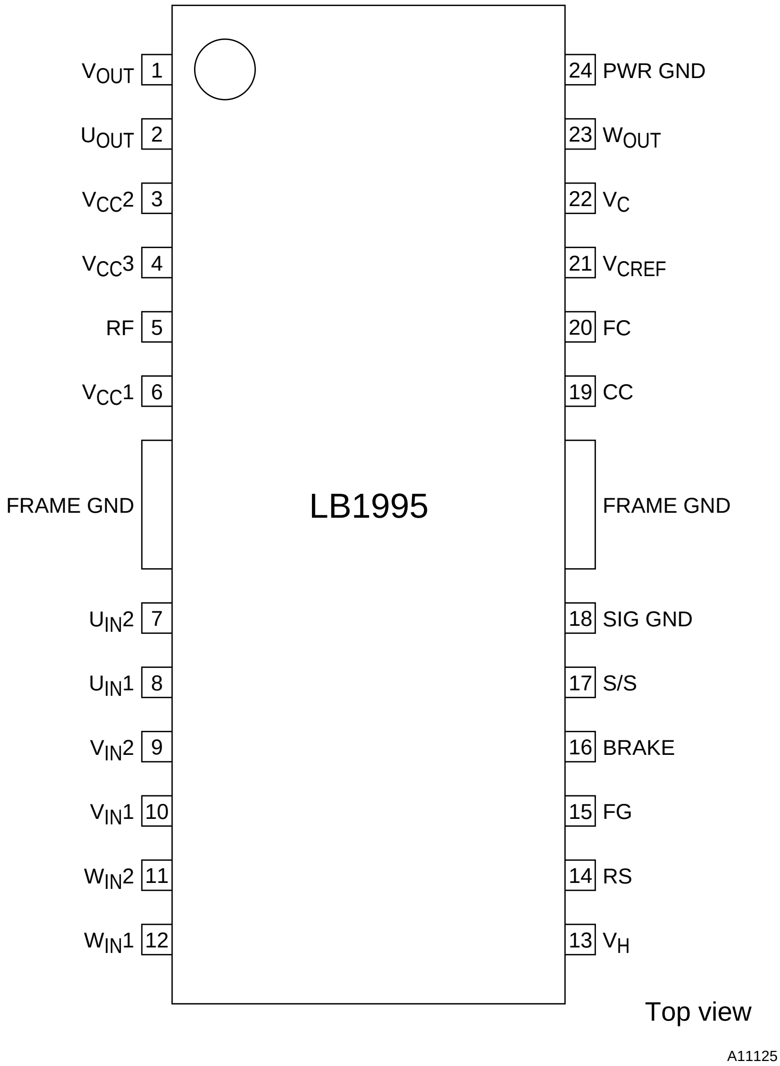
	Source –> Sink	Hall input U	Hall input V	Hall input W	Control V_C
1	Phase W –> Phase V	H	H	L	H
	Phase V –> Phase W				L
2	Phase W –> Phase U	H	L	L	H
	Phase U –> Phase W				L
3	Phase V –> Phase W	L	L	H	H
	Phase W –> Phase V				L
4	Phase U –> Phase V	L	H	L	H
	Phase V –> Phase U				L
5	Phase V –> Phase U	H	L	H	H
	Phase U –> Phase V				L
6	Phase U –> Phase W	L	H	H	H
	Phase W –> Phase U				L

Input:

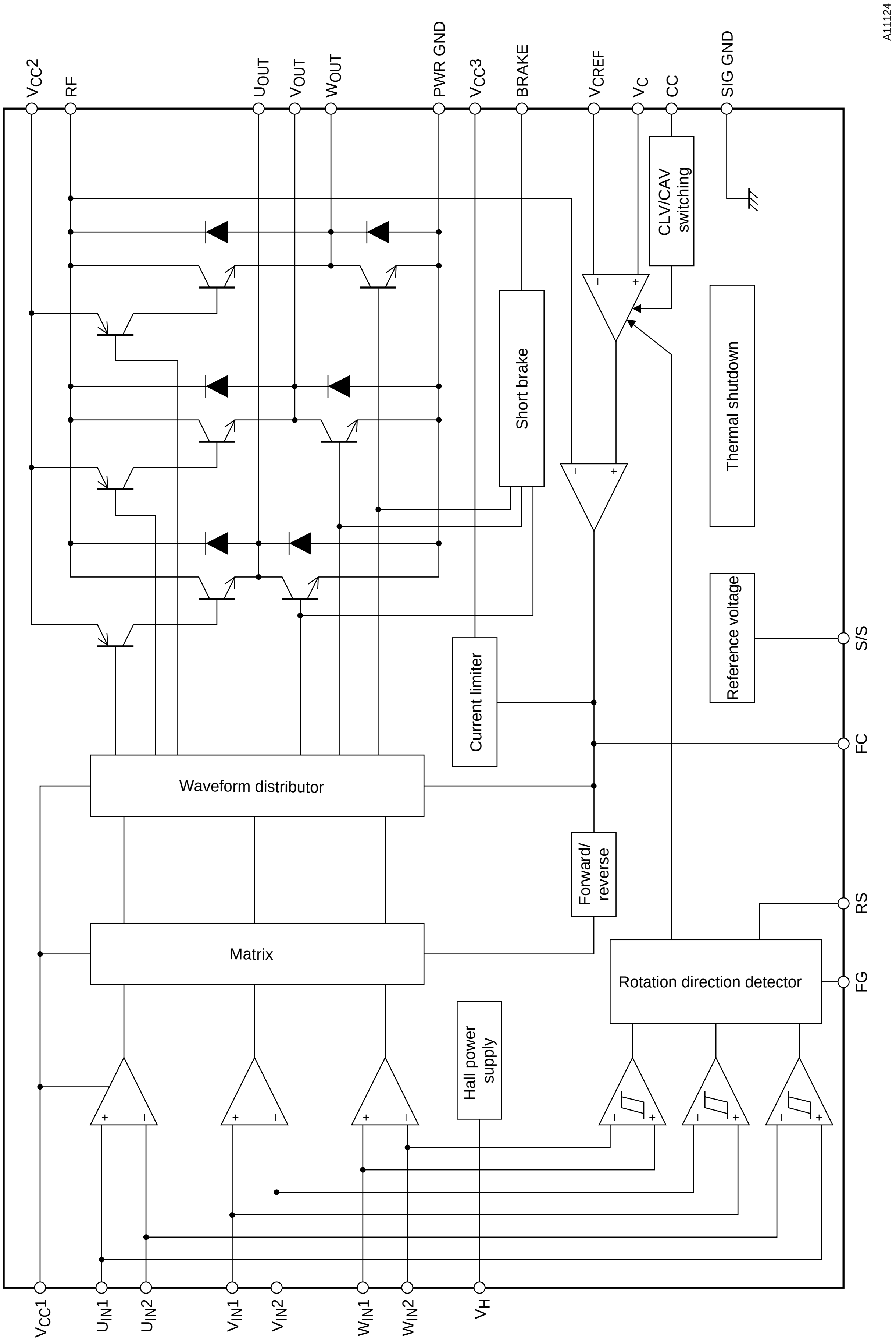
H: Input 1 is higher in potential than input 2 by at least 0.2V.

L: Input 1 is lower in potential than input 2 by at least 0.2V.

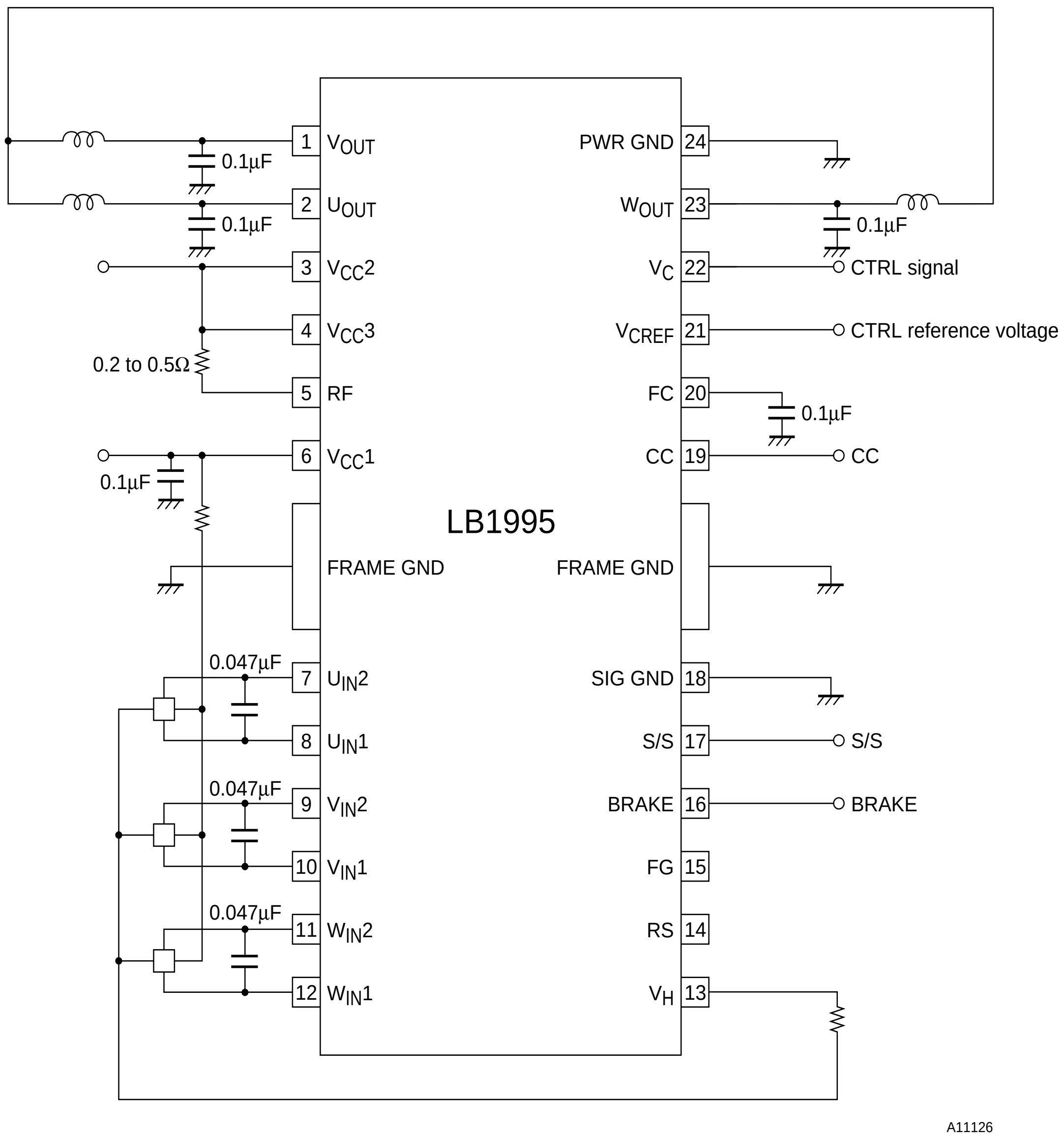
Pin Assignment



Block Diagram



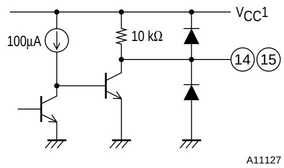
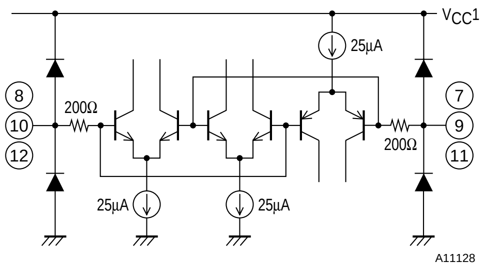
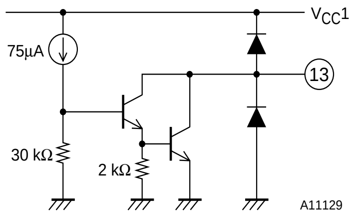
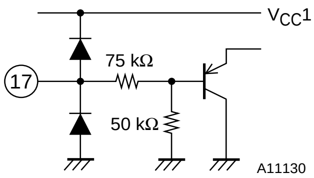
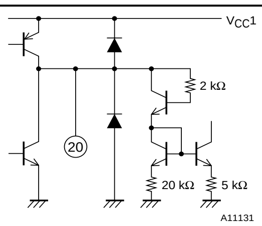
Sample Application Circuit



Power supply - GND
Output - GND
Between Hall inputs

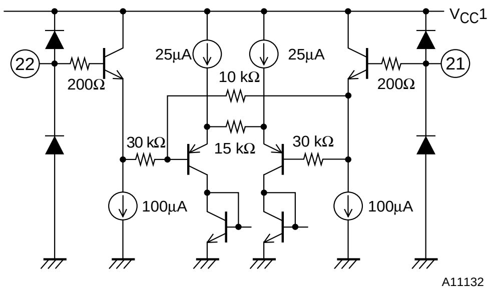
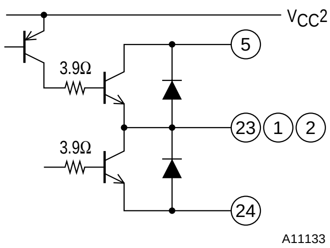
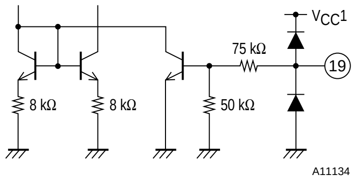
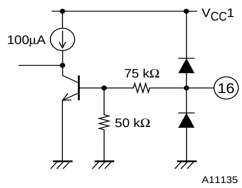
Capacitor requirements may change depending on motor.
For some motors, capacitor between Hall inputs may not be needed.

Pin Descriptions

Pin number	Pin name	Pin voltage	Equivalent circuit	Pin function
3	$V_{CC}2$	4V to 13.6V		Source side predrive voltage supply pin
4	$V_{CC}3$	4V to 13.6V		Constant current control amplifier voltage supply pin
6	$V_{CC}1$	4V to 6V		Power supply pin for all circuits except output transistors, source predriver, and low current control amplifier
14	RS			Reverse detector pin Forward rotation: High Reverse rotation: Low
15	FG			1 Hall element waveform Schmitt comparator composite output
8 7	$U_{IN}1$ $U_{IN}2$	1.2V to $V_{CC}1$–1V		U phase Hall element input and reverse detector U phase Schmitt comparator input pin Logic High indicates $U_{IN}1 > U_{IN}2$.
10 9	$V_{IN}1$ $V_{IN}2$			V phase Hall element input and reverse detector V phase Schmitt comparator input pin Logic High indicates $V_{IN}1 > V_{IN}2$.
12 11	$W_{IN}1$ $W_{IN}2$			W phase Hall element input and reverse detector W phase Schmitt comparator input pin Logic High indicates $W_{IN}1 > W_{IN}2$.
13	V_H			Hall element lower side bias voltage supply pin
17	S/S	0V to $V_{CC}1$		When this pin is at 0.7V or lower, or when it is open, all circuits are inactive. When driving motor, set this pin to 2V or higher.
18	SIG GND			GND pin for all circuits except output
20	FC			Control loop frequency compensator pin. Connecting a capacitor between this pin and GND prevents closed loop oscillation in current limiting circuitry.

Continued on next page

Continued from preceding page

Pin number	Pin name	Pin voltage	Equivalent circuit	Pin function
21	V_{CREF}	2V to 3V		Control reference voltage supply pin. Determines control start voltage.
22	V_C	0V to $V_{CC}1$		Speed control voltage supply pin V type control technique $V_C > V_{CREF}$: Forward $V_C < V_{CREF}$: Slowdown (Reverse-blocking circuit prevents reverse rotation.)
23	W_{OUT}			W phase output
24	PWR GND			Output transistor GND
1	V_{OUT}			V phase output
2	U_{OUT}			U phase output
5	RF			Upper side output PNP transistor collector pin (common for all 3 phases). For current detection, connect resistor between $V_{CC}3$ pin and RF pin. Constant current control and current limiter works by detecting this voltage.
19	CC			V type control/single-side control switching pin CC: High –> Single-side control Low/Open –> V type control
16	BRAKE			Short brake pin BRAKE: High –> Short brake operation Low/Open –> Motor drive operation

This catalog provides information as of June, 1999. Specifications and information herein are subject to change without notice.