DATA SHEET

Part No.	AN41908A
Package Code No.	∗QFN044-P-0606D

Contents

■ Overview 3
■ Features 3
■ Applications 3
■ Package 3
■ Type 3
■ Application Circuit Example 4
■ Block Diagram 5
■ Pin Descriptions 6
■ Absolute Maximum Ratings 8
■ Operating Supply Voltage Range 8
■ Allowable Current and Voltage Range 9
■ Electrical Characteristics 10
■ Electrical Characteristics (Reference values for design) 12
■ Technical Data 14
• I/O block circuit diagrams and pin function descriptions 14
• P_D — T_a diagram 25
■ Usage Notes 26
• Special attention and precaution in using 26
• Notes of Power LSI 27

AN41908A

Lens Driver IC for camcorder and security-camera incorporating Iris control

■ Overview

AN41908A is a lens motor driver IC for camcorder and security-camera featuring the functions of Iris control. Voltage drive system and several torque ripple correction techniques enable super- low noise microstep drive.

■ Features

- Voltage drive system 256-step microstep drivers (2 systems)
- Built-in Iris controller
- Motor control by 4-line serial data communication
- 2 systems of open-drain for driving LED

■ Applications

- Camcorder, Security-camera

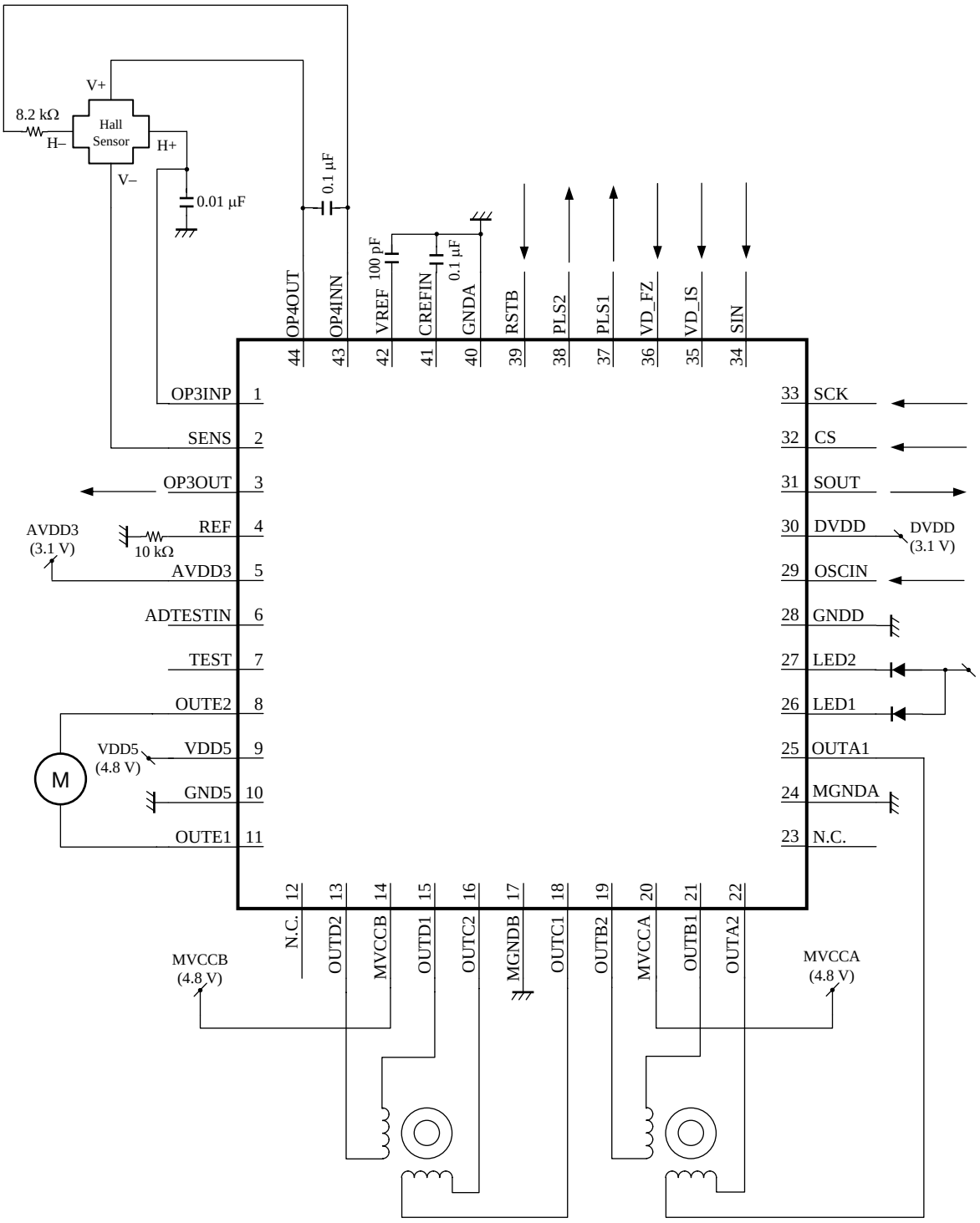
■ Package

- 44 pin Plastic Quad Flat Non-leaded Package (QFN Type)

■ Type

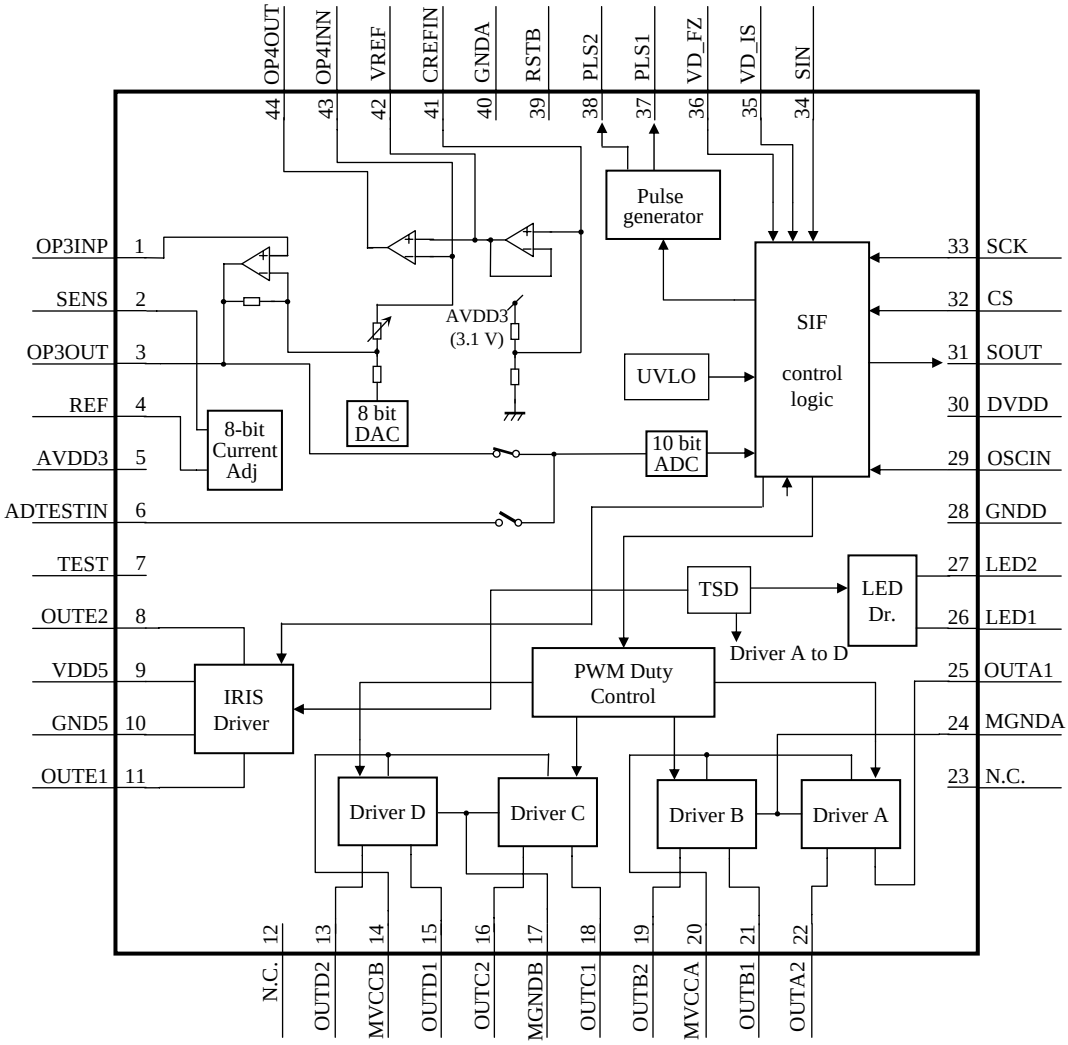
- Bi-COMS IC

■ Application Circuit Example



Note) This application circuit is shown as an example but does not guarantee the design for mass production set.

■ Block Diagram



Note) This block diagram is for explaining functions. The part of the block diagram may be omitted, or it may be simplified.

■ Pin Descriptions

Pin No.	Pin name	Type	Description
1	OP3INP	Input	Hall signal amplifier non-inverting input
2	SENS	Output	Hall current bias output
3	OP3OUT	Output	Hall signal amplifier output
4	REF	—	Resistor connection for Hall current bias setting
5	AVDD3	Power supply	3 V analog power supply
6	ADTESTIN	Input	ADC test input
7	TEST	Input	Test mode input
8	OUTE2	Output	Motor output E2
9	VDD5	Power supply	Power supply for Iris
10	GND5	Ground	GND for Iris
11	OUTE1	Output	Motor output E1
12	N.C.	—	N.C.
13	OUTD2	Output	Motor output D2
14	MVCCB	Power supply	Power supply for motor B
15	OUTD1	Output	Motor output D1
16	OUTC2	Output	Motor output C2
17	MGNDB	Ground	GND for motor B
18	OUTC1	Output	Motor output C1
19	OUTB2	Output	Motor output B2
20	MVCCA	Power supply	Power supply for motor A
21	OUTB1	Output	Motor output B1
22	OUTA2	Output	Motor output A2
23	N.C.	—	N.C.
24	MGNDA	Ground	GND for motor A
25	OUTA1	Output	Motor output A1
26	LED1	Input	Open-drain 1 for driving LED
27	LED2	Input	Open-drain 2 for driving LED
28	GNDD	Ground	Digital GND
29	OSCIN	Input	OSCIN input
30	DVDD	Power supply	3 V digital power supply
31	SOUT	Output	Serial data output
32	CS	Input	Chip select signal input
33	SCK	Input	Serial clock input
34	SIN	Input	Serial data input
35	VD_IS	Input	Iris video sync. signal input

■ Pin Descriptions (continued)

Pin No.	Pin name	Type	Description
36	VD_FZ	Input	Focus zoom sync. signal input
37	PLS1	Output	Pulse 1 output
38	PLS2	Output	Pulse 2 output
39	RSTB	Input	Reset signal input
40	GNDA	Ground	3 V analog GND
41	CREFIN	—	(AVDD3)/2 capacitor connection pin
42	VREF	Output	Reference voltage for Hall sensor
43	OP4INN	Input	Midpoint bias amplifier inverting input
44	OP4OUT	Output	Midpoint bias amplifier output

■ Absolute Maximum Ratings

Note) Absolute maximum ratings are limit values which do not result in damages to this IC, and IC operation is not guaranteed at these limit values.

A No.	Parameter	Symbol	Rating	Unit	Notes
1	Controller supply voltage	AVDD3	– 0.3 to + 4.0	V	*1
		DVDD	– 0.3 to + 4.0		
2	Supply voltage for motor controller 1	MVCCx	– 0.3 to + 6.0	V	*1
3	Supply voltage for motor controller 2	VDD5	– 0.3 to + 6.0	V	*1
4	Power dissipation	P_D	141.4	mW	*2
5	Operating ambient temperature	T_{opr}	–20 to + 85	°C	*3
6	Storage temperature	T_{stg}	–55 to + 125	°C	*3
7	Motor driver 1 (focus, zoom) H bridge drive current	$I_{M1(CD)}$	±0.25	A/ch	—
8	Motor driver 2 (iris) H bridge drive current	$I_{M2(CD)}$	±0.15	A/ch	—
9	Instantaneous H bridge drive current	$I_{M(pulse)}$	±0.4	A/ch	—
10	Digital input voltage	V_{in}	– 0.3 to (DVDD + 0.3)	V	*4

Notes) *1 : The values under the condition not exceeding the above absolute maximum ratings and the power dissipation.

*2 : The power dissipation shown is the value at T_a = 85°C for the independent (unmounted) IC package without a heat sink. When using this IC, refer to the • P_D-T_a diagram in the ■ Technical Data and design the heat radiation with sufficient margin so that the allowable value might not be exceeded based on the conditions of power supply voltage, load, and ambient temperature.

*3 : Except for the power dissipation, operating ambient temperature, and storage temperature, all ratings are for T_a = 25°C.

*4 : (DVDD + 0.3) V must not be exceeded 4.0 V.

■ Operating Supply Voltage Range

Parameter	Symbol	Range			Unit	Notes
		Min	Typ	Max		
Supply voltage range	AVDD3	2.7	3.1	3.6	V	*1
	DVDD	2.7	3.1	3.6		
	MVCCx	3.0	4.8	5.5		
	VDD5	3.0	4.8	5.5		

Note) *1 : The values under the condition not exceeding the above absolute maximum ratings and the power dissipation.

■ Allowable Current and Voltage Range

Notes)
- Allowable current and voltage ranges are limit ranges which do not result in damages to this IC, and IC operation is not guaranteed within these limit ranges.
- Voltage values, unless otherwise specified, are with respect to GND.
  GND is voltage for GNDA, GNDD, GND5, MGNDA, and MGNDB. GND = GNDA = GNDD = GND5 = MGNDA = MGNDB
- VCC3V is voltage for AVDD3 and DVDD. AVDD3 = DVDD
- Do not apply external currents or voltages to any pin not specifically mentioned.
- For the circuit currents, "+" denotes current flowing into the IC, and "–" denotes current flowing out of the IC.

Pin No.	Pin name	Rating	Unit	Notes
1	OP3INP	– 0.3 to (AVDD3 + 0.3)	V	*1
6	ADTESTIN	– 0.3 to (AVDD3 + 0.3)	V	*1
7	TEST	– 0.3 to (DVDD + 0.3)	V	*1
29	OSCIN	– 0.3 to (DVDD + 0.3)	V	*1
32	CS	– 0.3 to (DVDD + 0.3)	V	*1
33	SCK	– 0.3 to (DVDD + 0.3)	V	*1
34	SIN	– 0.3 to (DVDD + 0.3)	V	*1
35	VD_IS	– 0.3 to (DVDD + 0.3)	V	*1
36	VD_FZ	– 0.3 to (DVDD + 0.3)	V	*1
39	RSTB	– 0.3 to (DVDD + 0.3)	V	*1
43	OP4INN	– 0.3 to (AVDD3 + 0.3)	V	*1

Pin No.	Pin name	Rating	Unit	Notes
8	OUTE2	±0.15	A	—
11	OUTE1	±0.15	A	—
13	OUTD2	±0.25	A	—
15	OUTD1	±0.25	A	—
16	OUTC2	±0.25	A	—
18	OUTC1	±0.25	A	—
19	OUTB2	±0.25	A	—
21	OUTB1	±0.25	A	—
22	OUTA2	±0.25	A	—
25	OUTA1	±0.25	A	—
26	LED1	30	mA	—
27	LED2	30	mA	—

Note) *1 : (AVDD3 + 0.3) V must not be exceeded 4.0 V, and (DVDD + 0.3) V must not be exceeded 4.0 V.

■ Electrical Characteristics at VDD5 = MVCCx = 4.8 V, DVDD = AVDD3 = 3.1 V

Note) T_a = 25°C±2°C unless otherwise specified.

B No.	Parameter	Symbol	Conditions	Limits			Unit	Notes
				Min	Typ	Max		
Current circuit, Common circuit								
P1	MVCC supply current on Reset	$I_{Omdisable}$	No load, no 27 MHz input	—	0	3.0	μA	—
P2	MVCC supply current on Enable	$I_{menable}$	Output open	—	0.5	1.5	mA	—
P3	3 V supply current on Reset	$Icc3_{reset}$	No 27 MHz input	—	0	10.0	μA	—
P4	3 V supply current on Enable	$Icc3_{enable}$	Output open	—	7.0	20.0	mA	—
P5	VDD5 supply current on Reset	$Icc5_{reset}$	No 27 MHz input	—	0	3.0	μA	—
P6	VDD5 supply current on Enable	$Icc5_{enable}$	Output open	—	0.3	1.0	mA	—
P7	Supply current on Standby	$Icc_{standby}$	RSTB = High, output open, 27 MHz input, Total current	—	5.0	10.0	mA	—
P8	Supply current when FZ is Enable and Iris is in power save mode	Icc_{ps}	RSTB = High, output open, 27 MHz input, FZ = Enable, Total current	—	6.0	12.0	mA	—
Digital input / output								
D1	High-level input	$V_{in(H)}$	RSTB	0.54 × DVDD	—	DVDD + 0.3	V	—
D2	Low-level input	$V_{in(L)}$	RSTB	– 0.3	—	0.2 × DVDD	V	—
D3	SOUT High-level output	$V_{out(H):SDATA}$	[SOUT] 1 mA Source	DVDD – 0.5	—	—	V	—
D4	SOUT Low-level output	$V_{out(L):SDATA}$	[SOUT] 1 mA Sink	—	—	0.5	V	—
D5	PLS1 to 2 High-level output	$V_{out(H):MUX}$	—	0.9 × DVDD	—	—	V	—
D6	PLS1 to 2 Low-level output	$V_{out(L):MUX}$	—	—	—	0.1 × DVDD	V	—
D7	Input pull-down resistance	$R_{pullret}$	RSTB	50	100	200	kΩ	—
Motor driver 1 (focus, zoom)								
H1	H bridge ON resistance	R_{onFZ}	IM = 100 mA	—	—	2.5	Ω	—
H2	H bridge leak current	I_{leakFZ}	—	—	—	0.8	μA	—
Motor driver 2 (iris)								
H3	H bridge ON resistance	R_{onIR}	IM = 50 mA	—	—	5	Ω	—
H4	H bridge leak current	I_{leakIR}	—	—	—	0.8	μA	—
LED driver								
L1	Output ON resistance	R_{onLED}	I = 20 mA, 5 V cell	—	—	8	Ω	—
L2	Output leak current	$I_{leakLED}$	—	—	—	0.8	μA	—

■ Electrical Characteristics (continued) at VDD5 = MVCCx = 4.8 V, DVDD = AVDD3 = 3.1 V

Note) T_a = 25°C±2°C unless otherwise specified.

B No.	Parameter	Symbol	Conditions	Limits			Unit	Notes
				Min	Typ	Max		
OPAMP3 (HALL Sensor Amp. for output amplifier)								
O1	Input voltage range	V_{IN}	—	½ AVDD3 – 0.5	½ AVDD3	½ AVDD3 + 0.5	V	—
O2	Input offset voltage	V_{OF}	—	–15	—	15	mV	—
O3	Output voltage (Low)	V_{OL}	ILOAD = –100 μA	—	0.1	0.2	V	—
O4	Output voltage (High)	V_{OH}	ILOAD = 100 μA	AVDD3 – 0.2	AVDD3 – 0.1	—	V	—
O5	Gain	V_{OG}	Gain setting value : 0h	19.7	21.9	24.1	V/V	—
OPAMP4 (HALL Sensor Amp. for eliminating common-mode voltage)								
O6	Input voltage range	V_{IN}	—	½ AVDD3 – 0.1	—	½ AVDD3 + 0.1	V	—
O7	Input offset voltage	V_{OF}	—	–10	—	10	mV	—
O8	Output voltage (Low)	V_{OL}	ILOAD = –10 μA	—	0.1	0.2	V	—
O9	Output voltage (High)	V_{OH}	ILOAD = 3 mA	AVDD3 – 0.5	AVDD3 – 0.2	—	V	—
Reference voltage output block								
O10	Output voltage 1	VREF	ILOAD = 0 A, CVREF = 100 pF	½ AVDD3 – 0.1	½ AVDD3	½ AVDD3 + 0.1	V	—
O11	Output voltage 2	VREFL	ILOAD = ±100 μA, CVREF = 100 pF	VREF – 0.1	VREF	VREF + 0.1	V	—
Hall bias controller (SENS pin output)								
O12	Min. output current	IBL	REF = 10 kΩ, SENS = 0.7 V Setting value : 00 h	—	0	0.1	mA	—
O13	Output current accuracy 1	IB40H	REF = 10 kΩ, SENS = 0.7 V Setting value : 40 h	0.9	1.02	1.14	mA	—
O14	Output current accuracy 2	IBBFH	REF = 10 kΩ, SENS = 0.7 V Setting value : BE h	2.66	3.02	3.38	mA	—

■ Electrical Characteristics (Reference values for design) at VDD5 = MVCCx = 4.8 V, DVDD = AVDD3 = 3.1 V

Notes) T_a = 25°C±2°C unless otherwise specified.
The characteristics listed below are reference values derived from the design of the IC and are not guaranteed by inspection.
If a problem does occur related to these characteristics, we will respond in good faith to user concerns.

B No.	Parameter	Symbol	Conditions	Reference values			Unit	Notes
				Min	Typ	Max		
Serial port input								
S1	Serial clock	Sclock	—	1	—	5	MHz	—
S2	SCK low time	T1	—	100	—	—	ns	—
S3	SCK high time	T2	—	100	—	—	ns	—
S4	CS setup time	T3	—	60	—	—	ns	—
S5	CS hold time	T4	—	60	—	—	ns	—
S6	CS disable high time	T5	—	100	—	—	ns	—
S7	SIN setup time	T6	—	50	—	—	ns	—
S8	SIN hold time	T7	—	50	—	—	ns	—
S9	SOUT delay time	T8	—	—	—	60	ns	—
S10	SOUT hold time	T9	—	60	—	—	ns	—
S11	SOUT Enable-Hi-Z time	T10	—	—	—	60	ns	—
S12	SOUT Hi-Z-Enable time	T11	—	—	—	60	ns	—
S13	SOUT C load	T_{SC}	—	—	—	40	pF	—
Digital input / output								
D8	High-level input threshold voltage	$V_{in(H)}$	SCK, SIN, CS, OSCIN, VD_IS, VD_FZ, TEST	—	1.36	—	V	—
D9	Low-level input threshold voltage	$V_{in(L)}$	SCK, SIN, CS, OSCIN, VD_IS, VD_FZ, TEST	—	1.02	—	V	—
D10	RSTB signal pulse width	Trst	—	100	—	—	µs	—
D11	Input hysteresis width	V_{hysin}	SCK, SIN, CS, OSCIN, VD_IS, VD_FZ, TEST	—	0.34	—	V	—
D12	Video sync. signal width	VD_W	—	80	—	—	µs	—
D13	CS signal wait time 1	$T_{(VD-CS)}$	—	400	—	—	ns	—
D14	CS signal wait time 2	$T_{(CS-DT1)}$	—	5	—	—	µs	—

■ Electrical Characteristics (Reference values for design) (continued) at
VDD5 = MVCCx = 4.8 V, DVDD = AVDD3 = 3.1 V

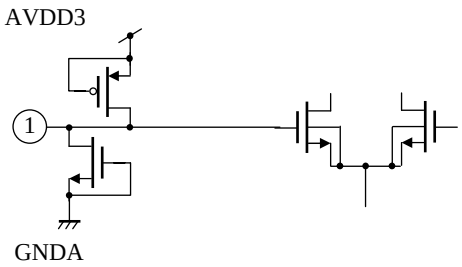
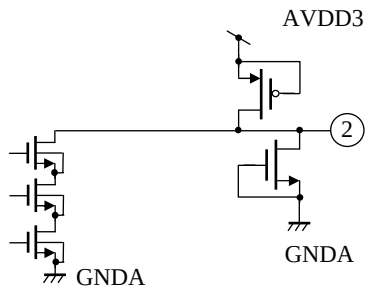
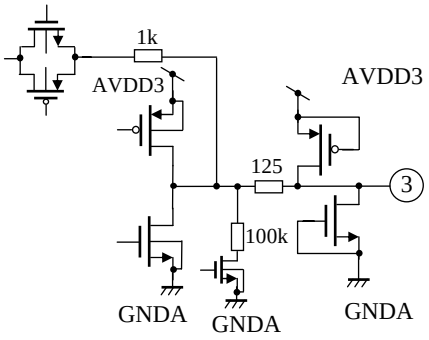
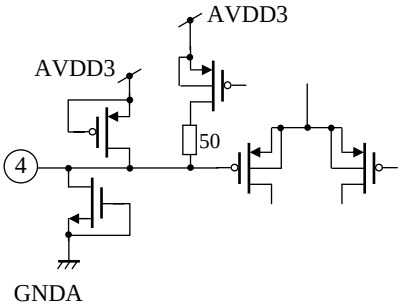
Notes) T_a = 25°C±2°C unless otherwise specified.
The characteristics listed below are reference values derived from the design of the IC and are not guaranteed by inspection.
If a problem does occur related to these characteristics, we will respond in good faith to user concerns.

B No.	Parameter	Symbol	Conditions	Reference values			Unit	Notes
				Min	Typ	Max		
Pulse generator								
PL1	Pulse start resolution for pulse 1	PL1wait	OSCIN = 27 MHz	—	20.1	—	µs	—
PL2	Pulse resolution for pulse 1	PL1width	OSCIN = 27 MHz	—	1.2	—	µs	—
PL3	Pulse start resolution for pulse 2	PL2wait	OSCIN = 27 MHz	—	20.1	—	µs	—
Iris control								
IR1	AD sampling frequency	$IRIS_{Sample}$	OSCIN = 27 MHz	—	500	—	kHz	—
Thermal shutdown								
T1	Thermal shutdown operation temperature	Ttsd	—	—	150	—	°C	—
T2	Thermal shutdown hysteresis width	ΔTtsd	—	—	40	—	°C	—
Supply voltage monitor circuit								
R1	3.3 V Reset operation	Vrston	—	—	2.27	—	V	—
R2	3.3 V Reset hysteresis width	Vrsthys	—	—	0.2	—	V	—
R3	MVCCx Reset operation	$V_{rstFZon}$	—	—	2.2	—	V	—
R4	MVCCx Reset hysteresis width	$V_{rstFZhys}$	—	—	0.2	—	V	—
R5	VDD5 Reset operation	$V_{rstISon}$	—	—	2.2	—	V	—
R6	VDD5 Reset hysteresis width	$V_{rstIShys}$	—	—	0.2	—	V	—
8 bit DAC for Hall Offset adjustment								
DA1	Adjustment range (High)	DAOTHof	—	—	AVDD3	—	V	—
DA2	Adjustment range (Low)	DAOTLof	—	—	0	—	V	—
10 bit ADC								
AD1	Input Range (High)	$V_{in(H)}$	—	—	—	AVDD3 – 0.2	V	—
AD2	Input Range (Low)	$V_{in(L)}$	—	0.2	—	—	V	—
AD3	DNLE (Differential linearity error)	DNL10A	—	—	1.0	—	LSB	—
AD4	INLE (Integral linearity error)	INL10A	—	—	2.0	—	LSB	—

■ Technical Data

- I/O block circuit diagrams and pin function descriptions

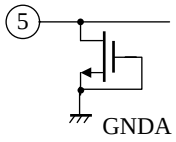
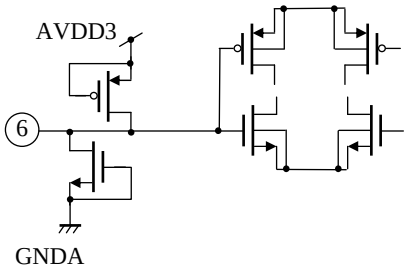
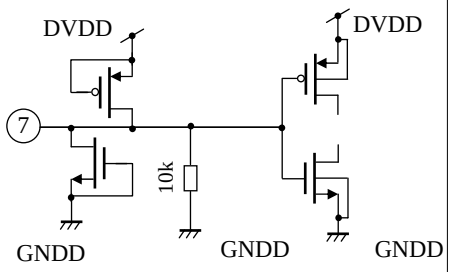
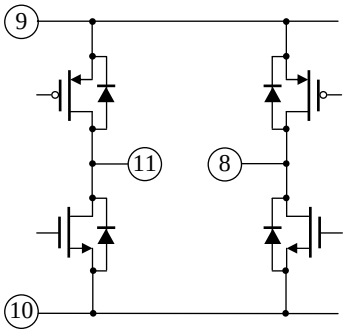
Note) The characteristics listed below are reference values derived from the design of the IC and are not guaranteed.

Pin No.	Waveform and voltage	Internal circuit	Impedance	Description
1	—		—	OP3INP Hall signal amplifier non-inverting input pin
2	—		—	SENS Hall current bias output pin
3	Hall signal amplifier output		—	OP3OUT Hall amp. output pin
4	—		—	REF Resistor pin for Hall bias

■ Technical Data (continued)

- I/O block circuit diagrams and pin function descriptions (continued)

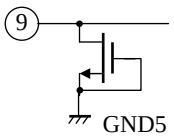
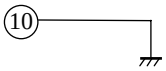
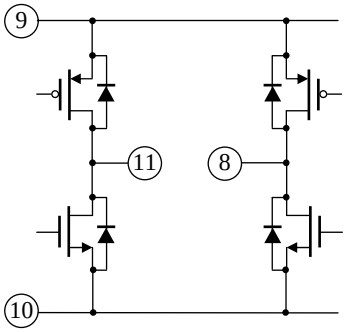
Note) The characteristics listed below are reference values derived from the design of the IC and are not guaranteed.

Pin No.	Waveform and voltage	Internal circuit	Impedance	Description
5	AVDD3		—	AVDD3 3 V analog power supply pin
6	—		—	ADTESTIN ADC test input pin
7	GNDD to DVDD Logic signal input		10 kΩ	TEST Test mode input pin TEST
8	—		—	OUTE2 Iris output pin 0

■ Technical Data (continued)

- I/O block circuit diagrams and pin function descriptions (continued)

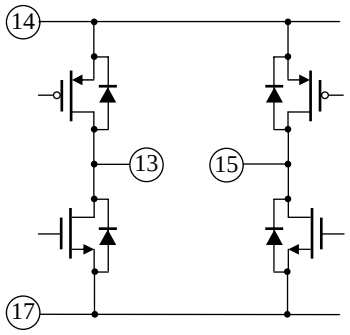
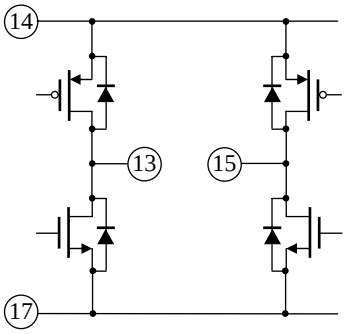
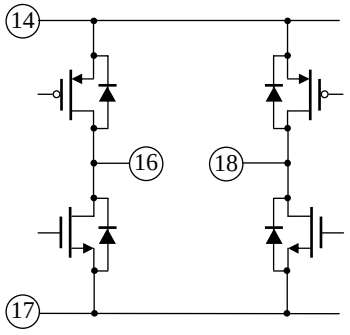
Note) The characteristics listed below are reference values derived from the design of the IC and are not guaranteed.

Pin No.	Waveform and voltage	Internal circuit	Impedance	Description
9	VDD5		—	VDD5 5 V power supply pin
10	GND5		—	GND5 5V GND pin
11	—		—	OUTE1 Iris output pin 1
12	—	—	—	N.C.

■ Technical Data (continued)

- I/O block circuit diagrams and pin function descriptions (continued)

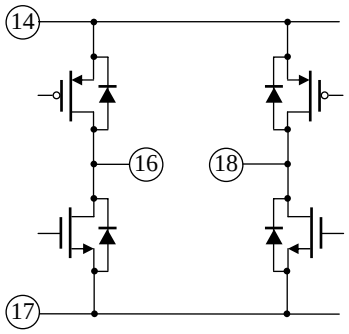
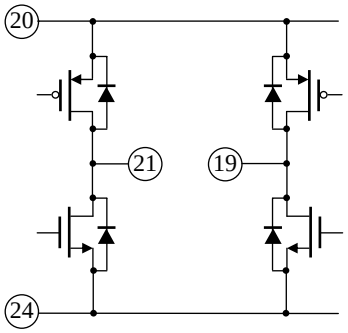
Note) The characteristics listed below are reference values derived from the design of the IC and are not guaranteed.

Pin No.	Waveform and voltage	Internal circuit	Impedance	Description
13	—		—	OUTD2 Motor output pin D2
14	MVCCB	—	—	MVCCB Power supply pin for motor B
15	—		—	OUTD1 Motor output pin D1
16	—		—	OUTC2 Motor output pin C2

■ Technical Data (continued)

- I/O block circuit diagrams and pin function descriptions (continued)

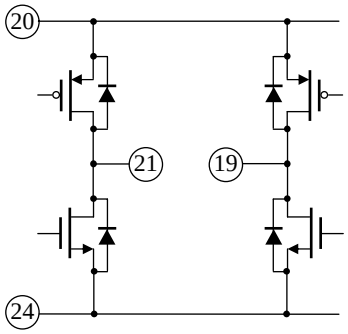
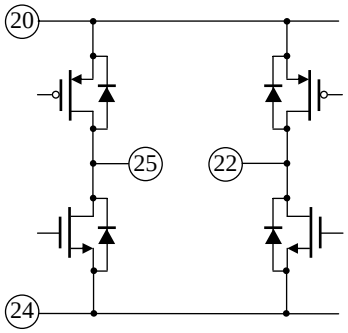
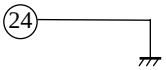
Note) The characteristics listed below are reference values derived from the design of the IC and are not guaranteed.

Pin No.	Waveform and voltage	Internal circuit	Impedance	Description
17	MGNDB		—	MGNDB GND pin for motor B
18	—		—	OUTC1 Motor output pin C1
19	—		—	OUTB2 Motor output pin B2
20	—	—	—	MVCCA Power supply pin for motor A

■ Technical Data (continued)

- I/O block circuit diagrams and pin function descriptions (continued)

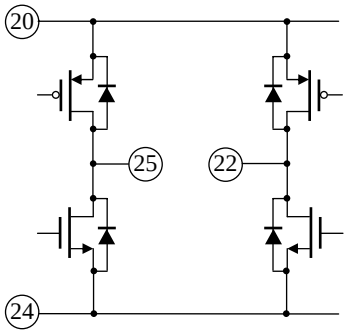
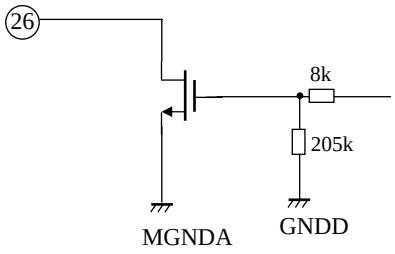
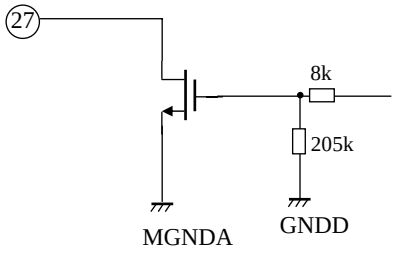
Note) The characteristics listed below are reference values derived from the design of the IC and are not guaranteed.

Pin No.	Waveform and voltage	Internal circuit	Impedance	Description
21	—		—	OUTB1 Motor output pin B1
22	—		—	OUTA2 Motor output pin A2
23	—	—	—	N.C.
24	MGNDA		—	MGNDA GND pin for motor A

■ Technical Data (continued)

- I/O block circuit diagrams and pin function descriptions (continued)

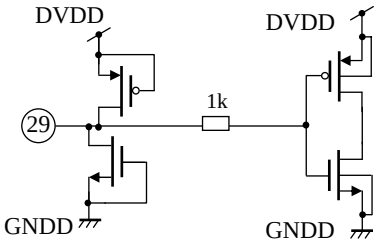
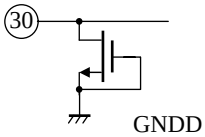
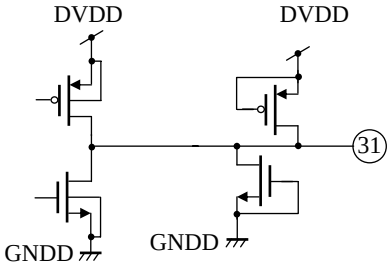
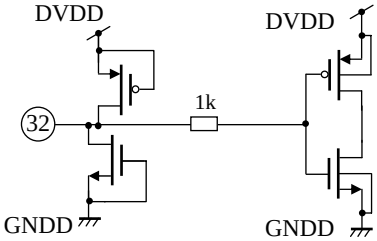
Note) The characteristics listed below are reference values derived from the design of the IC and are not guaranteed.

Pin No.	Waveform and voltage	Internal circuit	Impedance	Description
25	—		—	OUTA1 Motor output pin A1
26	Hi-Z or open-drain output		Serial selection Hi-Z Max. 8 Ω	LED1 Open-drain 1 for driving LED
27	Hi-Z or open-drain output		Serial selection Hi-Z Max. 8 Ω	LED2 Open-drain 2 for driving LED
28	GNDD		—	GNDD Digital GND pin

■ Technical Data (continued)

- I/O block circuit diagrams and pin function descriptions (continued)

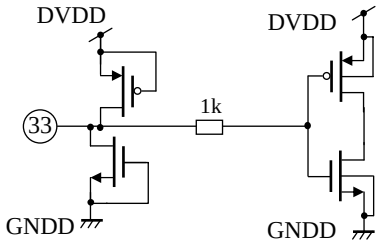
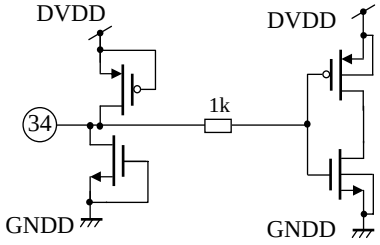
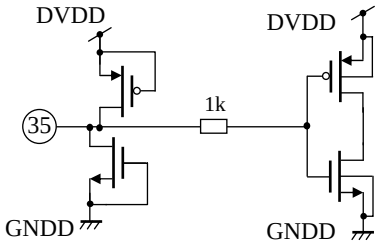
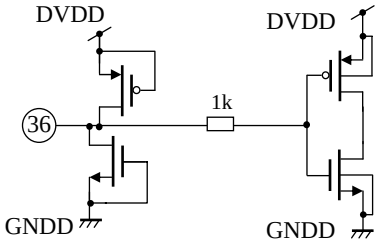
Note) The characteristics listed below are reference values derived from the design of the IC and are not guaranteed.

Pin No.	Waveform and voltage	Internal circuit	Impedance	Description
29	GNDD to DVDD logic signal input		Hi-Z	OSCIN OSCIN input pin (Schmidt)
30	DVDD		—	DVDD 3 V digital power supply pin
31	GNDD to DVDD logic signal output / Hi-Z		—	SOUT Serial data output pin
32	GNDD to DVDD logic signal input		Hi-Z	CS Chip select signal input pin (Schmidt)

■ Technical Data (continued)

- I/O block circuit diagrams and pin function descriptions (continued)

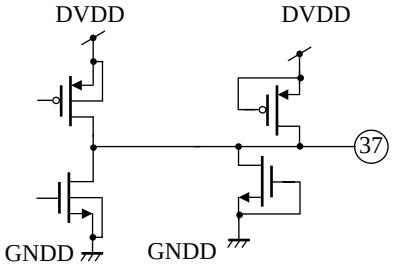
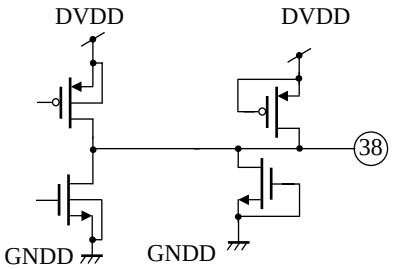
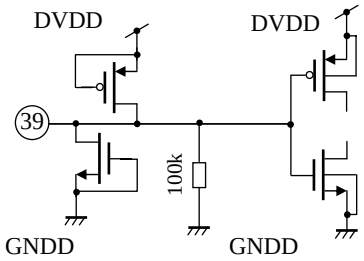
Note) The characteristics listed below are reference values derived from the design of the IC and are not guaranteed.

Pin No.	Waveform and voltage	Internal circuit	Impedance	Description
33	GNDD to DVDD logic signal input		Hi-Z	SCK Serial clock input pin (Schmidt)
34	GNDD to DVDD logic signal input		Hi-Z	SIN Serial data input pin (Schmidt)
35	GNDD to DVDD logic signal input		Hi-Z	VD_IS VD_IS input pin (Schmidt)
36	GNDD to DVDD logic signal input		Hi-Z	VD_FZ VD_FZ input pin (Schmidt)

■ Technical Data (continued)

- I/O block circuit diagrams and pin function descriptions (continued)

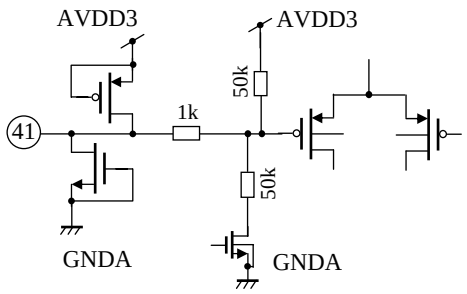
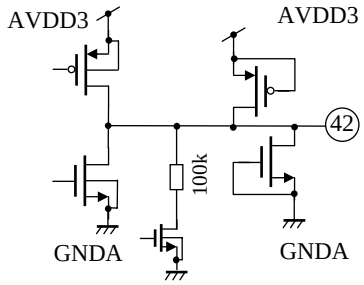
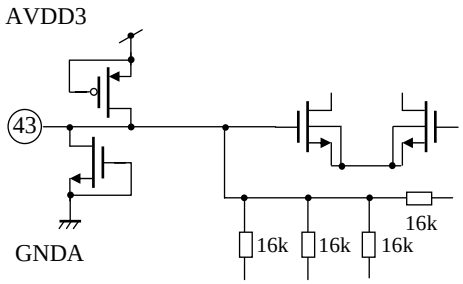
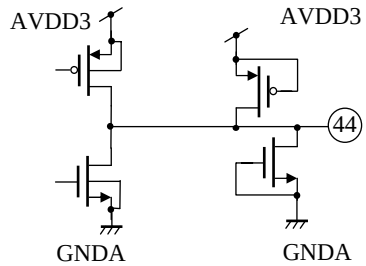
Note) The characteristics listed below are reference values derived from the design of the IC and are not guaranteed.

Pin No.	Waveform and voltage	Internal circuit	Impedance	Description
37	GNDD to DVDD logic signal output		—	PLS1 Pulse 1 output pin
38	GNDD to DVDD logic signal output		—	PLS2 Pulse 2 output pin
39	Logic signal input		100 kΩ	RSTB Reset signal input pin
40	GNDA		—	GNDA 3 V analog GND

■ Technical Data (continued)

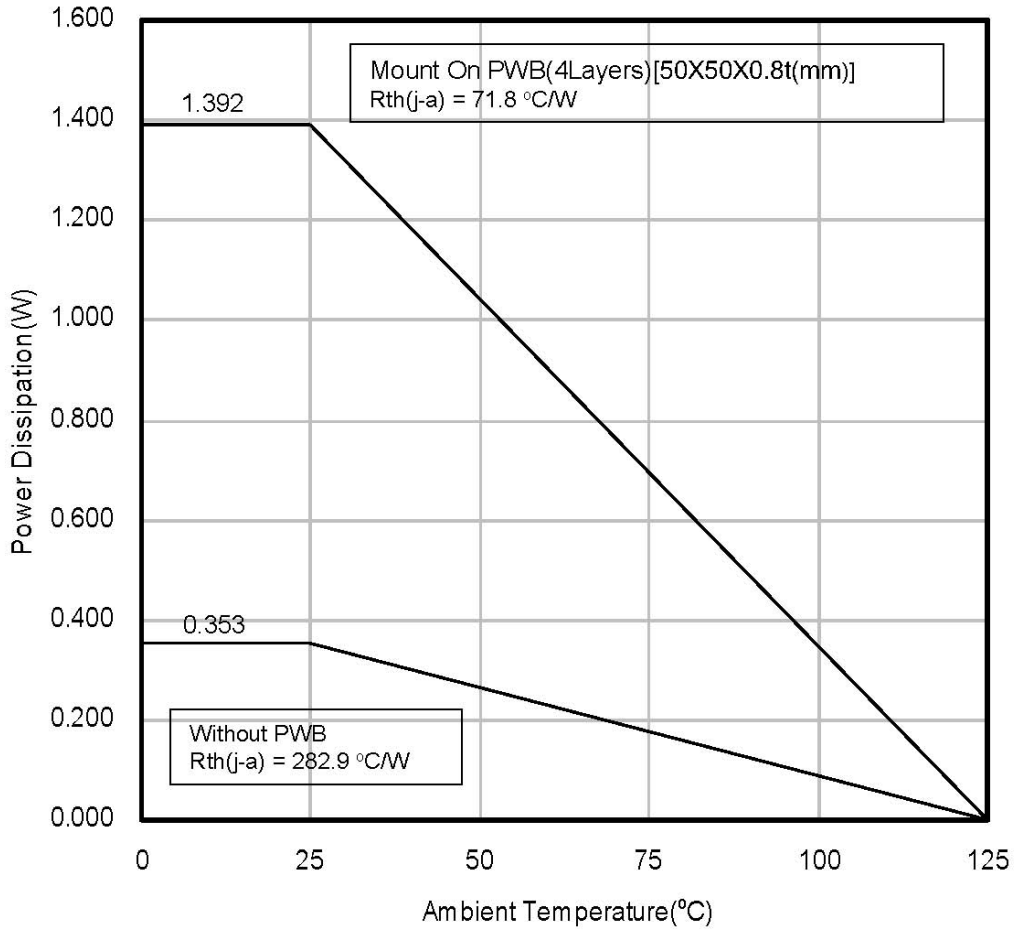
- I/O block circuit diagrams and pin function descriptions (continued)

Note) The characteristics listed below are reference values derived from the design of the IC and are not guaranteed.

Pin No.	Waveform and voltage	Internal circuit	Impedance	Description
41	—		25 kΩ	CREFIN (AVDD3)/2 capacitor connection pin
42	—		—	VREF Reference voltage for Hall sensor
43	—		—	OP4INN Midpoint bias amplifier non-inverting input pin
44	—		—	OP4OUT Midpoint bias amplifier output pin

■ Technical Data (continued)

• P_D — T_a diagram



■ Usage Notes

- Special attention and precaution in using

1. This IC is intended to be used for general electronic equipment [camcorder].
   Consult our sales staff in advance for information on the following applications:
   - Special applications in which exceptional quality and reliability are required, or if the failure or malfunction of this IC may directly jeopardize life or harm the human body.
   - Any applications other than the standard applications intended.
     (1) Space appliance (such as artificial satellite, and rocket)
     (2) Traffic control equipment (such as for automobile, airplane, train, and ship)
     (3) Medical equipment for life support
     (4) Submarine transponder
     (5) Control equipment for power plant
     (6) Disaster prevention and security device
     (7) Weapon
     (8) Others : Applications of which reliability equivalent to (1) to (7) is required

2. Pay attention to the direction of LSI. When mounting it in the wrong direction onto the PCB (printed-circuit-board), it might smoke or ignite.

3. Pay attention in the PCB (printed-circuit-board) pattern layout in order to prevent damage due to short circuit between pins. In addition, refer to the Pin Description for the pin configuration.

4. Perform a visual inspection on the PCB before applying power, otherwise damage might happen due to problems such as a solder-bridge between the pins of the semiconductor device. Also, perform a full technical verification on the assembly quality, because the same damage possibly can happen due to conductive substances, such as solder ball, that adhere to the LSI during transportation.

5. Take notice in the use of this product that it might break or occasionally smoke when an abnormal state occurs such as output pin-V_{CC} short (Power supply fault), output pin-GND short (Ground fault), or output-to-output-pin short (load short) .
   And, safety measures such as an installation of fuses are recommended because the extent of the above-mentioned damage and smoke emission will depend on the current capability of the power supply.

6. When designing your equipment, comply with the range of absolute maximum rating and the guaranteed operating conditions (operating power supply voltage and operating environment etc.). Especially, please be careful not to exceed the range of absolute maximum rating on the transient state, such as power-on, power-off and mode-switching. Otherwise, we will not be liable for any defect which may arise later in your equipment.
   Even when the products are used within the guaranteed values, take into the consideration of incidence of break down and failure mode, possible to occur to semiconductor products. Measures on the systems such as redundant design, arresting the spread of fire or preventing glitch are recommended in order to prevent physical injury, fire, social damages, for example, by using the products.

7. When using the LSI for new models, verify the safety including the long-term reliability for each product.

8. When the application system is designed by using this LSI, be sure to confirm notes in this book.
   Be sure to read the notes to descriptions and the usage notes in the book.

9. Take time to check the characteristics on use. When changing an external circuit constant for use, consider not only static characteristics, but also transient characteristics and external parts with respect to the characteristics difference among ICs so that you can get enough margin. Moreover, consider the influence of electric charge remaining in an external capacitor on rising/falling of power supply.

■ Usage Notes (continued)

- Notes of Power LSI

1. The protection circuit is for maintaining safety against abnormal operation. Therefore, the protection circuit should not work during normal operation.
   Especially for the thermal protection circuit, if the area of safe operation or the absolute maximum rating is momentarily exceeded due to output pin to V_{CC} short (Power supply fault), or output pin to GND short (Ground fault), the LSI might be damaged before the thermal protection circuit could operate.

2. Unless specified in the product specifications, make sure that negative voltage or excessive voltage are not applied to the pins because the device might be damaged, which could happen due to negative voltage or excessive voltage generated during the ON and OFF timing when the inductive load of a motor coil or actuator coils of optical pick-up is being driven.

3. The product which has specified ASO (Area of Safe Operation) should be operated in ASO.

4. Verify the risks which might be caused by the malfunctions of external components.

5. Apply voltage from a low-impedance to power supply pins and connect a bypass capacitor to the LSI as near as possible.