Ordering number : ENA0595

SANYO Semiconductors
DATA SHEET

LA6505 — Monolithic Linear IC For CD-ROM, DVD-ROM and MD players Six-Channel Driver

Overview

The LA6505 is a six-channel driver for CD and MD players and recorders.
It adopts direct PWM drive output in the spindle motor drive to minimize heat generation at high spindle speeds. It also features a soft switching function that minimizes spindle motor drive noise by making the current changes at each phase switch more gradual.
The sled motor driver implements two-phase stepping drive and supports direct PWM inputs. The LA6505 uses a BTL amplifier design for the focus and tracking driver blocks, and a similar design for the loading driver as well.

Functions

(1) Spindle motor driver block
- Three-phase brushless motor driver
- Adopts a current feedback direct PWM drive design
- Supports analog inputs and features a V-type control amplifier
- Built-in oscillator circuit (The oscillator frequency can be set with an external capacitor.)
- Soft-switching drive
- FG output for one phase (the U phase)
- Built-in reverse rotation prevention circuit
- Built-in Hall sensor power supply (npn transistor, open collector output)
- Current limiter setting function (The limit is set by the resistor RF.)
- Standby mode (SS) function that operates for the spindle driver and BTL amplifiers.

(2) Sled motor driver block
- Adopts a current feedback direct PWM drive design
- Supports stepping motors
- Muting function (MUTE-SLD; only applies to the sled driver)

(3) Sled motor driver block
- BTL amplifier based design
- Built-in level shifting circuits
- Built-in input operational amplifiers
- Standby mode (SS) function

■ Any and all SANYO Semiconductor Co.,Ltd. products described or contained herein are, with regard to "standard application", intended for the use as general electronics equipment (home appliances, AV equipment, communication device, office equipment, industrial equipment etc.). The products mentioned herein shall not be intended for use for any "special application" (medical equipment whose purpose is to sustain life, aerospace instrument, nuclear control device, burning appliances, transportation machine, traffic signal system, safety equipment etc.) that shall require extremely high level of reliability and can directly threaten human lives in case of failure or malfunction of the product or may cause harm to human bodies, nor shall they grant any guarantee thereof. If you should intend to use our products for applications outside the standard applications of our customer who is considering such use and/or outside the scope of our intended standard applications, please consult with us prior to the intended use. If there is no consultation or inquiry before the intended use, our customer shall be solely responsible for the use.

■ Specifications of any and all SANYO Semiconductor Co.,Ltd. products described or contained herein stipulate the performance, characteristics, and functions of the described products in the independent state, and are not guarantees of the performance, characteristics, and functions of the described products as mounted in the customer's products or equipment. To verify symptoms and states that cannot be evaluated in an independent device, the customer should always evaluate and test devices mounted in the customer's products or equipment.

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

Downloaded from Elcodis.com electronic components distributor

(4) Loading block
- BTL amplifier based design
- Muting function (MUTE-LOAD; only applies to the loading driver)

(5) Other circuits
- Built-in thermal shutdown circuit (design guarantee)

Specifications

Absolute Maximum Ratings at Ta = 25°C

Parameter	Symbol	Conditions	Ratings	Unit
Supply voltage - V_{CC}	$V_{CC}S$	Signal system supply voltage, $V_{CC} \geq$ VS-*	14	V
Supply voltage - P-SPD	VS-SPD	Spindle block power stage supply voltage	14	V
Supply voltage - P-SLD	VS-SLD	Sled block power stage supply voltage	14	V
Supply voltage - P-BTL	VS-BTL	BTL amplifier block power stage supply voltage	14	V
Allowable power dissipation	Pd max1	Independent IC	0.85	W
	Pd max2	When mounted on the specified circuit	1.72	W
Maximum input voltage	V_{IN} max		6	V
Maximum output current 1	I_O max1	Spindle block	1.25	A
Maximum output current 2	I_O max2	Sled block output	0.5	A
Maximum output current 3	I_O max3	Outputs for the focus, tracking, and loading blocks	0.5	A
Operating temperature	Topr		-30 to +85	°C
Storage temperature	Tstg		-55 to +150	°C

* Specified board size : 76.1mm×114.3mm×1.6mm, glass epoxy board.

Recommended Operating Conditions at Ta = 25°C

Parameter	Symbol	Conditions	Ratings	Unit
Supply voltage S	V_{CC}-S	V_{CC}-S ≥ VS-*	6 to 13	V
Supply voltage P	V_{CC}-P*	V_{CC}-S ≥ VS-*	6 to 13	V

* : The term "VS-*" refers to VS-SPD, VS-BTL, and VS-SLD.

Electrical Characteristics at Ta = 25°C, V_{CC} = VS-SPD = VS-SLD = VS-BTL = 8V, VREF = 1.65V, RF-SPD = 0.5Ω, unless especially specified.

Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
Overall						
No-load current drain	I_{CC}-ON1	SS : H, MUTE SLED/LOAD : H		50	58	mA
	I_{CC}-OFF	SS/MUTE SLED/MUTE LOAD : L		12	20	mA
Thermal shutdown operating temperature	TSD	Junction temperature, design guarantee	150	180	210	°C
Thermal shutdown hysteresis	ΔTSD	Junction temperature, design guarantee		40		°C
VREF-AMP						
VREF-AMP offset voltage	V_{OFF}-VREF	The potential difference between VREF and VREF-OUT	-7		7	mV
VREF pin input current	IVCREF	VC = VREF = 1.65V			1	μA
Output on/off function (S/S : Spindle driver)						
Low-level input voltage	$V_{SS}L$				0.5	V
High-level input voltage	$V_{SS}H$		2.0			V
Input current	$I_{SS}H$				60	μA
MUTE-SLD/LOAD : Sled driver and loading driver						
Low-level input voltage	$V_{MUTE}L$				0.5	V
High-level input voltage	$V_{MUTE}H$		2.0			V
Input current	$I_{MUTE}H$				60	μA

Continued on next page.

Downloaded from Elcodis.com electronic components distributor

Continued from preceding page.

Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
Spindle Motor Driver Block (Output Block)						
Output saturation voltage	V_OSATL	I_O = 0.5A, V_O (SINK)		0.4	0.45	V
	V_OSATH	I_O = 0.5A, V_O (SOURCE)		1.2	1.5	V
Output leakage current	I_O-LEAK (L)	Sink side			100	µA
	I_O-LEAK (H)	Source side			100	µA
Hall Amplifier Block						
Input offset voltage	V_{OFF}-HALL		-6		6	mV
Input bias current	IHB			1	3	µA
Input voltage range	V_ICM		1.3		4	V
Minimum Hall sensor input level	V_HIN		60			mV
PWM Oscillator						
PWM oscillator frequency	FOSC	Between OSC and ground : 330 pF	65	86	105	kHz
Input Amplifier						
VC pin input current	IVCTL	VC = VREF = 1.65V, spindle motor driver input			1	µA
Forward gain	GDF+		0.4	0.46	0.52	V/V
Reverse gain	GDF-		0.4	0.46	0.52	V/V
Forward limiter voltage	VRF1		0.42	0.5	0.58	V
Reverse limiter voltage	VRF2		0.42	0.5	0.58	V
Startup voltage	V_{IN}		1.5		1.8	V
Input dead zone width	VDZ-SPDL		150	200	250	mV
FG Pin : Speed pulse output						
Low-level output voltage	V_{FG}L	IFG = 2mA			0.4	V
Hall comparator hysteresis	V_{FG}HYS		4	8	15	mV
Hall Sensor Power Supply						
Hall sensor power supply voltage	V_H	I_H = 5 mA, with respect to the ground potential.		0.8	1.2	V
Allowable current	I_H				20	mA
Sled Driver Block (Output Block)						
Maximum output voltage	V_O-SLD	I_O = 0.2A	6.35	6.8		V
Output leakage current	I_OLEAK (L)	Sink side			100	µA
	I_OLEAK (H)	Source side			100	µA
Input Amplifier						
V_{IN} pin input current	IVCTL	VC = VREF = 1.65V, sled driver input			1	µA
I/O gain	VG-SLD		0.2	0.23	0.26	V/V
Output limit voltage	LIMT-SLD		0.21	0.25	0.29	V
Startup voltage	V_{IN}		1.5		1.8	V
Input dead zone width	VDZ-SLD		100	150	200	mV
Input voltage range	V_{IN}-OP (SLD)	Design guarantee, input buffer amplifier	0		V_{CC}-1.5	V
Output on delay time	TON			2	10	µs
Output off delay time	TOFF			2	10	µs
Switching time	TSW			2	10	µs
Focus and Tracking (BTL-AMP)						
Output offset voltage	V_{OFF}-BTL	Input operational amplifier buffer	-50		50	mV
Maximum output voltage	V_O-BTL	I_O = 0.3A	5.7	6		V
I/O gain	V_G-BTL		3.6	4	4.4	times
Slew rate	SR	Across the BTL amplifier output		1		V/µs
Input voltage range	V_{IN}-OP (BTL)	Design guarantee, input buffer amplifier	0		V_{CC}-1.5	V

Continued on next page.

Downloaded from Elcodis.com electronic components distributor

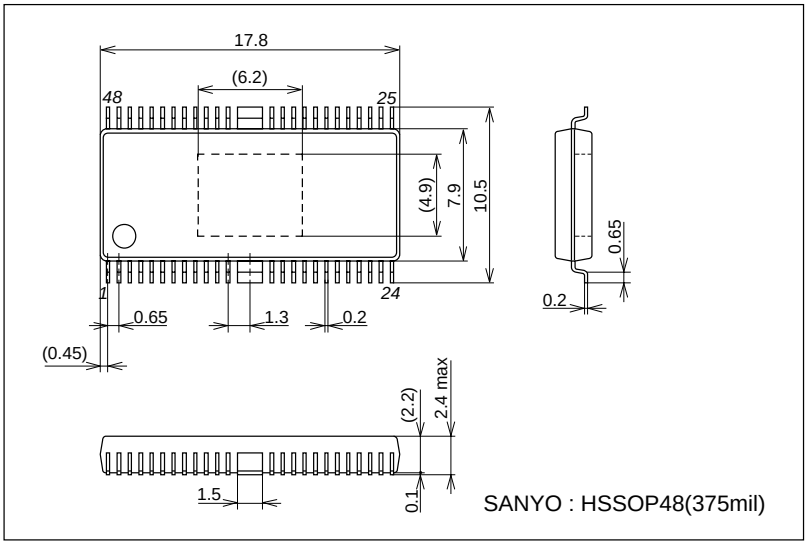
Continued from preceding page.

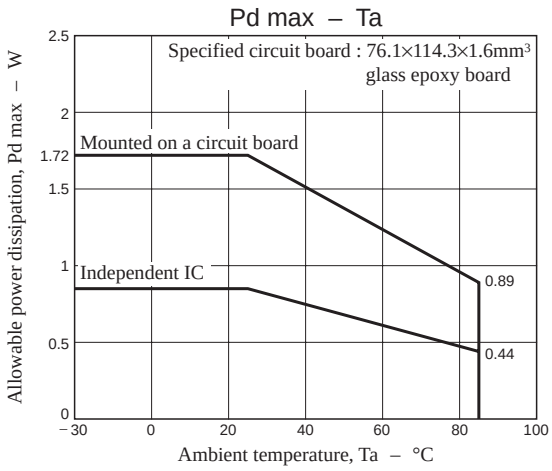
Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
Input Operational Amplifier						
Output offset voltage	V_{OFF}-OP		-7		7	mV
Output sink current	SINK-OP		2			mA
Output source current	SOURCE-OP		300	500		µA
Input voltage range	V_{IN}-OP			1		V/µs
Input voltage range	V_{IN}-OP (BTL)		0		V_{CC}-1.5	V
Loading Block (BTL-AMP)						
Output offset voltage	V_{OFF}-LOAD		-50		50	mV
Maximum output voltage	V_O-LOAD	I_O = 0.5A	6	6.6		V
I/O gain	V_G-LOAD		3.6	4	4.4	times
Slew rate	SR			1		V/µs
Input voltage range	VIN-LOAD	Design guarantee, input buffer amplifier	0		V_{CC}-1.5	V

Package Dimensions

unit : mm (typ)

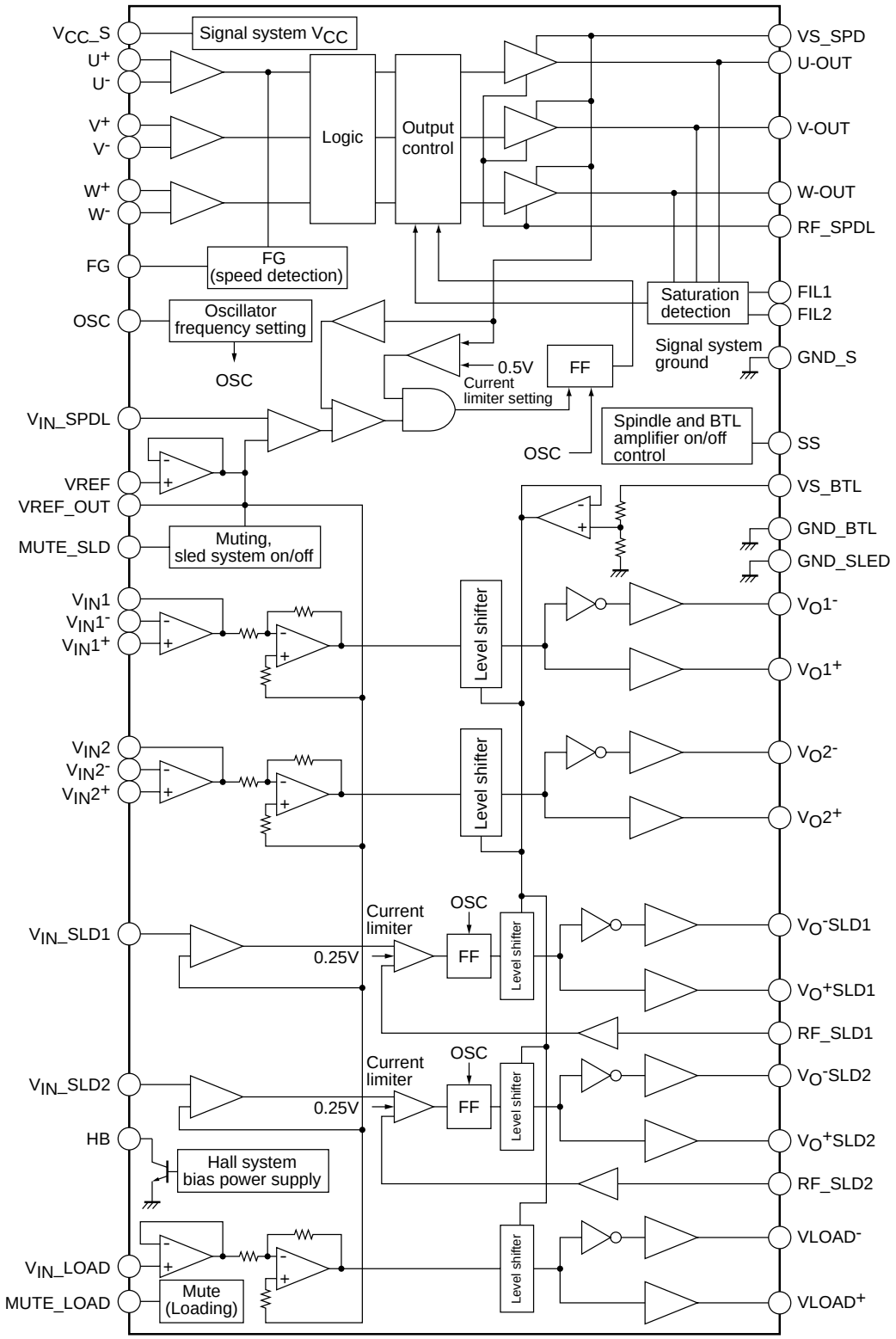
3278





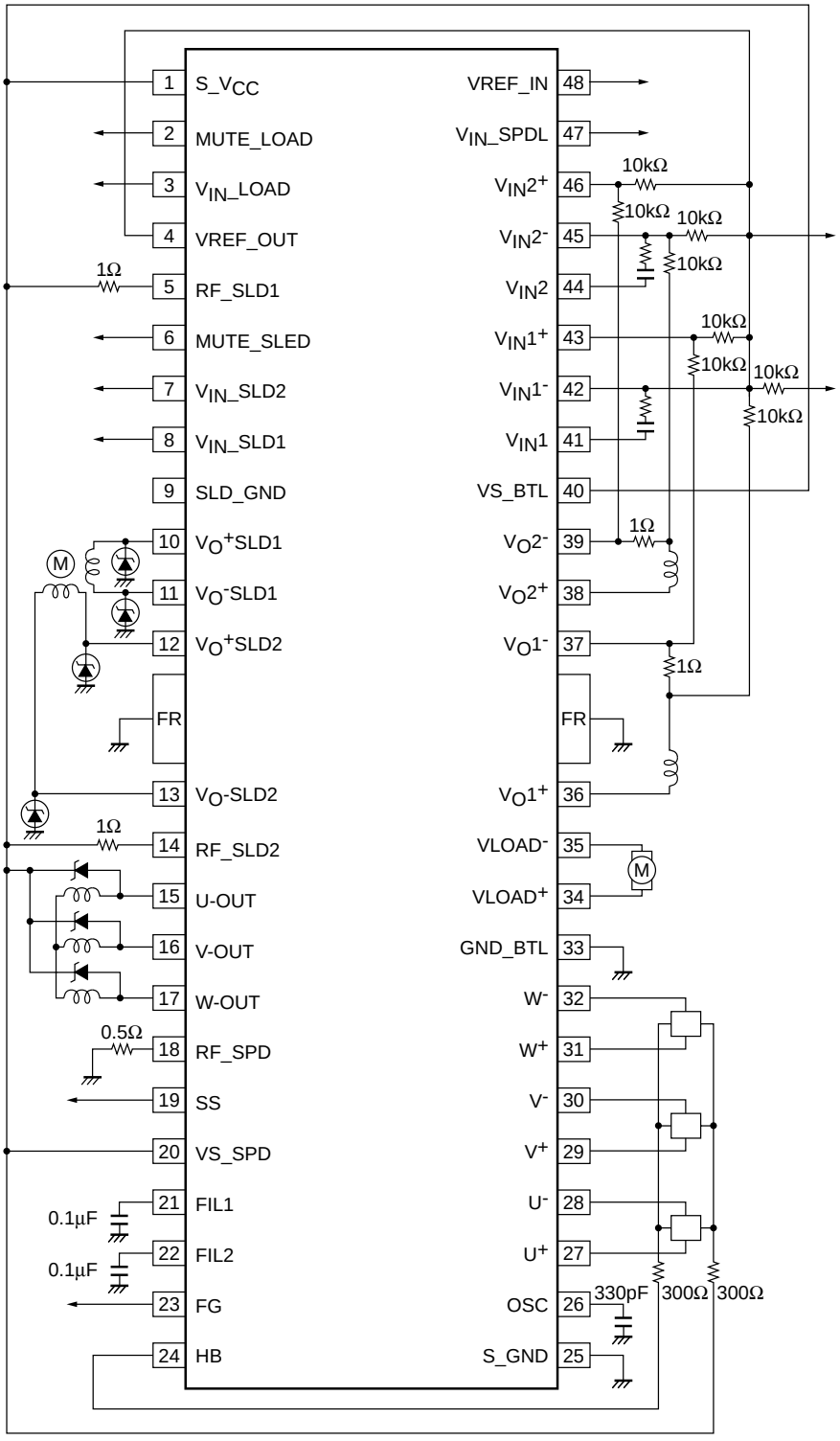
Downloaded from Elcodis.com electronic components distributor

Block Diagram



Downloaded from Elcodis.com electronic components distributor

Pin Assignment and Application Circuit Example



For the diodes between the spindle outputs (pins 15, 16, and 17), use Schottky barrier diodes with current capacities of over 1A, small temperature coefficients, and low reverse currents.

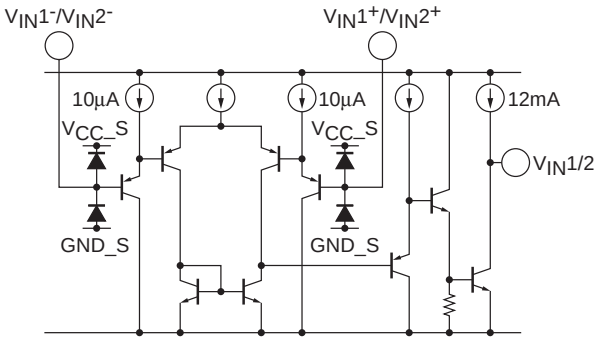
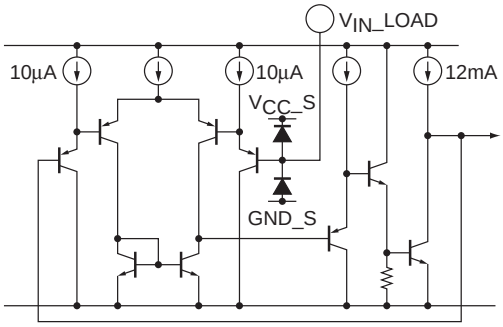
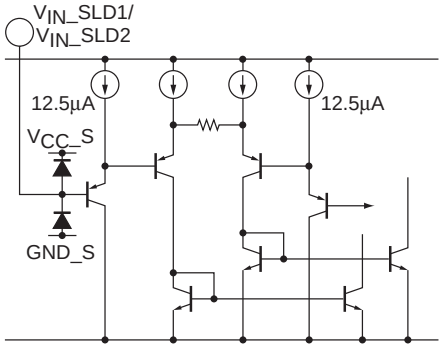
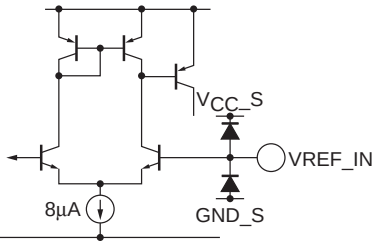
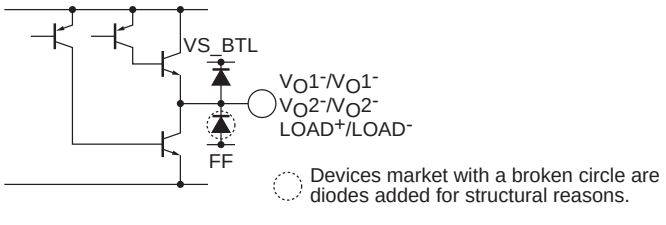
Downloaded from Elcodis.com electronic components distributor

Pin Functions

Pin No.	Pin	Descriptions
1	V_{CC}_S	Signal system power supply and BTL amplifier output stage power supply
2	MUTE_LOAD	Loading output on/off control
3	V_{IN}_LOAD	Loading input
4	VREF-OUT	VREG amplifier (buffer) output
5	RF_SLD1	SLED1 output current detection
6	MUTE_SLED	Sled output on/off control
7	V_{IN}_SLD2	SLED2 input
8	V_{IN}_SLD1	SLED1 input
9	GND_SLD	Power system ground, Sled
10	V_O^+SLD1	SLED1$^+$ output
11	V_O^-SLD1	SLED1$^-$ output
12	V_O^+SLD2	SLED2$^+$ output
13	V_O^-SLD2	SLED2$^-$ output
14	RF_SLD2	SLED2 output current detection
15	U-OUT	U phase output
16	V-OUT	V phase output
17	W-OUT	W phase output
18	RF_SPDL	Output current detection (SPINDLE)
19	SS	BTL amplifier (channels 1 and 2) and spindle driver on/off control
20	VS_SPDL	Spindle output stage power supply
21	FIL1	Source side output oscillation prevention
22	FIL2	Sink side output oscillation prevention
23	FG	FG output. This is an open collector output that outputs one of the Hall phases (the U phase).
24	HB	Hall sensor bias power supply (open collector output)
25	GND_S	Signal system ground
26	OSC	PWM oscillator frequency setting (A capacitor is connected between this pin and ground.)
27	U^+	Hall sensor bias input (U^+)
28	U^-	Hall sensor bias input (U^-)
29	V^+	Hall sensor bias input (V^+)
30	V^-	Hall sensor bias input (V^-)
31	W^+	Hall sensor bias input (W^+)
32	W^-	Hall sensor bias input (W^-)
33	GND_BTL	Power system ground and BTL amplifier (including loading driver)
34	VLOAD$^+$	Loading driver output (+)
35	VLOAD$^-$	Loading driver output (-)
36	V_O1^+	Channel 1 output (+)
37	V_O1^-	Channel 1 output (-)
38	V_O2^+	Channel 2 output (+)
39	V_O2^-	Channel 2 output (-)
40	VS_BTL	Power system ground and BTL amplifier (including loading driver)
41	$V_{IN}1$	Channel 1 input, channel 1 operational amplifier output
42	$V_{IN}1^-$	Channel 1 input, input operational amplifier inverting input
43	$V_{IN}1^+$	Channel 1 input, input operational amplifier noninverting input
44	$V_{IN}2$	Channel 2 input, channel 1 operational amplifier output
45	$V_{IN}2^-$	Channel 2 input, input operational amplifier inverting input
46	$V_{IN}2^+$	Channel 2 input, input operational amplifier noninverting input
47	V_{IN}_SPDL	Spindle input
48	VREF_IN	Reference voltage input

Downloaded from Elcodis.com electronic components distributor

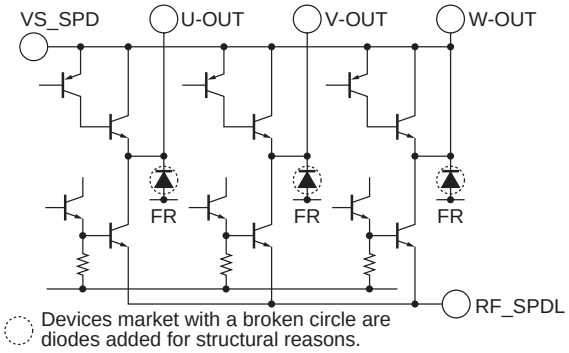
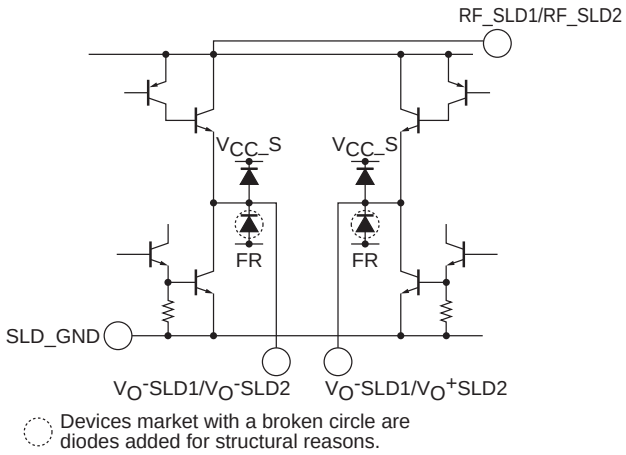
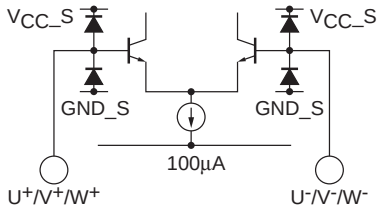
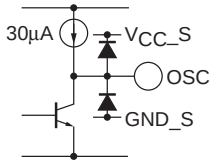
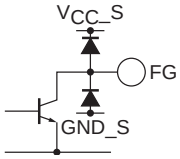
Pin Description

Pin No.	Pin	Function	Equivalent circuit
43 42 41 46 45 44	$V_{IN}1^+$ $V_{IN}1^-$ $V_{IN}1$ $V_{IN}2^+$ $V_{IN}2^-$ $V_{IN}2$	Channel 1 and channel 2 (BTL amplifier) input. operational amplifier inputs and outputs.	
3	V_{IN}_LOAD	Loading driver input.	
8 7 47	V_{IN}_SLD1 V_{IN}_SLD2 V_{IN}_SLD3	Sled and spindle driver inputs.	
48	VREF_IN	VREF-IN input (VREF amplifier input).	
36 37 38 39 34 35	V_O1^+ V_O1^- V_O2^+ V_O2^- $VLOAD^+$ $VLOAD^-$	Outputs for channel 1, channel 2, and the loading driver.	

Continued on next page.

Downloaded from Elcodis.com electronic components distributor

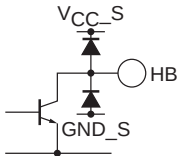
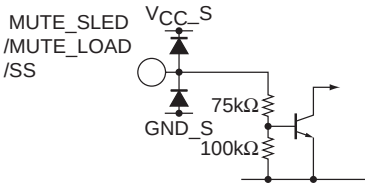
Continued from preceding page.

Pin No.	Pin	Function	Equivalent circuit
20 18 15 16 17	VS_SPD RF_SPDL U-OUT V-OUT W-OUT	Spindle and other output pins.	
5 14 9 10 11 12 13	RF_SLD1 RF_SLD2 SLD_GND V_O^+SLD1 V_O^-SLD1 V_O^+SLD2 V_O^-SLD2	Sled system output pins.	
27 28 29 30 31 32	U^+ U^- V^+ V^- W^+ W^-	Hall sensor bias inputs.	
26	OSC	Oscillator frequency setting. This pin sets the PWM oscillator frequency.	
23	FG	FG output. This pin outputs a signal synchronized with the U phase. (Single Hall sensor output)	

Continued on next page.

Downloaded from Elcodis.com electronic components distributor

Continued from preceding page.

Pin No.	Pin	Function	Equivalent circuit
24	HB	Hall bias output.	
6 2 19	MUTE_SLED MUTE_LOAD SS	SS and muting control inputs. These inputs control the on/off states of the corresponding outputs.	

Downloaded from Elcodis.com electronic components distributor

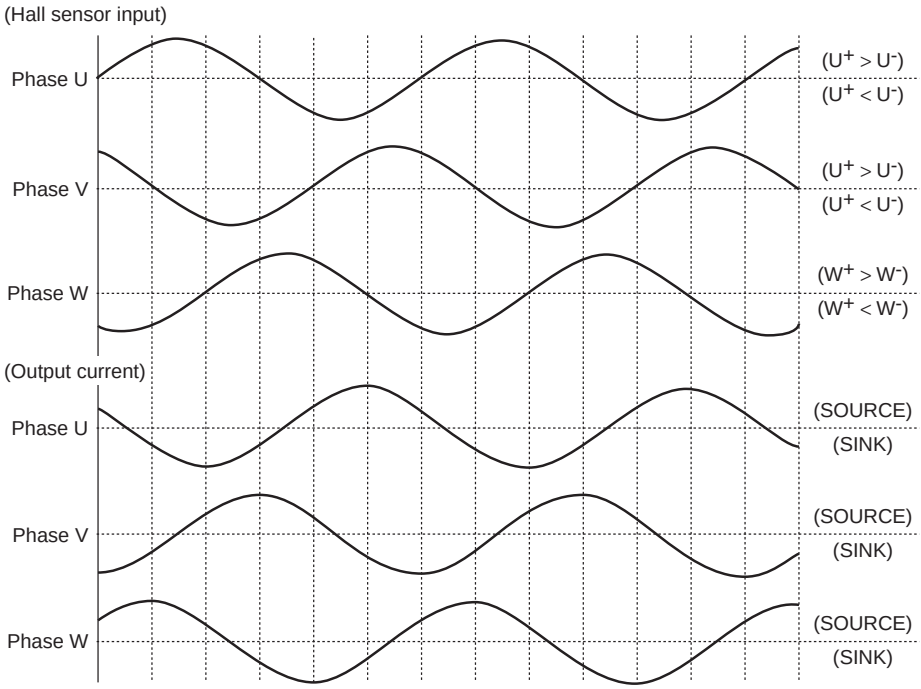
Spindle Truth Table

(For forward rotation, V_{IN} SPDL > VREF)

	Input	Hall sensor input						Output status			FG output
		U		V		W		SOURCE	→	SINK	
		U^+	U^-	V^+	V^-	W^+	W^-				
(1)	H	H	L	H	L	L	H	W	→	V	H
(2)		H	L	L	H	L	H	W	→	U	H
(3)		H	L	L	H	H	L	V	→	U	H
(4)		L	H	L	H	H	L	V	→	W	L
(5)		L	H	H	L	H	L	U	→	W	L
(6)		L	H	H	L	L	H	U	→	V	L

(For reverse rotation, V_{IN} SPDL < VREF)

	Input	Hall sensor input						Output status			FG output
		U		V		W		SOURCE	→	SINK	
		U^+	U^-	V^+	V^-	W^+	W^-				
(1)	H	H	L	H	L	L	H	V	→	W	H
(2)		H	L	L	H	L	H	U	→	W	H
(3)		H	L	L	H	H	L	U	→	V	H
(4)		L	H	L	H	H	L	W	→	V	L
(5)		L	H	H	L	H	L	W	→	U	L
(6)		L	H	H	L	L	H	V	→	U	L



Downloaded from Elcodis.com electronic components distributor

Output On/Off Control Functions

1. Relationships Between Muting Inputs and Output States

MUTE SLED	Sled output
H	ON
L	OFF

MUTE SLED	Loading driver output
H	ON
L	OFF

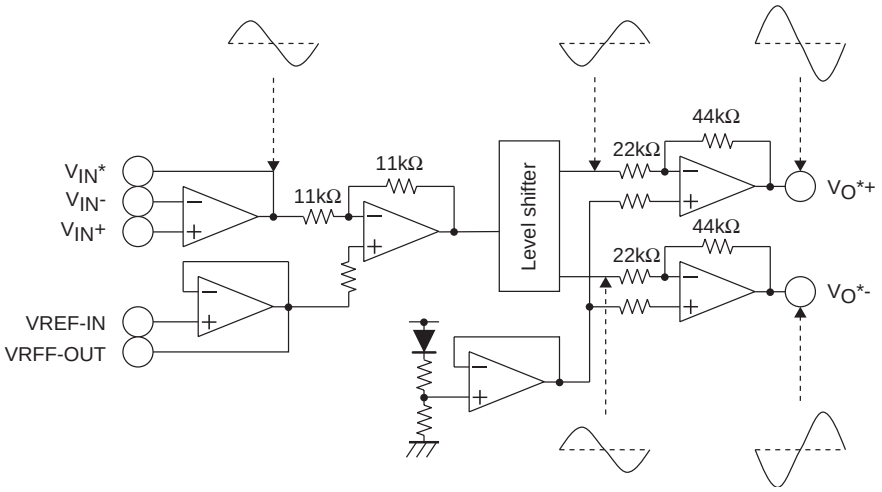
2. Relationship Between S/S and the Corresponding Output

MUTE SLED	Spindle BTL-AMP
H	ON
L	OFF

* : The BTL amplifier and the loading driver input amplifier operate regardless of the MUTE inputs. The output on/off states are controlled only by muting the output amplifiers.

* : When both the MUTE and S/S pins are low, the outputs go to the high-impedance state. However, note that the output amplifier gain setting feedback resistor is connected.

BTL Amplifier I/O Relationship

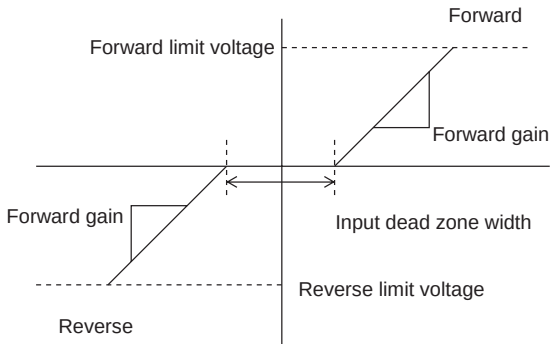


* : The loading driver input operational amplifier is a voltage-follower circuit (V_{IN} and V_{IN}- are shorted together).

* : To make the I/O relationship easier to see in figure 7, Block Diagram, the diagram is written as though gain is applied in the input amplifier. In the actual circuit, however, the gain occurs in the output amplifier.

Downloaded from Elcodis.com electronic components distributor

Spindle and Sled Gain and Limiter



(SPINDLE)

RF resistor (Ω)	Forward/reverse limiter current (A)	I/O gain	
		(A/V)	(V/V)
0.5 1.0	1.0 0.5	1.0 0.5	0.5

(SLED)

RF resistor (Ω)	Forward/reverse limiter current (A)	I/O gain	
		(A/V)	(V/V)
0.5 1.0	0.50 0.25	0.50 0.25	0.25

- SANYO Semiconductor Co.,Ltd. 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 Semiconductor Co.,Ltd. products described or contained herein.
- SANYO Semiconductor Co.,Ltd. strives to supply high-quality high-reliability products, however, any and all semiconductor products fail or malfunction with some probability. It is possible that these probabilistic failures or malfunction could give rise to accidents or events that could endanger human lives, trouble that could give rise to smoke or fire, or accidents that could cause damage to other property. When designing equipment, adopt safety measures so that these kinds of accidents or events cannot occur. Such measures include but are not limited to protective circuits and error prevention circuits for safe design, redundant design, and structural design.
- In the event that any or all SANYO Semiconductor Co.,Ltd. products described or contained herein are controlled under any of applicable local export control laws and regulations, such products may require the export license from the authorities concerned in accordance with the above law.
- No part of this publication may be reproduced or transmitted in any form or by any means, electronic or mechanical, including photocopying and recording, or any information storage or retrieval system, or otherwise, without the prior written consent of SANYO Semiconductor Co.,Ltd.
- Any and all information described or contained herein are subject to change without notice due to product/technology improvement, etc. When designing equipment, refer to the "Delivery Specification" for the SANYO Semiconductor Co.,Ltd. product that you intend to use.
- Information (including circuit diagrams and circuit parameters) herein is for example only; it is not guaranteed for volume production.
- Upon using the technical information or products described herein, neither warranty nor license shall be granted with regard to intellectual property rights or any other rights of SANYO Semiconductor Co.,Ltd. or any third party. SANYO Semiconductor Co.,Ltd. shall not be liable for any claim or suits with regard to a third party's intellctual property rights which has resulted from the use of the technical information and products mentioned above.

This catalog provides information as of February, 2007. Specifications and information herein are subject to change without notice.

Downloaded from Elcodis.com electronic components distributor