Ordering number : EN8315

SANYO Semiconductors
DATA SHEET

Monolithic Digital IC

LB11699H — For CD-ROM Drives Spindle Motor Driver IC

Overview

The LB11699H is a spindle motor driver IC for CD-ROM drives.

Features

- Three-phase brushless motor driver

Functions

- Current linear drive
- Voltage controlled amplifier
- The use of high side current detection means that there is no loss (or voltage drop) due to the current detection resistor.
- Built-in short-circuit braking circuit
- Built-in reverse rotation prevention circuit
- Hall sensor FG output
- Built-in start/stop function
- Built-in current limiter circuit (adjustable)
- Built-in Hall sensor power supply
- Built-in thermal shutdown circuit
- Supports 3.3V DSPs
- Maximum current rating: 2.0A

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Specifications

Maximum Ratings at Ta = 25°C

Parameter	Symbol	Conditions	Ratings	Unit
Supply voltage1	$V_{CC}1$ max		7.0	V
Supply voltage 2	$V_{CC}2$ max		14.4	V
Output apply voltage	V_O max		14.4	V
Input apply voltage	V_I max		$V_{CC}1$	V
Output current	I_O max		2.0	A
Allowable internal power dissipation	Pd max	Independent IC	0.8	W
		When mounted on a circuit board *1	1.9	
Operating temperature	Topr		-20 to +75	°C
Storage temperature	Tstg		-55 to +150	°C

*1 Specified circuit board : 114.3 × 76.1 × 1.6mm^3, glass epoxy.

Operating Conditions at Ta = 25°C

Parameter	Symbol	Conditions	Ratings	Unit
Supply voltage 1	$V_{CC}1$		4 to 6	V
Supply voltage 2	$V_{CC}2$	≥ $V_{CC}1$	4 to 13.6	V

Application Example at Ta = 25°C

(1) 12V model

Power supply pin	Conditions	Ratings	Unit
$V_{CC}1$	Regulated voltage	4 to 6	V
$V_{CC}2$	Unregulated voltage	4 to 13.6	V

Electrical Characteristics at Ta = 25°C, $V_{CC}1$ = 5.0V, $V_{CC}2$ = 12V (unless otherwise specified)

Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
Supply Current						
Supply current 1	$I_{CC}1$	VC = VCREF		6.0	9.0	mA
Supply current 2	$I_{CC}2$	VC = VCREF			1.0	mA
Output stop current 1	$I_{CC}1OQ$	VS/S = 0V			200	µA
Output stop current 2	$I_{CC}2OQ$	VS/S = 0V			350	µA
Output Block						
High-side saturation voltage 1	VOU1	I_O = -0.5A		1.0	1.5	V
Low-side saturation voltage 1	VOD1	I_O = 0.5A		0.3	0.5	V
High-side saturation voltage 2	VOU2	I_O = -1.5A		1.1	1.8	V
Low-side saturation voltage 2	VOD2	I_O = 1.5A		0.6	1.2	V
Hall Sensor Amplifier Block						
Common-mode input voltage range	VHCOM		1.2		$V_{CC}1$ - 1.0	V
Input bias current	VHIB			1		µA
Hall sensor minimum input level	VHIN		60			mVp-p
S/S Pin						
High-level voltage	VS/SH		2.0		$V_{CC}1$	V
Low-level voltage	VS/SL				0.7	V
Input current	IS/SI	VS/S = 5V			200	µA
Leakage current	IS/SL	VS/S = 0V	-30			µA

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Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
Control Block						
VC pin input current	IVC	VC = VCREF = 1.65V	-1			μA
VCREF pin input current	IVCREF	VC = VCRE F= 1.65V	-1			μA
Voltage gain	GVCO	ΔVRF/ΔVC		0.4		Times/deg
Rising voltage	VCTH	VCREF = 1.65V	1.5		1.8	V
Rising voltage width	ΔVCTH	VCREF = 1.65V	50		150	mV
Hall Sensor Power Supply						
Hall sensor supply voltage	VH	I_H = 5mA		0.8		V
Allowable current	IH		20			mA
Thermal Shutdown Circuit						
Thermal shutdown operating temperature	TTSD	Design target value*	150	180	210	°C
Thermal shutdown temperature hysteresis	ΔTTSD	Design target value*		15		°C
Short-Circuit Braking						
BRAKE pin high-level voltage	VBRH		2.5		5	V
BRAKE pin low-level voltage	VBRL		0		1	V
Single Hall Sensor/Three Hall Sensor FG Switching						
FGSEL pin high-level voltage	VFSH		2.5		5	V
FGSEL pin low-level voltage	VFSL		0		1	V
Current Limiter Setting						
Current limiter set voltage	VCL1	REF = 0.39Ω, VLMC = VREF		0.4		V
VLMC pin input voltage range	VLMCC	Design target value*	0		1.3	V
Reference voltage	VREF	IVREF =10μA		1.25		V

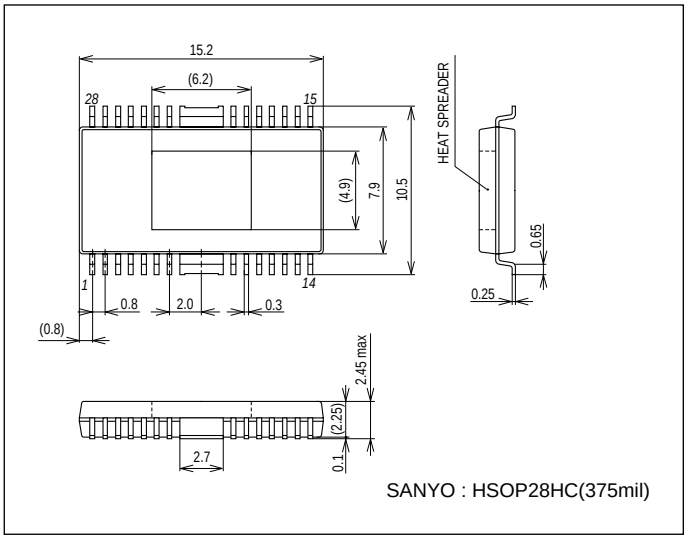
Note: The Hall comparator output goes to the high level when the S/S pin is in the off state (standby mode).

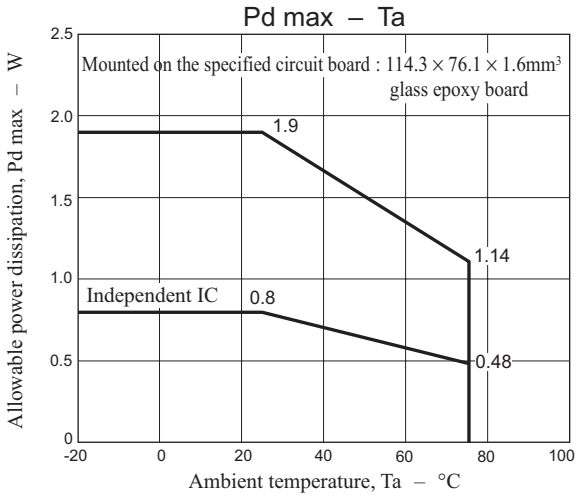
* The design specification items are design guarantees and are not measured.

Package Dimensions

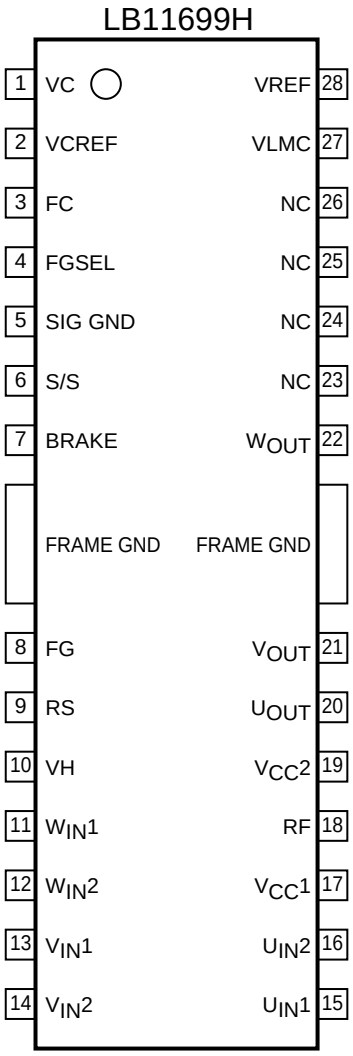
unit : mm (typ)

3234B





Pin Assignment



Top view

Truth Table

	Source → Sink	Input			Control voltage
		U	V	W	
1	W phase → V phase	High	High	Low	High
	V phase → W phase				Low
2	W phase → U phase	High	Low	Low	High
	U phase → W phase				Low
3	V phase → W phase	Low	Low	High	High
	W phase → V phase				Low
4	U phase → V phase	Low	High	Low	High
	V phase → U phase				Low
5	V phase → U phase	High	Low	High	High
	U phase → V phase				Low
6	U phase → W phase	Low	High	High	High
	W phase → U phase				Low

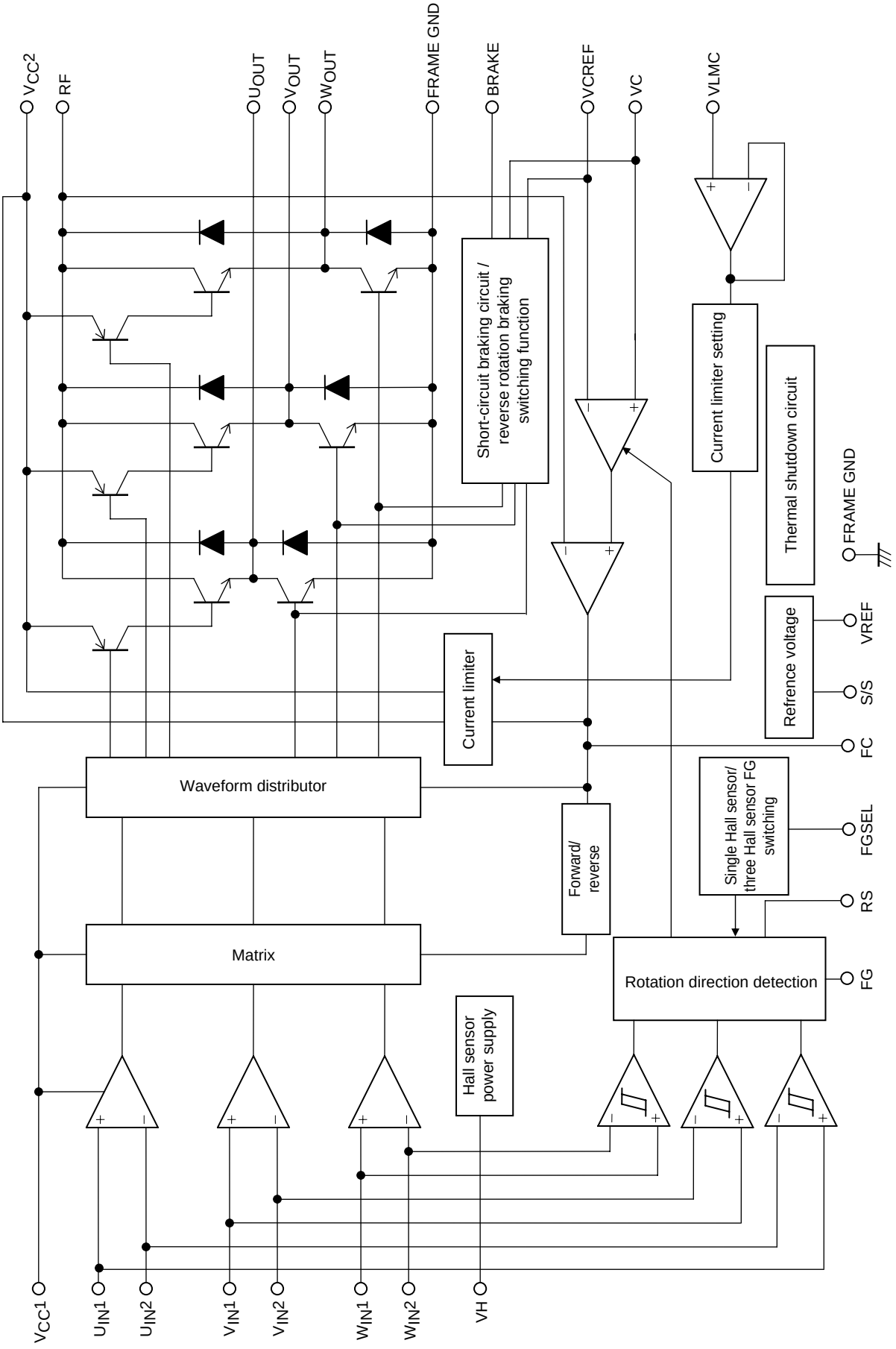
Input high: Input 1 is at least 0.2V higher than input 2 for a given phase.

Input low: Input 2 is at least 0.2V higher than input 1 for a given phase.

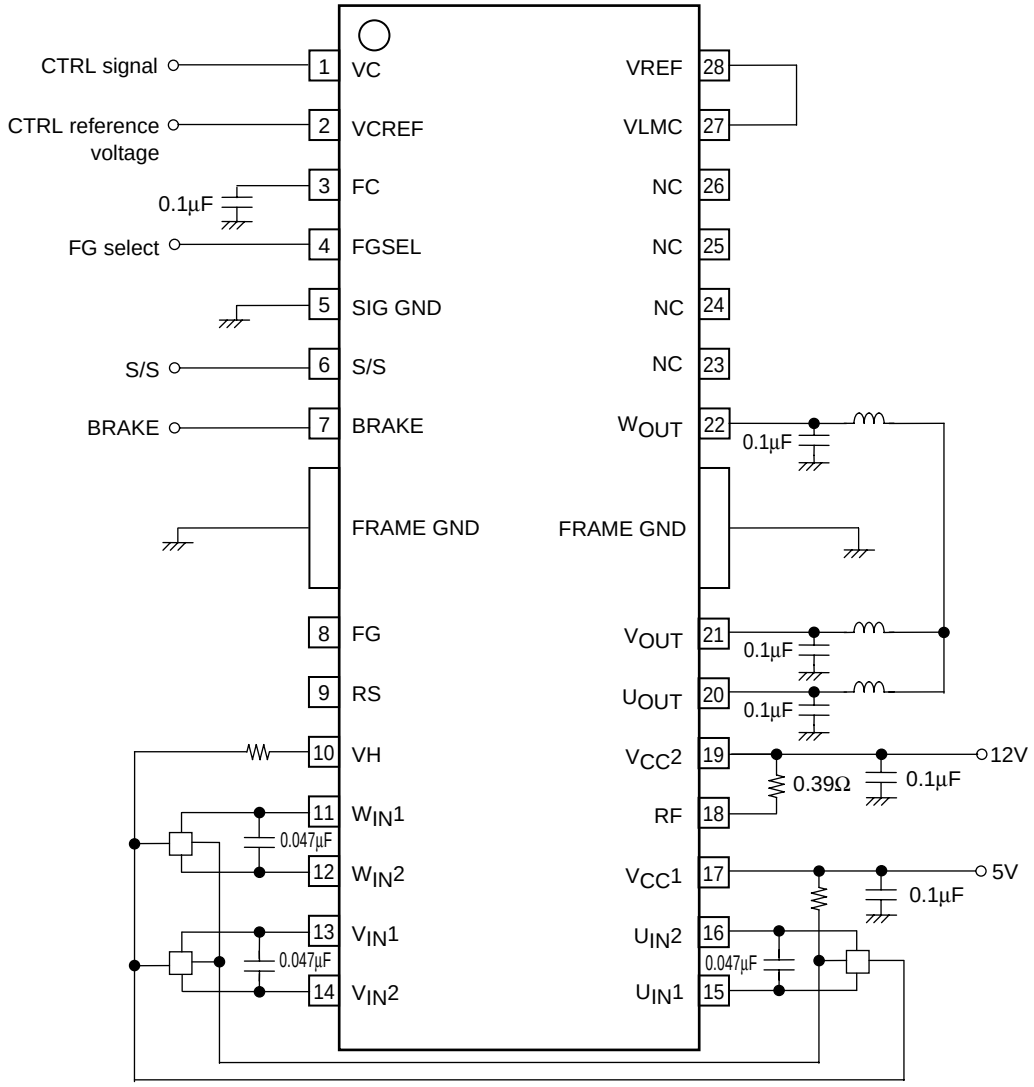
Brake Operation Truth Table

BRAKE pin	Operation at VC < VCREF
High	Short-circuit braking
Low or open	Reverse torque braking

Block Diagrams



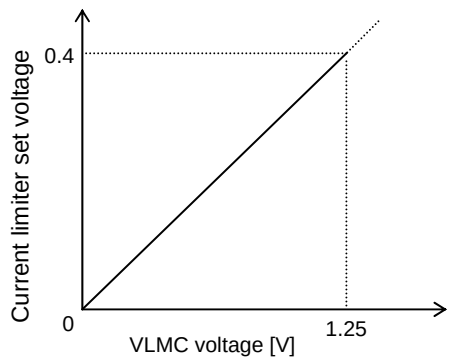
Application Example



The values of the capacitors between power supply and ground, between output and ground, and between the Hall sensor inputs vary depending on the motor used. In particular, the Hall sensor input capacitors may not be required for some motors.

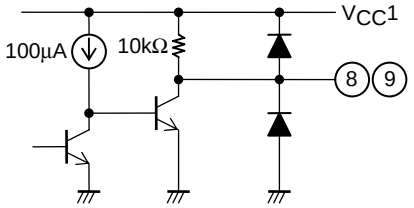
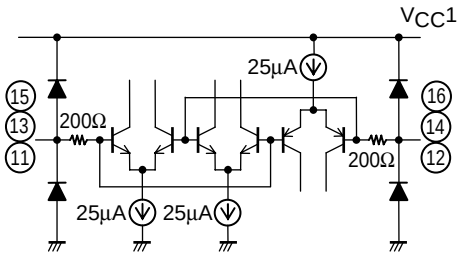
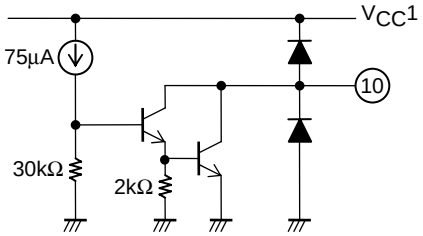
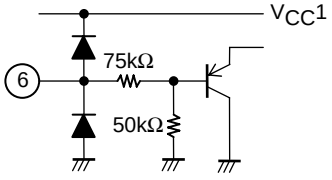
<Information>

Current Limiter Setting



The LB11699H current limiter set voltage is the VLMC pin voltage, and varies as shown in the figure to the left.
When the VLMC pin voltage is 0V, the current limiter set voltage will be 0V and no output current will flow.

Pin Functions

Pin No.	Pin	Pin voltage	Description	Equivalent Circuit
19	$V_{CC}2$	4V to 13.6V	Power supply that provides the source side predriver voltage. Power supply that provides the constant current control amplifier voltage.	
17	$V_{CC}1$	4V to 6V	Power supply that provides all voltages other than those for the output transistors, the source side predrivers, and the low-current control amplifier.	
9	RS		Reverse rotation detection Outputs a high level for forward rotation. Outputs a low level for reverse rotation.	
8	FG		One or three Hall sensor Schmitt trigger comparator synthesized output	
15	$U_{IN}1$	1.2V to $V_{CC}1$-1V	U phase Hall sensor input and reverse rotation detection U phase Schmitt trigger comparator input. The logical high state indicates the state where $U_{IN}1 > U_{IN}2$.	
16	$U_{IN}2$			
13	$V_{IN}1$		V phase Hall sensor input and reverse rotation detection V phase Schmitt trigger comparator input. The logical high state indicates the state where $V_{IN}1 > V_{IN}2$.	
14	$V_{IN}2$			
11	$W_{IN}1$		W phase Hall sensor input and reverse rotation detection W phase Schmitt trigger comparator input. The logical high state indicates the state where $W_{IN}1 > W_{IN}2$.	
12	$W_{IN}2$			
10	VH		Provides the Hall sensor low side device voltage.	
6	S/S	0V to $V_{CC}1$	All internal circuits are stopped by setting this pin to 0.7V or lower or by setting it open. Set this pin to 2.0V or higher when driving the motor.	
5	SIG GND		Ground for all systems except the output system.	

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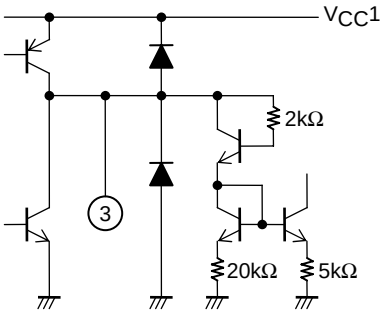
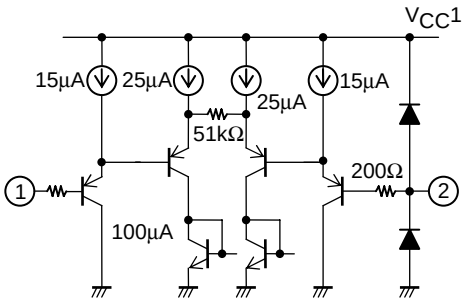
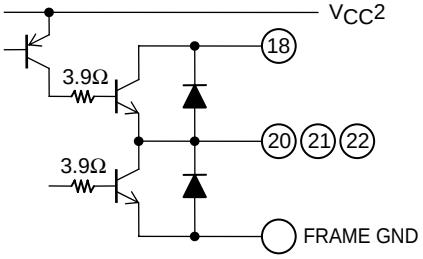
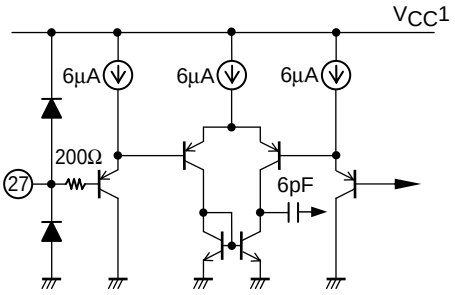
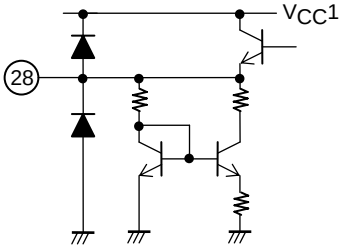
Pin No.	Pin	Pin voltage	Description	Equivalent Circuit
3	FC		Control loop frequency characteristics correction Current control system closed loop oscillations can be prevented by connecting a capacitor between this pin and ground.	
2	VCREF	0V to VCC1-1.5V	Control system reference voltage input The control system start voltage is determined by this voltage.	
1	VC	0V to VCC1	Speed control voltage input This is a voltage controlled system in which: The motor turns in the forward direction when VC > VCREF, and The motor turns decelerates when VC < VCREF. (Since the LB11699H includes a reverse rotation prevention circuit, the motor will never turn in the reverse direction.)	
22	W_{OUT}		W phase output	
	FRAME GND		Output transistor ground	
21	V_{OUT}		V phase output	
20	U_{OUT}		U phase output	
18	RF		High side output transistor collector (common to all three phases) Connect a resistor between the RF pin and VCC3 for current detection. The LB11699H detects this voltage to operate the constant current control and current limiter functions.	
27	VLMC	0 to 1.3V	This pin determines the current limiter set voltage. The current limiter set voltage can be changed by applying a voltage to this pin.	
28	VREF		Reference voltage (1.25V typical) output	

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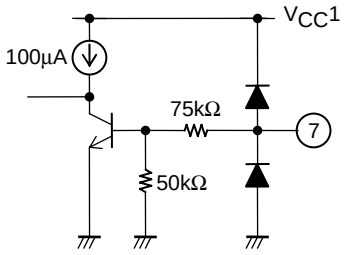
Pin No.	Pin	Pin voltage	Description	Equivalent Circuit
7	BRAKE	0V to $V_{CC}1$	Short-circuit braking pin BRAKE : High → brake Low → drive Open	
4	FGSEL	0V to $V_{CC}1$	Single Hall sensor/three Hall sensor FG switching pin FGSEL : High → three Hall senso Low → single Hall sensor Open