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SANYO Semiconductors
DATA SHEET

Monolithic Linear IC

LA6502 — 5ch driver for CD and DVD Spindle driver : 3-phase linear sensor-less drive BTL 4ch

Overview

This LA6502 is a 5ch driver for CD and DVD Spindle driver : 3-phase linear sensor-less drive BTL 4ch.

Features

- Spindle driver block
  1) 3-phase sensor-less motor driver
  2) Soft switching drive
  3) Analog input V type control
  4) Current limiter incorporated
  5) Counter electromotive FG output
  6) Reverse prevention circuit incorporated
- Threading, focusing, tracking, and loading blocks
  1) BTL-AMP type
- Common block
  1) Thermal shutdown circuit incorporated (design guarantee)
  2) MUTE function incorporated (pin 3)
  3) OP-AMP (1ch) incorporated (open collector output)

Specifications

Absolute Maximum Ratings at Ta = 25°C

Parameter	Symbol	Conditions	Ratings	Unit
Motor Supply Voltage 1	$V_{CC}1$	SPINDLE, SLED, LOADING power supply	14.5	V
Motor Supply Voltage 2	$V_{CC}2$	FOCUS, TRACKING power supply	14.5	V
Allowable power dissipation	Pd max1	Independent IC	0.8	W
	Pd max2	Mounted on a specified board. *	1.7	W

* Mounted on a board : 114.3×76.1×1.6mm^3, glass epoxy board.

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Parameter	Symbol	Conditions	Ratings	Unit
Maximum input voltage	V_{IN} max		-0.3 to V_{CC}+0.3	V
Maximum output current 1	I_O max1	SPINDLE output	1.0	A
Maximum output current 2	I_O max2	SLED output	0.6	A
Maximum output current 3	I_O max3	FOCUS, TRACKING output	0.85	A
Maximum output current 4	I_O max4	LOADING output	0.6	A
Operating temperature	Topr		-20 to +75	°C
Storage temperature	Tstg		-55 to +150	°C

Recommended Operating Conditions at Ta = 25°C

Parameter	Symbol	Conditions	Ratings	Unit
Motor Supply Voltage 1	$V_{CC}1$	SPINDLE, SLED, LOADING power supply	4.5 to 13.8	V
Motor Supply Voltage 2	$V_{CC}2$	FOCUS, TRACKING power supply	4.5 to 13.8	V

Electrical Characteristics at Ta = 25°C, $V_{CC}1$ = 8V, $V_{CC}2$ = 8V, VREF = 1.65V

Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
Common						
Current drain	I_{CC}	MUTE1, 2, 3 : H, V_C = VREF		30	40	mA
Standby current	I_{CCQ}	MUTE1, 2, 3 : L		0.3	0.5	mA
VREF pin input voltage range	VREF		1.0		3.3	V
VREF pin input current	IVCREF	V_C = VREF = 1.65V	-0.2	-0.1		µA
MUTE1, 2, 3 L voltage	VMUTE-L				0.5	V
MUTE1, 2, 3 H voltage	VMUTE-H		2.8		4.5	V
MUTE1, 2, 3 input current	IMUTE	VMUTE = 3V		60	100	µA
Thermal shutdown operation temperature	TSD	Designed target value	150	180	210	°C
Thermal shutdown hysteresis width	ΔTSD	Designed target value		40		°C
Note) Design guarantee values, not measured.						
Spindle Driver						
Output saturation voltage	V_OSAT_SP	I_O =0.5A, Source+Sink		1.8	2.4	V
CTL pin input voltage range	VCTL_SP		0		5	V
CTL pin input current	IVCTL_SP	V_C = VREF = 1.65V		-0.2	-0.5	µA
Control gain	GVCO_SP		0.29	0.34	0.39	V/V
Control dead zone width 1	VCDZ1_SP	Forward		+90	150	mV
Control dead zone width 2	VCDZ2_SP	Revers	-150	-90		mV
Current limiter voltage	VLIM_SP		0.36	0.4	0.44	V
VCOIN input current	IVCOIN_SP	VCOIN = 3V			1	µA
VCO min frequency	FVCOMIN_SP	CX = 0.01µF, VCOIN = OPEN	0.35	0.45	0.55	kHz
VCO max frequency	FVCOMAX_SP	CX = 0.01µF, VCOIN = 5V	36	40	44	kHz
C1,C2 source current ratio	RSOURCE_SP	1-(IC1 SOURCE/IC2 SOUCE)	-10		10	%
C1,C2 sink current ratio	RSINK_SP	1-(IC1 SINK/IC2 SINK)	-10		10	%
C1 source, sink current ratio	RC1_SP	IC1 SOURCE/IC1 SINK	40		60	%
C2 source, sink current ratio	RC2_SP	IC2 SOURCE/IC2 SINK	40		60	%
FGO pin H voltage	FGOH_SP	FGO resistance 20kΩ, 5V pull-up	4.8			V
FGO pin L voltage	FGOL_SP	FGO resistance 20kΩ, 5V pull-up		0.15	0.4	V
FR pin input voltage range	VFR		0		5	V
FR pin input current	IFR	VFR = 3V		54	100	µA
Thread driver (AMP3)						
Output saturation voltage	V_OSAT_3	I_O = 0.3A, Source+Sink		1.5	1.8	V
Input voltage range	V_{IN}_3		0		5	V
CTL pin input current	I_{IN}_3	V_{IN} = VREF = 1.65V	-0.5	-0.1		µA
Current gain	GVCO_3		17.8	18.7	19.6	dB
Output offset voltage	V_OOFF_3	Note)	-50	0	50	mV

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Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
Focusing and tracking drivers (AMP1, 2)						
Output saturation voltage	V_OSAT_1	I_O = 0.6A, Source+Sink		1.8	2.2	V
Input voltage range	V_{IN}_1		0		5	V
CTL pin input current	I_{IN}_1	V_{IN} = VREF = 1.65V	-0.5	-0.1		µA
Control gain	GVCO_1		11.6	12.7	13.8	dB
Output offset voltage	V_OOFF_1	Note)	-50	0	50	mV
Loading driver (AMP4)						
Output saturation voltage	V_OSAT_4	I_O = 0.2A, Source+Sink		1.3	1.6	V
Input voltage range	V_{IN}_4		0		5	V
CTL pin input current	I_{IN}_4	V_{IN} = VREF = 1.65V	-0.5	-0.2		µA
Control gain	GVCO_4		17.8	18.7	19.6	dB
Output offset voltage	V_OOFF_4	Note)	-50	0	50	mV
OP-AMP						
Output L voltage	V_OL_5	I_O = 1mA, Sink		0.2	0.4	V
Input voltage range	V_{IN}_5		0		5	V
Input offset voltage	V_IOFF_5		-5	0	5	mV

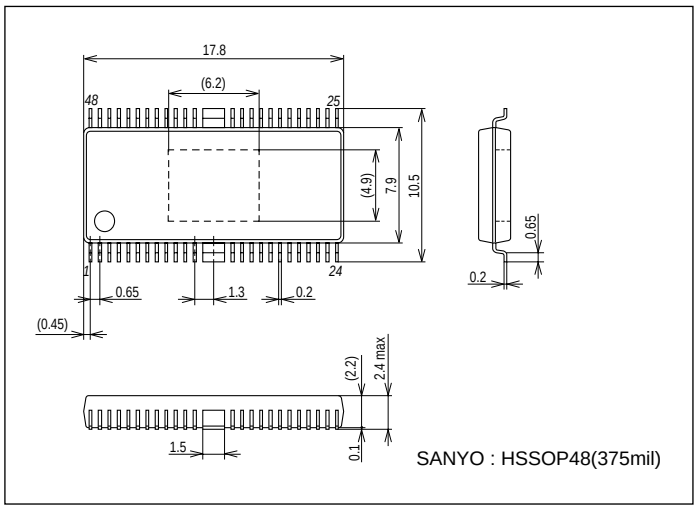
Note) The pre-OPAMP in the previous stage is used as buffer.

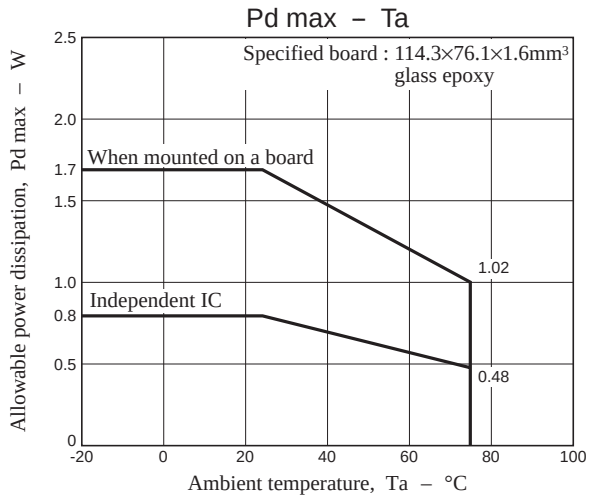
MUTE function	Mode
MUTE1 : H	SPINDLE : ON
MUTE2 : H	FOCUS, TRACKING, SLED : ON
MUTE3 : H	LOADENG : ON

Package Dimensions

unit : mm (typ)

3278





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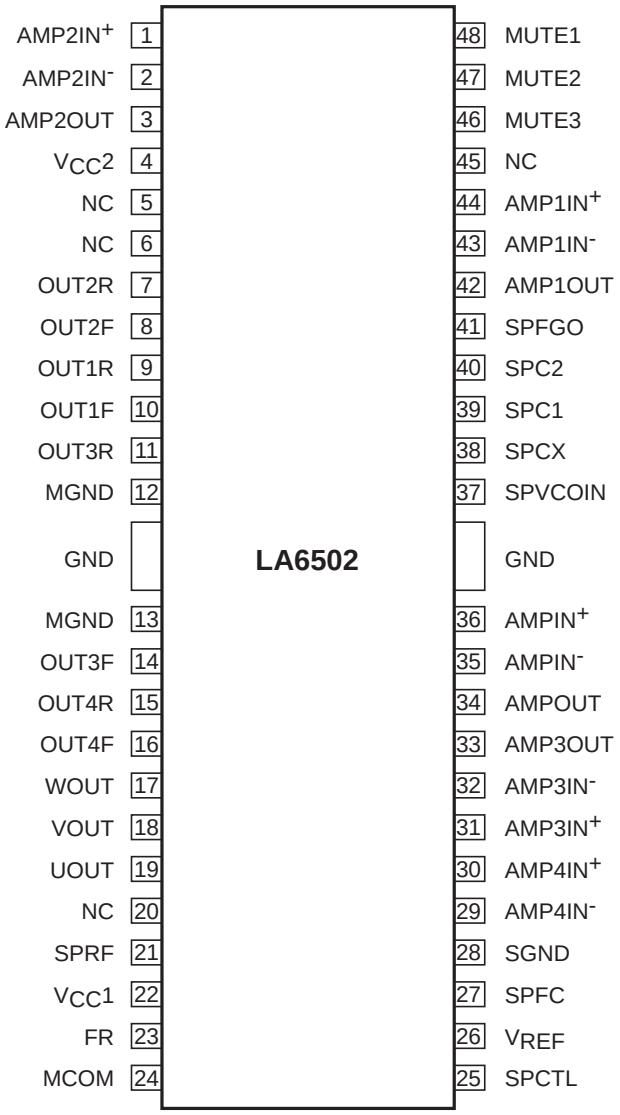
Pin Assignment



Top view

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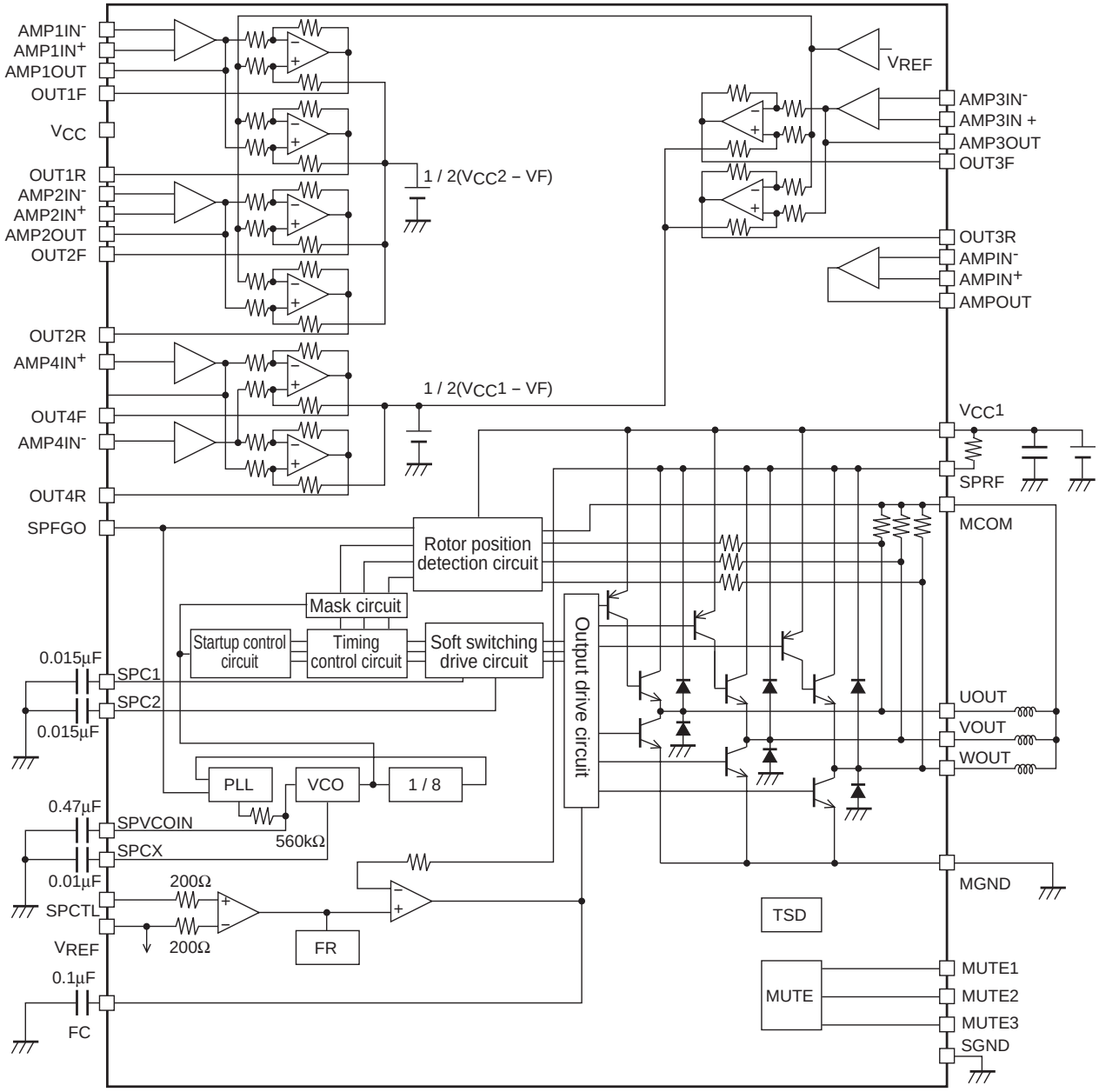
Block Diagram (In certain applications, snubber may be added to the spindle motor coil output.)



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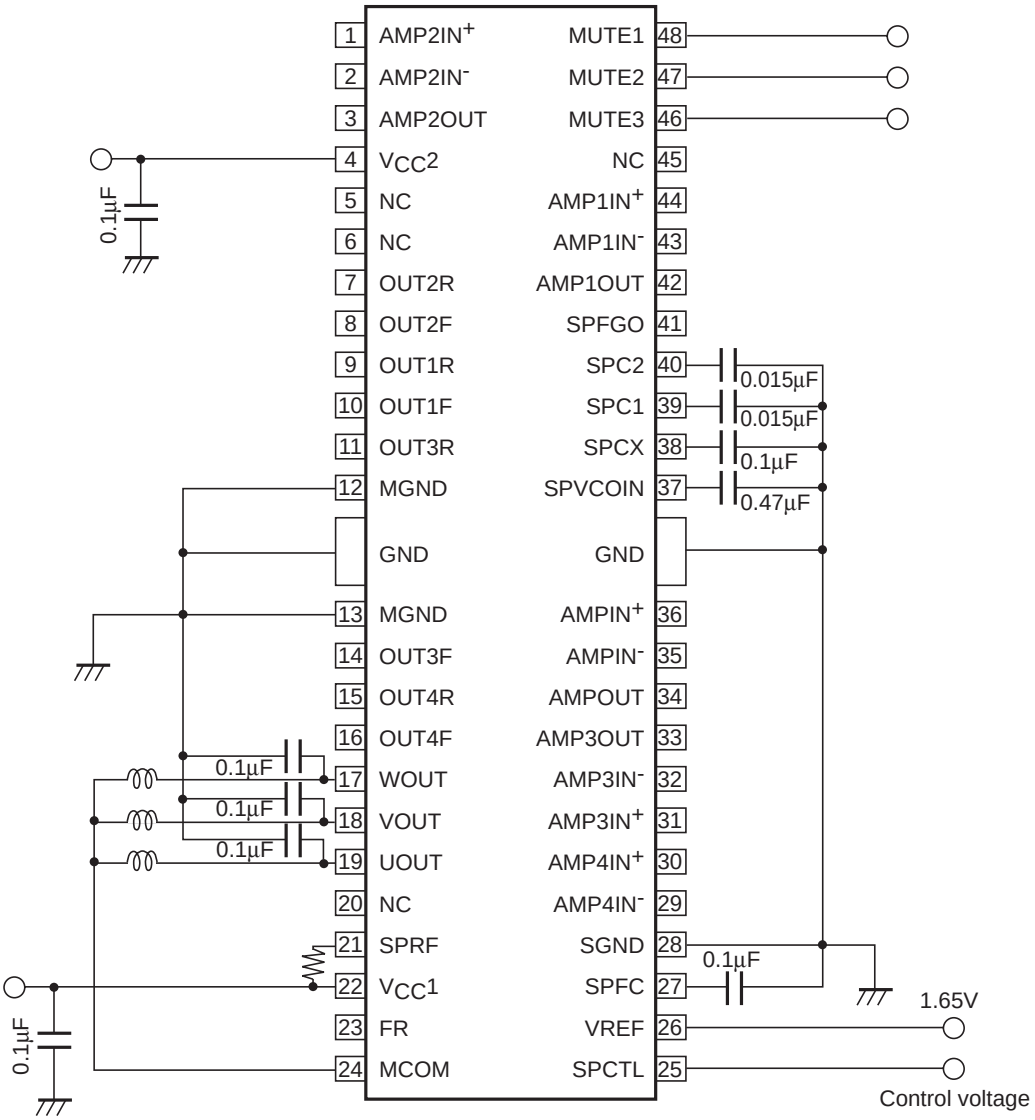
Sample Application Circuit (Spindle Block)



Note) The external constant is for reference only and the optimum constant may differ from one motor to another.

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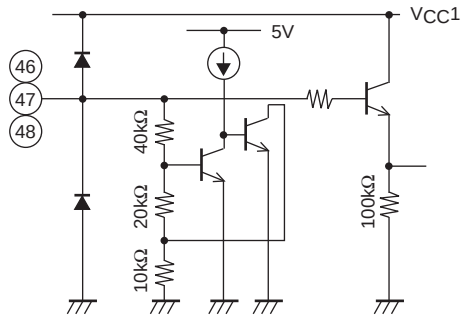
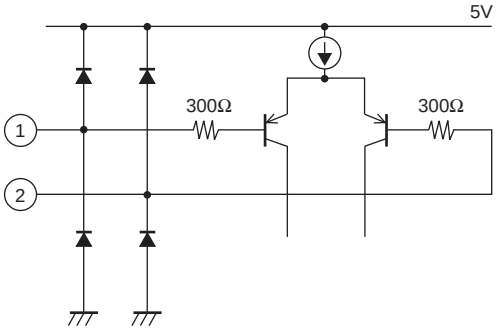
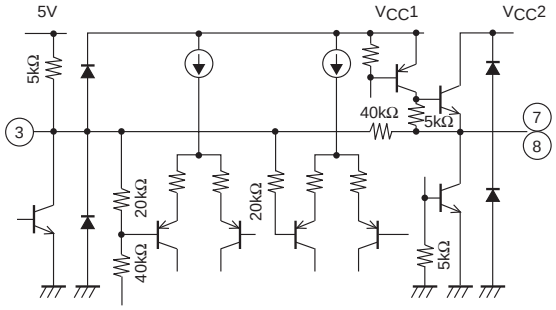
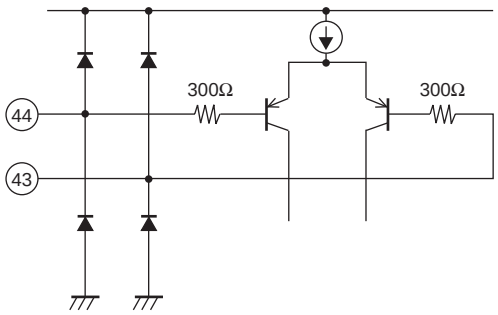
Pin Function

Pin No.	Pin name	Function	Pin voltage	Equivalent circuit
22	$V_{CC}1$	Power pin to provide the voltage of all other than BTL-AMP1 and 2 output transistors.	4.5 to 13.8	
4	$V_{CC}2$	Power pin of the BTL-AMP1 and 2 outputs.	4.5 to 13.8	
28	SGND	GND for all other than output.		
12 13	MGND	Output GND other than spindle		
46	MUTE3	MUTE function control pin. MUTE : H ⇒ Motor drive MUTE : L ⇒ drive OFF "H" is for 2.8V or more. "L" is for 0.5V or less. MUTE1 : SP MUTE2 : BTL1, 2, 3 MUTE3 : BTL4	0V to 4V	
47	MUTE2			
48	MUTE1			
1	AMP2IN+	OP-AMP non-inverted input pin.	0V to 5V	
2	AMP2IN-	OP-AMP inverted input pin.		
3	AMP2OUT	OP-AMP output pin.		
8	OUT2F	BTL-AMP Forward output pin		
7	OUT2R	BTAL-AMP Reverse output pin		
44	AMP1IN+	OP-AMP non-inverted input pin.	0V to 5V	
43	AMP1IN-	OP-AMP inverted input pin.		

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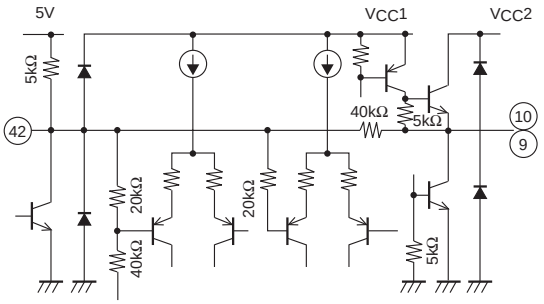
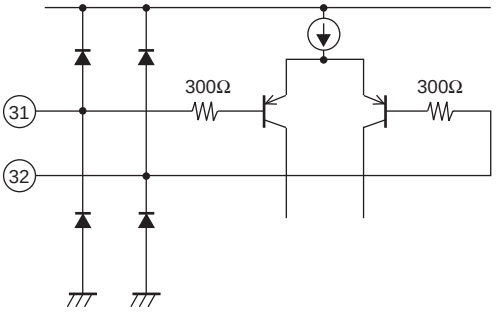
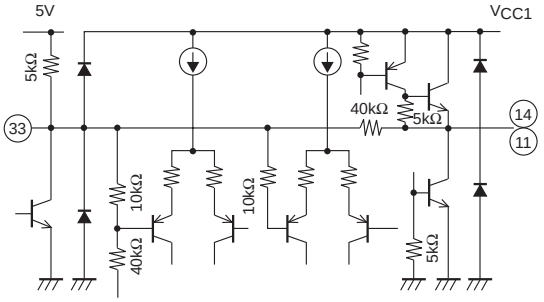
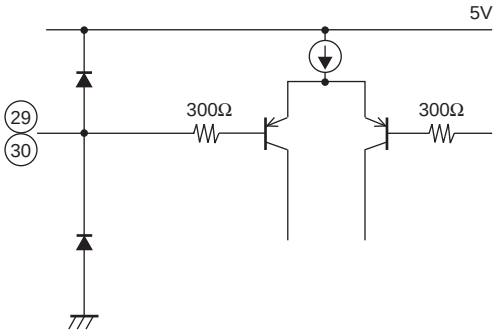
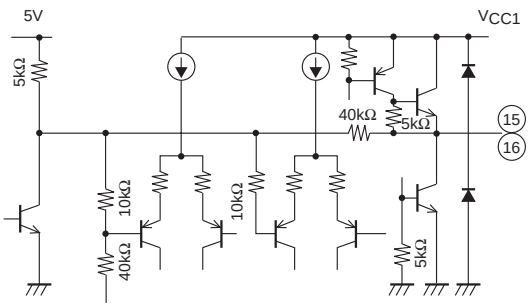
Pin No.	Pin name	Function	Pin voltage	Equivalent circuit
42	AMP1OUT	OP-AMP output pin.		
10	OUT1F	BTL-AMP Forward output pin.		
9	OUT1R	BTL-AMP Reverse output pin.		
31	AMP3IN+	OP-AMP non-inverted input pin.	0V to 5V	
32	AMP3IN-	OP-AMP inverted input pin.		
33	AMP3OUT	OP-AMP output pin of previous stage.		
14	OUT3F	BTL-AMP Forward output pin.		
11	OUT3R	BTL-AMP Reverse output pin.		
30	AMP4IN+	non-inverted input pin.	0.3V to 5V	
29	AMP4IN-	BTL-4ch reference voltage pin	1V to 4V	
16	OUT4F	BTL-AMP Forward output pin.		
15	OUT4R	BTL-AMP Reverse output pin.		

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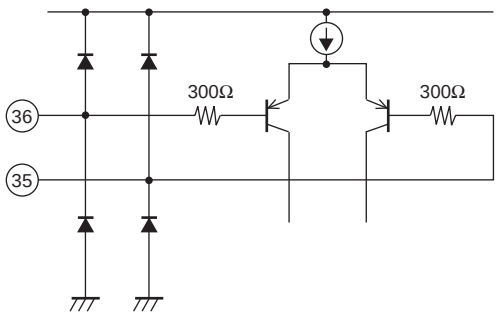
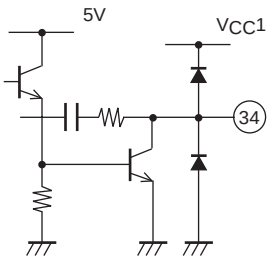
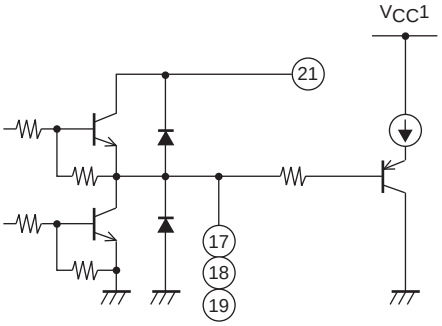
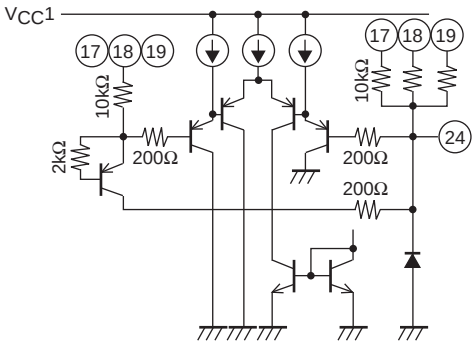
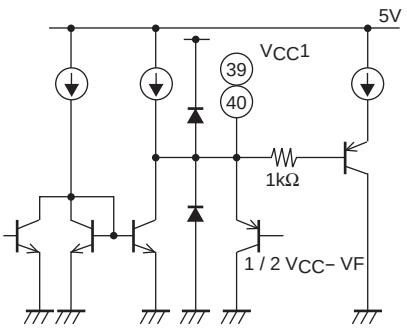
Pin No.	Pin name	Function	Pin voltage	Equivalent circuit
36	AMPIN+	OP-AMP non-inverted input pin.	0V to 5V	
35	AMPIN-	OP-AMP inverted input pin.		
34	AMPOUT	OP-AMP output pin.		
19	SPUOUT	Spindle motor driver output pin.		
18	SPVOUT			
17	SPWOUT			
21	SPRF	Spindle motor driver output transistor power pin Detects this voltage for constant current control /The current limiter also detects this potential and is activated.		
24	MCOM	Spindle motor coil mid-point input pin Detects the coil voltage waveform with reference to this voltage.		
39	SPC1	Spindle triangular wave generating capacitor connection pin With this triangular wave, the coil output waveform is soft switched.		
40	SPC2			

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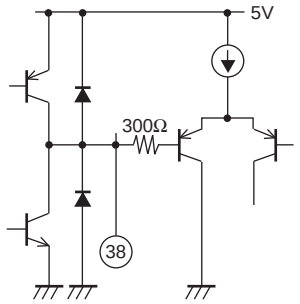
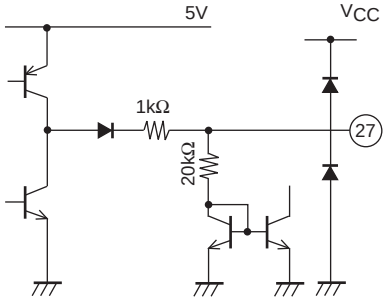
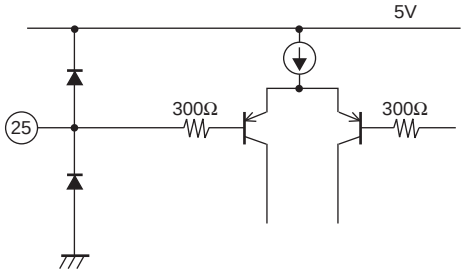
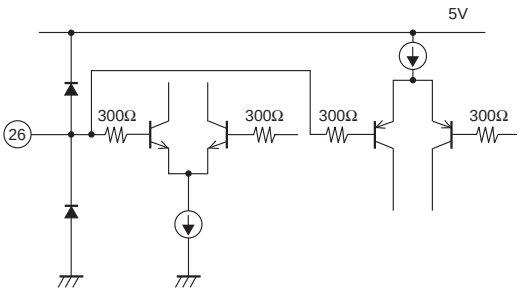
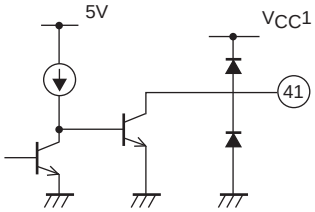
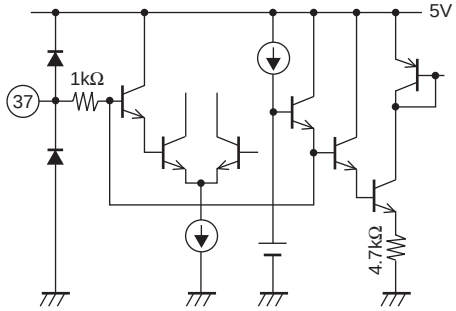
Pin No.	Pin name	Function	Pin voltage	Equivalent circuit
38	SPCX	With the value of a capacitor connected between this pin and GND in the spindle VCO circuit, the operation frequency range and minimum operation frequency are determined.		
27	SPFC	Frequency characteristics compensation pin. With a capacitor inserted between this pin and GND, oscillation of the current control system closed loop can be stopped.		
25	SPCTL	Spindle speed control pin Control is the constant current control by applying current return from DRS.	0V to 5V	
26	VREF	Spindle speed control reference pin BTLAMP internal VREF buffer input pin.	1V to 3.3V	
41	SPFGO	Spindle motor counter electromotive voltage detection FG output pin (synthesis of three phases)		
37	SPVCOIN	Drum block VCO circuit voltage input pin PCOUT pin voltage is filtered with CR for input.		

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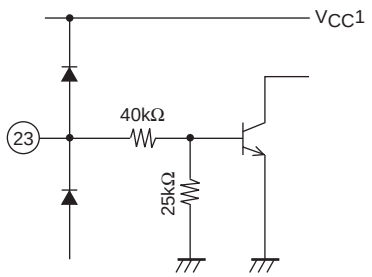
Pin No.	Pin name	Function	Pin voltage	Equivalent circuit
23	FR	Spindle block V-type control switching pin. FR : H ⇒ VREF < SPCTL drive FR : L ⇒ VREF < SPCTL drive "H" is for 2.8V or more. "L" is for 0.5V or less.	0V to $V_{CC}1$	

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