

Optical disc ICs

# 6CH Power Driver for CD-ROM, DVD-ROM

## BD7905BFS

BD7905BFS is a 6-channel driver IC that integrates all drivers necessary for optical disc driver. Low vibration, low noise, and low heat operation have been realized by adopting 180° PWM driving system for spindle motor driver. The built-in 2-channel sled motor driver is used for the stepping motor.

### ●Applications

CD-ROM, DVD-ROM

### ●Features

- 1) 3channel BTL driver, 2channel PWM driver and 3phase motor driver.
  - ALL of the motor and actuator for CD-ROM, DVD-ROM etc.
- 2) These mode is able to be selected by the two control terminals.
  - ON/OFF of loading, and other 5channels, brake mode and gain select of spindle driver and standby mode.
- 3) Built-in triangular-wave generator.
- 4) Package SSOP-A54 has large power dissipation.
- 5) Built in thermal-shut-down circuit.

〈 Spindle driver 〉

- Efficient drive by current feedback 180deg PWM drive.
- Built in current limit, hall bias, short brake, FG 3-phase mixed signal output and reverse protection circuit.
- Low ON-Resistor. (RON=0.85Ω)

〈 Sled motor driver 〉

- Efficient drive by current feedback PWM drive.
- Built in 2channel for stepping motor.

〈 Actuator driver, Loading driver 〉

- Linear BTL drive system.

## Optical disc ICs

## ●Absolute maximum ratings (Ta=25°C)

| Parameter                                    | Symbol  | Limits   | Unit |
|--|---|----------|------|
| POWER MOS power supply voltage               | SPVM1,2,SLRNF1,2                                    | 15*1     | V    |
| Preblock/BTL powerblock power supply voltage | V <sub>CC</sub> ,SLV <sub>DD</sub> ,AV <sub>M</sub> | 15       | V    |
| PWM control block power supply voltage       | DV <sub>CC</sub>                                    | 7        | V    |
| Power dissipation                            | P <sub>d</sub>                                      | 2.6*2    | W    |
| Operating temperature range                  | T <sub>opr</sub>                                    | -40~+85  | °C   |
| Storage temperature                          | T <sub>stg</sub>                                    | -55~+150 | °C   |

\*1 POWER MOS output terminals (9, 11, 18, 34~37pin) is contained.

\*2 PCB (70mm×70mm×1.6mm glass epoxy) mounting.

Reduced by 20.8mW for each increase in Ta of 1°C over 25°C.

## ●Recommended operating conditions (Ta=25°C)

(Set the power supply voltage taking allowable dissipation into considering)

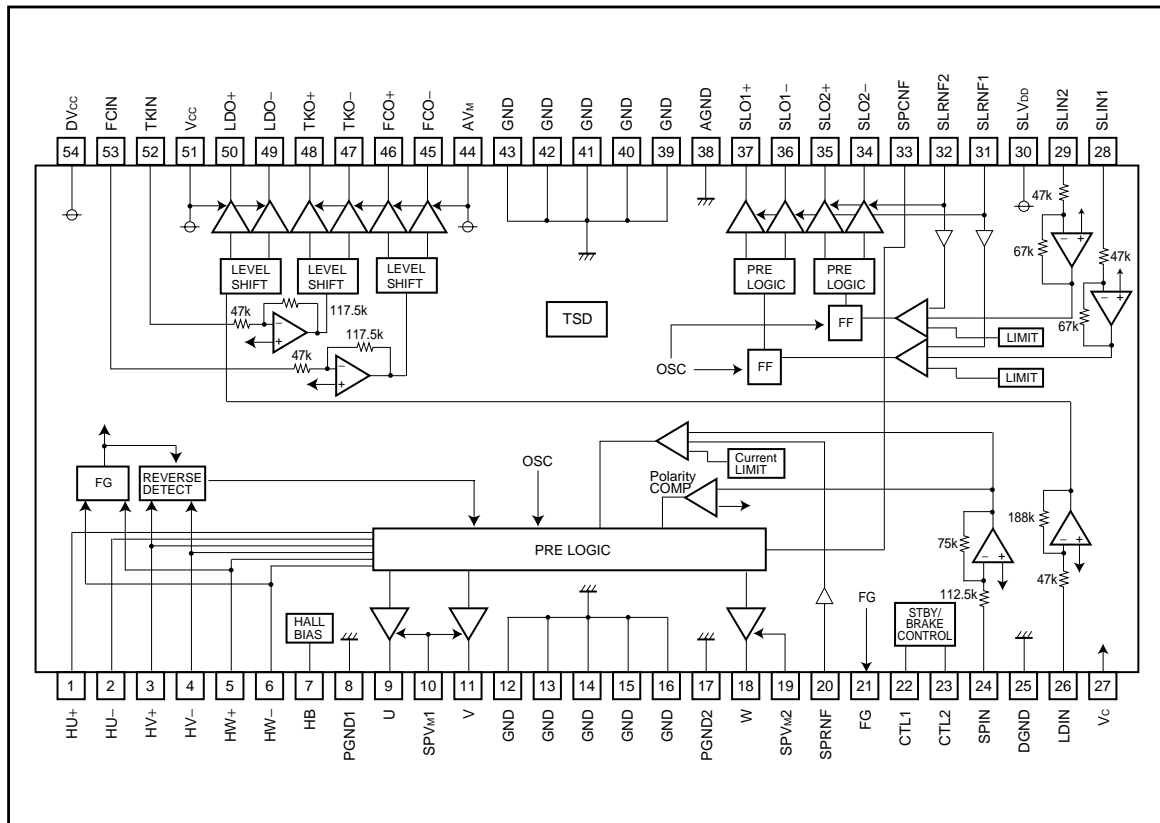
| Parameter                              | Symbol                              | Min.            | Typ.                 | Max.            | Unit |
|--|-------------------------------------|-----------------|----------------------|-----------------|------|
| POWER MOS Power supply voltage 1       | SPVM1, 2                            | –               | V <sub>CC</sub> *3   | –               | V    |
| POWER MOS Power supply voltage 2       | SLRNF1, 2                           | –               | SLV <sub>DD</sub> *3 | –               | V    |
| Preblock Power supply voltage          | SLV <sub>DD</sub> , V <sub>CC</sub> | AV <sub>M</sub> | 12                   | 14              | V    |
| Power block Power supply voltage       | AV <sub>M</sub>                     | 4.3             | 5.0                  | V <sub>CC</sub> | V    |
| PWM control block Power supply voltage | DV <sub>CC</sub>                    | 4.3             | 5.0                  | 6.0             | V    |
| Spindle output current                 | I <sub>osp</sub>                    | –               | 1.2                  | 2.5*4           | A    |
| SL/FO/TR/LO output current             | I <sub>oo</sub>                     | –               | 0.5                  | 0.8             | A    |

\*3 Set the same supply voltage to V<sub>CC</sub> and SPVM1, 2 to SLV<sub>DD</sub> and SLRNF1, 2.

\*4 The current is guaranteed 3.0A in case of the current is turned on/off in a duty-ratio of less than 1/10 with a maximum on-time of 5msec.

Optical disc ICs

●Block diagram



## Optical disc ICs

## ●Pin descriptions

| Pin No. | Pin name          | Function                      | Pin No. | Pin name          | Function                               |
|---------|-------------------|-------------------------------|---------|-------------------|--|
| 1       | HU+               | Hall amp. U positive input    | 28      | SLIN1             | Sled driver 1 input                    |
| 2       | HU-               | Hall amp. U negative input    | 29      | SLIN2             | Sled driver 2 input                    |
| 3       | HV+               | Hall amp. V positive input    | 30      | SLV <sub>DD</sub> | Sled driver PowerMOS pre-supply        |
| 4       | HV-               | Hall amp. V negative input    | 31      | SLRNF1            | Sled driver 1 current sense            |
| 5       | HW+               | Hall amp. W positive input    | 32      | SLRNF2            | Sled driver 2 current sense            |
| 6       | HW-               | Hall amp. W negative input    | 33      | SPCNF             | Spindle driver feedback filter         |
| 7       | HB                | Hall bias                     | 34      | SLO2-             | Sled driver 2 negative output          |
| 8       | PGND1             | Spindle driver power ground 1 | 35      | SLO2+             | Sled driver 2 positive output          |
| 9       | U                 | Spindle driver output U       | 36      | SLO1-             | Sled driver 1 negative output          |
| 10      | SPV <sub>M1</sub> | Spindle driver power supply 1 | 37      | SLO1+             | Sled driver 1 positive output          |
| 11      | V                 | Spindle driver output V       | 38      | AGND              | BTL block and sled driver power ground |
| 12      | GND               | GND                           | 39      | GND               | GND                                    |
| 13      | GND               | GND                           | 40      | GND               | GND                                    |
| 14      | GND               | GND                           | 41      | GND               | GND                                    |
| 15      | GND               | GND                           | 42      | GND               | GND                                    |
| 16      | GND               | GND                           | 43      | GND               | GND                                    |
| 17      | PGND2             | Spindle driver power ground 2 | 44      | AV <sub>M</sub>   | Actuator driver block power supply     |
| 18      | W                 | Spindle driver output W       | 45      | FCO-              | Focus driver negative output           |
| 19      | SPV <sub>M2</sub> | Spindle driver power supply 2 | 46      | FCO+              | Focus driver positive output           |
| 20      | SPRNF             | Spindle driver current sense  | 47      | TKO-              | Tracking driver negative output        |
| 21      | FG                | Frequency generator output    | 48      | TKO+              | Tracking driver positive output        |
| 22      | CTL1              | Driver logic control input 1  | 49      | LDO-              | Loading driver negative output         |
| 23      | CTL2              | Driver logic control input 2  | 50      | LDO+              | Loading driver positive output         |
| 24      | SPIN              | Spindle driver input          | 51      | V <sub>CC</sub>   | BTL pre and Loading power supply       |
| 25      | DGND              | PWM block pre-ground          | 52      | TKIN              | Tracking driver input                  |
| 26      | LDIN              | Loading driver input          | 53      | FCIN              | Focus driver input                     |
| 27      | V <sub>C</sub>    | Reference voltage input       | 54      | DV <sub>CC</sub>  | PWM block control power supply         |

\* Positive/negative of the output terminals are determined in reference to those of the input terminals.

Optical disc ICs

●Input output circuit

|  |   |                                 |
|--|---|---------------------------------|
| <p>Three-phase motor driver output</p> | <p>Spindle driver current detection input</p> | <p>Hall bias</p>                |
| <p>Hall signal input</p>               | <p>Spindle driver feedback filter pin</p>     | <p>FG signal output</p>         |
| <p>PWM driver output SLED1, 2</p>      | <p>BTL driver output FO, TK</p>               | <p>BTL driver output LD</p>     |
| <p>BTL driver input FO, TK, LD</p>     | <p>PWM driver input SLED1, 2</p>              | <p>PWM driver input Spindle</p> |
| <p>Reference voltage input</p>         |   | <p>Control signal input</p>     |

## Optical disc ICs

## ●Electrical characteristics

(unless otherwise noted, Ta=25°C, SLVDD=VCC=12V, DVCC=AVM=5V, Vc=1.65V, SPRNF=0.22Ω, SLRNF=0.5Ω)

| Parameter                               | Symbol  | Min.           | Typ.          | Max.           | Unit                 | Conditions                              | Circuit |
|---|---------|----------------|---------------|----------------|----------------------|---|---------|
| Circuit current                         |         |                |               |                |                      |   |         |
| Quiescent current 1                     | IQ1     | –              | 13            | 22             | mA                   | Vcc (Loading OFF)                       | Fig1, 2 |
| Quiescent current 2                     | IQ2     | –              | 9             | 16             | mA                   | Vcc (Loading ON)                        | Fig1, 2 |
| Quiescent current 3                     | IQ3     | –              | 2.5           | 4.5            | mA                   | DVcc                                    | Fig1, 2 |
| Standby-on current 1                    | IST1    | –              | –             | 0.1            | mA                   | Vcc                                     | Fig1, 2 |
| Standby-on current 2                    | IST2    | –              | 0.2           | 0.4            | mA                   | DVcc                                    | Fig1, 2 |
| Sled driver block                       |         |                |               |                |                      |   |         |
| Input dead zone (one side)              | VDZSL   | 5              | 30            | 55             | mV                   |   | Fig1, 2 |
| Input output gain                       | gmSL    | 1.0<br>(0.50)  | 1.3<br>(0.65) | 1.6<br>(0.8)   | A/V<br>(V/V)         | SLRNF=0.5Ω                              | Fig1, 2 |
| Output ON resistor (upper)              | RONUSL  | –              | 1.8           | 2.3            | Ω                    | IL=500mA                                | Fig1, 2 |
| Output ON resistor (lower)              | RONLSL  | –              | 0.8           | 1.4            | Ω                    | IL=-500mA                               | Fig1, 2 |
| Output limit current                    | ILIMSL  | 0.84<br>(0.42) | 1.0<br>(0.50) | 1.16<br>(0.58) | A<br>(V)             | SLRNF=0.5Ω                              | Fig1, 2 |
| PWM frequency                           | fosc    | –              | 100           | –              | kHz                  |   | Fig1, 2 |
| Spindle driver block ( Hall bias )      |         |                |               |                |                      |   |         |
| Hall bias voltage                       | VHB     | 0.7            | 1.15          | 1.6            | V                    | IHB=10mA                                | Fig1, 2 |
| Spindle driver block ( Hall amplifier ) |         |                |               |                |                      |   |         |
| Input bias current                      | IHIB    | –              | 1             | 5              | μA                   |   | Fig1, 2 |
| Input level                             | VHIM    | 100            | –             | –              | mVPP                 |   | Fig1, 2 |
| Common mode input Range                 | VHICM   | 1              | –             | 4              | V                    |   | Fig1, 2 |
| Spindle driver block ( Torque control ) |         |                |               |                |                      |   |         |
| Input dead zone 1 (one side)            | VDZSP1  | 0              | 10            | 40             | mV                   | CTL1="H", CTL2="H"                      | Fig1, 2 |
| Input dead zone 2 (one side)            | VDZSP2  | 0              | 30            | 120            | mV                   | CTL1="L", CTL2="H"                      | Fig1, 2 |
| Input output gain 1                     | gmSP1   | 1.2<br>(0.264) | 1.5<br>(0.33) | 1.8<br>(0.396) | Arms/V<br>(Vrms/V)   | Effective current<br>CTL1="H", CTL2="H" | Fig1, 2 |
| Input output gain 2                     | gmSP2   | 170<br>(37.4)  | 245<br>(53.9) | 320<br>(70.4)  | mArms/V<br>(mVrms/V) | Effective current<br>CTL1="L", CTL2="H" | Fig1, 2 |
| Output ON resistor (upper)              | RONUSP  | –              | 0.6           | 1.0            | Ω                    | IL=500mA                                | Fig1, 2 |
| Output ON resistor (lower)              | RONLSP  | –              | 0.25          | 0.5            | Ω                    | IL=-500mA                               | Fig1, 2 |
| Output limit current 1                  | ILIMSP1 | 1.2<br>(0.264) | 1.5<br>(0.33) | 1.8<br>(0.396) | A<br>(V)             | CTL1="H", CTL2="H"                      | Fig1, 2 |
| Output limit current 2                  | ILIMSP2 | 300<br>(66.0)  | 440<br>(96.8) | 580<br>(127.6) | mA<br>(mV)           | CTL1="L", CTL2="H"                      | Fig1, 2 |
| PWM frequency                           | fosc    | –              | 100           | –              | kHz                  |   | Fig1, 2 |
| Spindle driver block ( FG output )      |         |                |               |                |                      |   |         |
| High voltage                            | VFGH    | –              | 4.9           | –              | V                    |   | Fig1, 2 |
| Low voltage                             | VFGL    | –              | 0.1           | –              | V                    |   | Fig1, 2 |
| Actuator driver block                   |         |                |               |                |                      |   |         |
| Output offset voltage                   | VOFFT   | -70            | 0             | 70             | mV                   |   | Fig1, 2 |
| Output saturation voltage "H"           | VOHFT   | –              | 0.45          | 0.8            | V                    | IL=500mA                                | Fig1, 2 |
| Output saturation voltage "L"           | VOLFT   | –              | 0.45          | 0.8            | V                    | IL=-500mA                               | Fig1, 2 |
| Voltage gain                            | GVFT    | 17.7           | 19.5          | 21.3           | dB                   |   | Fig1, 2 |

© This product is not designed for protection against radioactive rays.

## Optical disc ICs

| Parameter                     | Symbol | Min. | Typ. | Max. | Unit | Conditions | Circuit |
|-------------------------------|--------|------|------|------|------|------------|---------|
| Loading driver block          |        |      |      |      |      |            |         |
| Output offset voltage         | VOFLD  | -100 | 0    | 100  | mV   |            | Fig1, 2 |
| Output saturation voltage "H" | VOHLD  | -    | 1.1  | 1.4  | V    | IL=500mA   | Fig1, 2 |
| Output saturation voltage "L" | VOLL   | -    | 0.45 | 0.8  | V    | IL=-500mA  | Fig1, 2 |
| Voltage gain                  | GVLD   | 21.5 | 23.5 | 25.5 | dB   |            | Fig1, 2 |
| CTL1, CTL2                    |        |      |      |      |      |            |         |
| Input high voltage            | VIH    | 2.0  | -    | -    | V    |            | Fig1, 2 |
| Input low voltage             | VIL    | -    | -    | 0.5  | V    |            | Fig1, 2 |
| Others                        |        |      |      |      |      |            |         |
| Vc drop-muting                | VMVc   | 0.4  | 0.7  | 1.0  | V    |            | Fig1, 2 |
| Vcc drop-muting               | VMVcc  | 3.4  | 3.8  | 4.2  | V    |            | Fig1, 2 |

© This product is not designed for protection against radioactive rays.

Optical disc ICs

● Measurement circuits

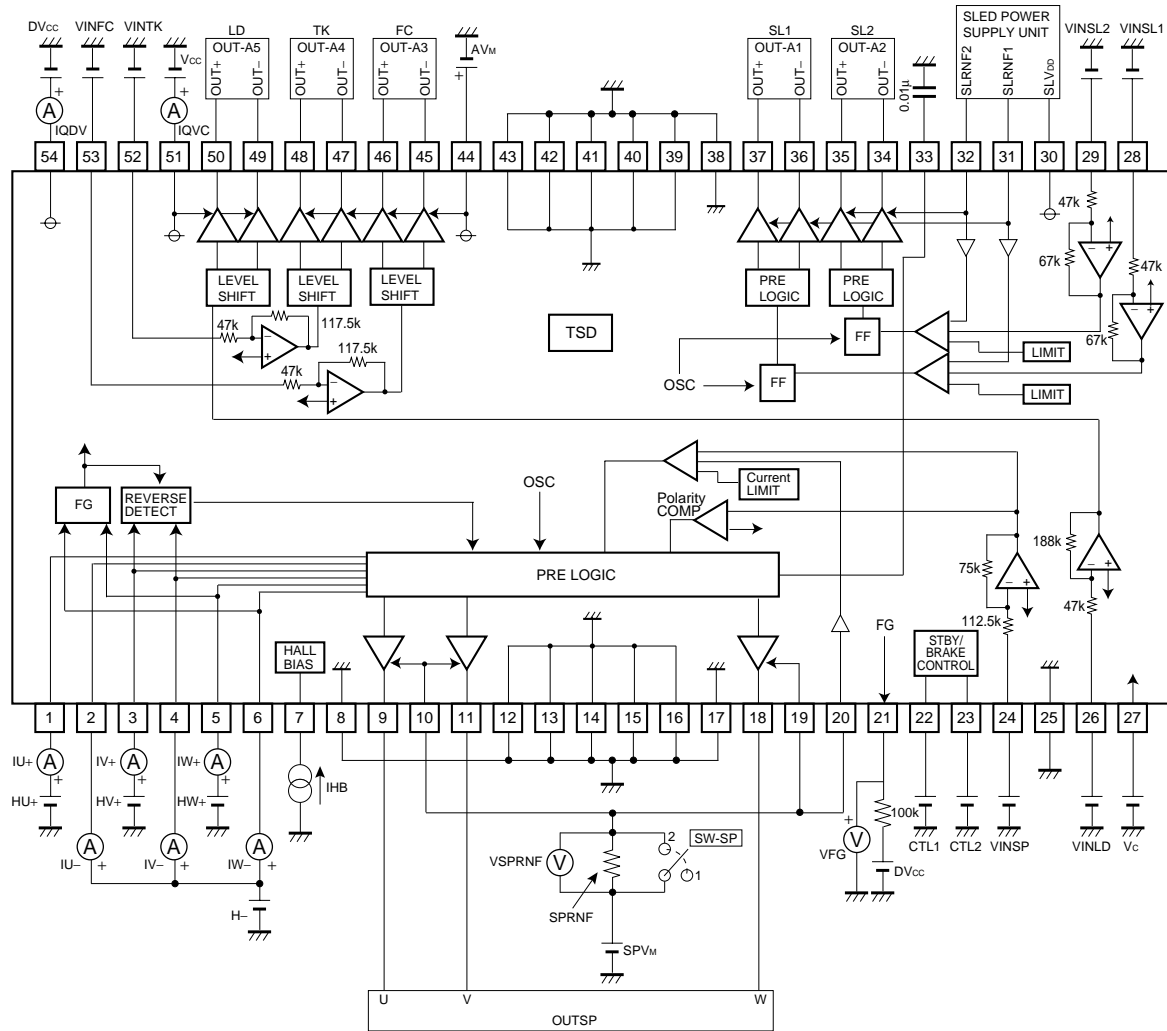
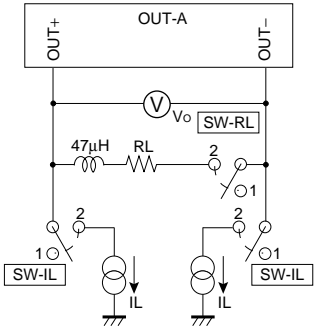
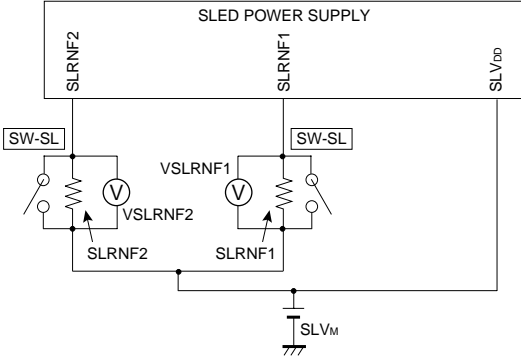


Fig.1



\*A3, A4 and A5 require no coil. (47µH)

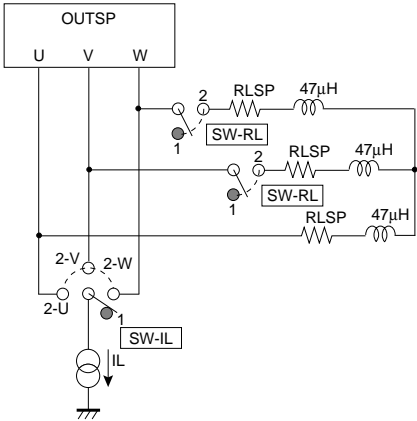


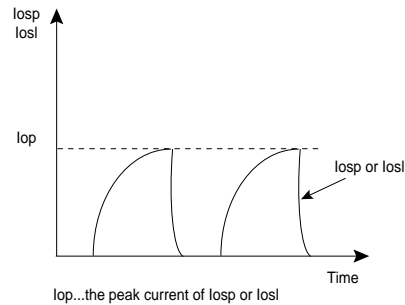
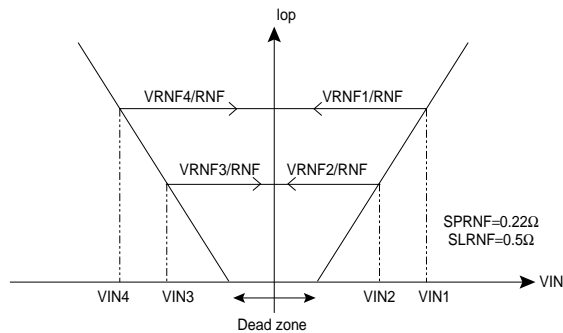
Fig.2

Optical disc ICs

●Table of measure circuit switches position 1

(V<sub>CC</sub>=SPV<sub>M</sub>=SLV<sub>M</sub>=12V, DV<sub>CC</sub>=AV<sub>M</sub>=5V, V<sub>C</sub>=1.65V, R<sub>L</sub>(SL)=8Ω+47μH, R<sub>L</sub>(SP)=2Ω+47μH, R<sub>L</sub>(ACT, LD)=8Ω, SLRNF=0.5Ω, SPRNF=0.22Ω, H<sub>-</sub>=2.5V, HU<sub>+</sub>=2.6V, HV<sub>+</sub>=HW<sub>+</sub>=2.4V)

| Designation       | INPUT        | CTL |   | SWITCH |    |    |    | Conditions  | Measure point      |
|-------------------|--------------|-----|---|--------|----|----|----|---|--------------------|
|                   | VIN          | 1   | 2 | RL     | SP | SL | IL |   |                    |
| Circuit current   |              |     |   |        |    |    |    |   |                    |
| IQ1               | -            | L   | H | 1      | 1  | 1  | 1  |   | IQVC               |
| IQ2               | -            | H   | L | 1      | 1  | 1  | 1  |   | IQVC               |
| IQ3               | -            | L   | H | 1      | 1  | 1  | 1  |   | IQDV               |
| IST1              | -            | L   | L | 1      | 1  | 1  | 1  |   | IQVC               |
| IST2              | -            | L   | L | 1      | 1  | 1  | 1  |   | IQDV               |
| Sled driver block |              |     |   |        |    |    |    |   |                    |
| VDZSL             | *1           | H   | H | 2      | 1  | 1  | 1  | *1 Check VSLRNF with no output at VIN=V <sub>C</sub> ±5mV<br>Check VSLRNF with output at VIN=V <sub>C</sub> ±55mV | VSLRNF             |
| gmSL              | *2           | H   | H | 2      | 1  | 1  | 1  | See bellow  | VSLRNF             |
| RONUSL            | 3.3V<br>(0V) | H   | H | 1      | 1  | 2  | 2  | ILSL=500mA     RON= $\frac{12V - VO_{SL} + (-)}{0.5A}$  | OUT+ (-)           |
| RONLSL            | 0V<br>(3.3V) | H   | H | 1      | 1  | 2  | 2  | ILSL=-500mA     RON= $\frac{VO_{SL} + (-)}{0.5A}$   | OUT+ (-)           |
| ILIMSL            | 3.3V<br>(0V) | H   | H | 2      | 1  | 1  | 1  |   | VSLRNF             |
| fosc              | 1.45         | H   | H | 2      | 1  | 1  | 1  |   | VO <sub>SL</sub> + |



\*2 Sled driver

VIN1=230mV, VIN2=130mV  
VIN3=-130mV, VIN4=-230mV

$$gm (+) = \left( \frac{VSLRNF1 - VSLRNF2}{230mV - 130mV} \right) / 0.5\Omega$$

$$gm (-) = \left( \frac{VSLRNF4 - VSLRNF3}{230mV - 130mV} \right) / 0.5\Omega$$

\*4 Spindle driver

VIN1=300mV (gm1), 600mV (gm2)  
VIN2=100mV (gm1), 300mV (gm2)  
VIN3=-300mV (gm2), VIN4=-600mV (gm2)

$$gm1 (+) = \left( \frac{VSPRNF1 - VSPRNF2}{300mV - 100mV} \right) / 0.22\Omega$$

$$gm2 (+) = \left( \frac{VSPRNF1 - VSPRNF2}{600mV - 300mV} \right) / 0.22\Omega$$

$$gm2 (-) = \left( \frac{VSPRNF4 - VSPRNF3}{600mV - 300mV} \right) / 0.22\Omega$$

## Optical disc ICs

## ●Table of measure circuit switches position 2

( $V_{CC}=SPV_M=SLV_M=12V$ ,  $DV_{CC}=AV_M=5V$ ,  $V_C=1.65V$ ,  $R_L(SL)=8\Omega+47\mu H$ ,  $R_L(SP)=2\Omega+47\mu H$ ,  $R_L(ACT, LD)=8\Omega$ ,  $SLRNF=0.5\Omega$ ,  $SPRNF=0.22\Omega$ ,  $H=-2.5V$ ,  $HU+=2.6V$ ,  $HV+=HW+=2.4V$ )

| Designation          | INPUT | CTL |   | SWITCH |    |    |    | Conditions  | Measure point                   |
|----------------------|-------|-----|---|--------|----|----|----|---|---------------------------------|
|                      | VIN   | 1   | 2 | RL     | SP | SL | IL |   |                                 |
| Spindle driver block |       |     |   |        |    |    |    |   |                                 |
| 〈 Hall bias 〉        |       |     |   |        |    |    |    |   |                                 |
| VHB                  | 1.65V | H   | H | 1      | 1  | 1  | 1  | IHB=10mA  | Pin 7                           |
| 〈 Hall amplifier 〉   |       |     |   |        |    |    |    |   |                                 |
| IHIB                 | 1.65V | H   | H | 1      | 1  | 1  | 1  | Current flowing in each terminal at $H=-2.5V$ , $H+=2.6V$ (2.4V)                          | IU+ (-),<br>IV+ (-),<br>IW+ (-) |
| 〈 Torque command 〉   |       |     |   |        |    |    |    |   |                                 |
| VDZSP1               | *3    | H   | H | 2      | 1  | 1  | 1  | *3 Check VRNF with no output at $VIN=V_C$<br>Check VRNF with output at $VIN=V_C+40mV$     | VSPRNF                          |
| VDZSP2               | *3    | L   | H | 2      | 1  | 1  | 1  | *3 Check VRNF with no output at $VIN=V_C$<br>Check VRNF with output at $VIN=V_C\pm 120mV$ | VSPRNF                          |
| gmSP1                | *4    | H   | H | 2      | 1  | 1  | 1  | See 10 of 17  | VSPRNF                          |
| gmSP2                | *4    | L   | H | 2      | 1  | 1  | 1  | See 10 of 17  | VSPRNF                          |
| RONUSP               | 3.3V  | H   | H | 1      | 2  | 1  | 2  | ILSP=500mA $RON = \frac{12V - VOSP}{0.5A}$  | OUTU, V, W                      |
| RONLSP               | 3.3V  | H   | H | 1      | 2  | 1  | 2  | ILSP=-500mA $RON = \frac{VOSP}{0.5A}$   | OUTU, V, W                      |
| ILIMSP1, 2           | 3.3V  | H   | H | 2      | 1  | 1  | 1  |   | VSPRNF                          |
| ILIMSP1, 2           | 3.3V  | L   | H | 2      | 1  | 1  | 1  |   | VSPRNF                          |
| fosc                 | 1.85  | H   | H | 2      | 1  | 1  | 1  |   | VOSPU                           |
| 〈 FG 〉               |       |     |   |        |    |    |    |   |                                 |
| VFGH                 | 1.65V | H   | H | 1      | 1  | 1  | 1  | HU+=2.6V, HV+=2.4V, HW+=2.4V  | VFG                             |
| VFGL                 | 1.65V | H   | H | 1      | 1  | 1  | 1  | HU+=2.6V, HV+=2.4V, HW+=2.6V  | VFG                             |

\*5 Condition of input

| HU+  | HV+  | HW+  | U      | V      | W      | Condition    | Measure point |
|------|------|------|--------|--------|--------|--------------|---------------|
| 2.4V | 2.6V | 2.6V | Source | Middle | Sink   | IOSPU=500mA  | VOSPU         |
| 2.6V | 2.4V | 2.6V | Sink   | Source | Middle | IOSPV=500mA  | VOSPV         |
| 2.6V | 2.6V | 2.4V | Middle | Sink   | Source | IOSPW=500mA  | VOSPW         |
| 2.6V | 2.4V | 2.4V | Sink   | Middle | Source | IOSPU=-500mA | VOSPU         |
| 2.4V | 2.6V | 2.4V | Source | Sink   | Middle | IOSPV=-500mA | VOSPV         |
| 2.4V | 2.4V | 2.6V | Middle | Source | Sink   | IOSPW=-500mA | VOSPW         |

## Optical disc ICs

## ●Table of measure circuit switches position 3

( $V_{CC}=SPV_M=SLV_M=12V$ ,  $DV_{CC}=AV_M=5V$ ,  $V_C=1.65V$ ,  $RL(SL)=8\Omega+47\mu H$ ,  $RL(SP)=2\Omega+47\mu H$ ,  $RL(ACT, LD)=8\Omega$ ,  $SLRNF=0.5\Omega$ ,  $SPRNF=0.22\Omega$ ,  $H-=2.5V$ ,  $HU+=2.6V$ ,  $HV+=HW+=2.4V$ )

| Designation           | INPUT        | CTL |   | SWITCH |    |    |    | Conditions                         | Measure point |
|-----------------------|--------------|-----|---|--------|----|----|----|------------------------------------|---------------|
|                       | VIN          | 1   | 2 | RL     | SP | SL | IL |                                    |               |
| Actuator driver block |              |     |   |        |    |    |    |                                    |               |
| VOFFT                 | 1.65V        | H   | H | 2      | 1  | 1  | 1  |                                    | VO            |
| VOHFT                 | 3.3V<br>(0V) | H   | H | 1      | 1  | 1  | 2  | IL=500mA                           | 5-OUT+ (-)    |
| VOLFT                 | 0V<br>(3.3V) | H   | H | 1      | 1  | 1  | 2  | IL=-500mA                          | OUT+ (-)      |
| GVFT                  | $\pm 0.25V$  | H   | H | 2      | 1  | 1  | 1  | $20\log  (VO - VOFFT) / \pm 0.25 $ | VO            |
| Loading driver block  |              |     |   |        |    |    |    |                                    |               |
| VOFLD                 | 1.65V        | H   | L | 2      | 1  | 1  | 1  |                                    | VO            |
| VOHLD                 | 3.3V<br>(0V) | H   | L | 1      | 1  | 1  | 2  | IL=500mA                           | 12-OUT+ (-)   |
| VOLL D                | 0V<br>(3.3V) | H   | L | 1      | 1  | 1  | 2  | IL=-500mA                          | OUT+ (-)      |
| GVLD                  | $\pm 0.25V$  | H   | L | 2      | 1  | 1  | 1  | $20\log  (VO - VOFFT) / \pm 0.25 $ | VO            |
| CTL1, CTL2            |              |     |   |        |    |    |    |                                    |               |
| VIH                   | 1.65V        | L   | L | 2      | 1  | 1  | 1  | Check active at "H"=2.0            | IQVC          |
| VIL                   | 1.65V        | H   | H | 2      | 1  | 1  | 1  | Check stand-by at "L"=0.5          | IQVC          |
| CTL1, CTL2            |              |     |   |        |    |    |    |                                    |               |
| VMV <sub>c</sub>      | 1.65V        | H   | H | 1      | 1  | 1  | 1  | Check all output at $V_C=0.7V$     | OUTPUT        |
| VMV <sub>cc</sub>     | 1.65V        | H   | H | 1      | 1  | 1  | 1  | Check all output at $V_{CC}=3.8V$  | OUTPUT        |

## ●Circuit operation

## 1. Driver control terminal 1 and 2 (pin22 and pin23)

All the drivers and spindle-drive braking mode and input output gain can be switched on/off by inputting combinations of H-level signal (higher than 2V) and L-level signal (lower than 0.5V) to these terminals.

| CTL1<br>(Pin22) | CTL2<br>(Pin23) | Spindle | Sled | Focus | Tracking | Loading |                     |
|-----------------|-----------------|---------|------|-------|----------|---------|---------------------|
| L               | L               | ×       | ×    | ×     | ×        | ×       | 1)                  |
| H               | L               | ×       | ×    | ×     | ×        | ○       | 2)                  |
| -               | H               | ○       | ○    | ○     | ○        | ×       | ○... ON    ×... OFF |

| CTL1<br>(Pin22) | CTL2<br>(Pin23) | input output gain (spindle driver) | SPIN > V <sub>c</sub> | SPIN < V <sub>c</sub>         |    |
|-----------------|-----------------|------------------------------------|-----------------------|-------------------------------|----|
| L               | H               | 245mArms/V (Typ.)                  | Forward-rotation mode | Reverse-rotation braking mode | 3) |
| H               | H               | 1.5Arms/V (Typ.)                   | Forward-rotation mode | Short-circuit braking mode    | 4) |

## 1) Standby mode

The IC is brought into standby state, and its power dissipation can be limited.

## 2) Drivers muting

All the output channels except the loading are muted and their outputs are turn off.

Optical disc ICs

3) Reverse-rotation braking mode (spindle)

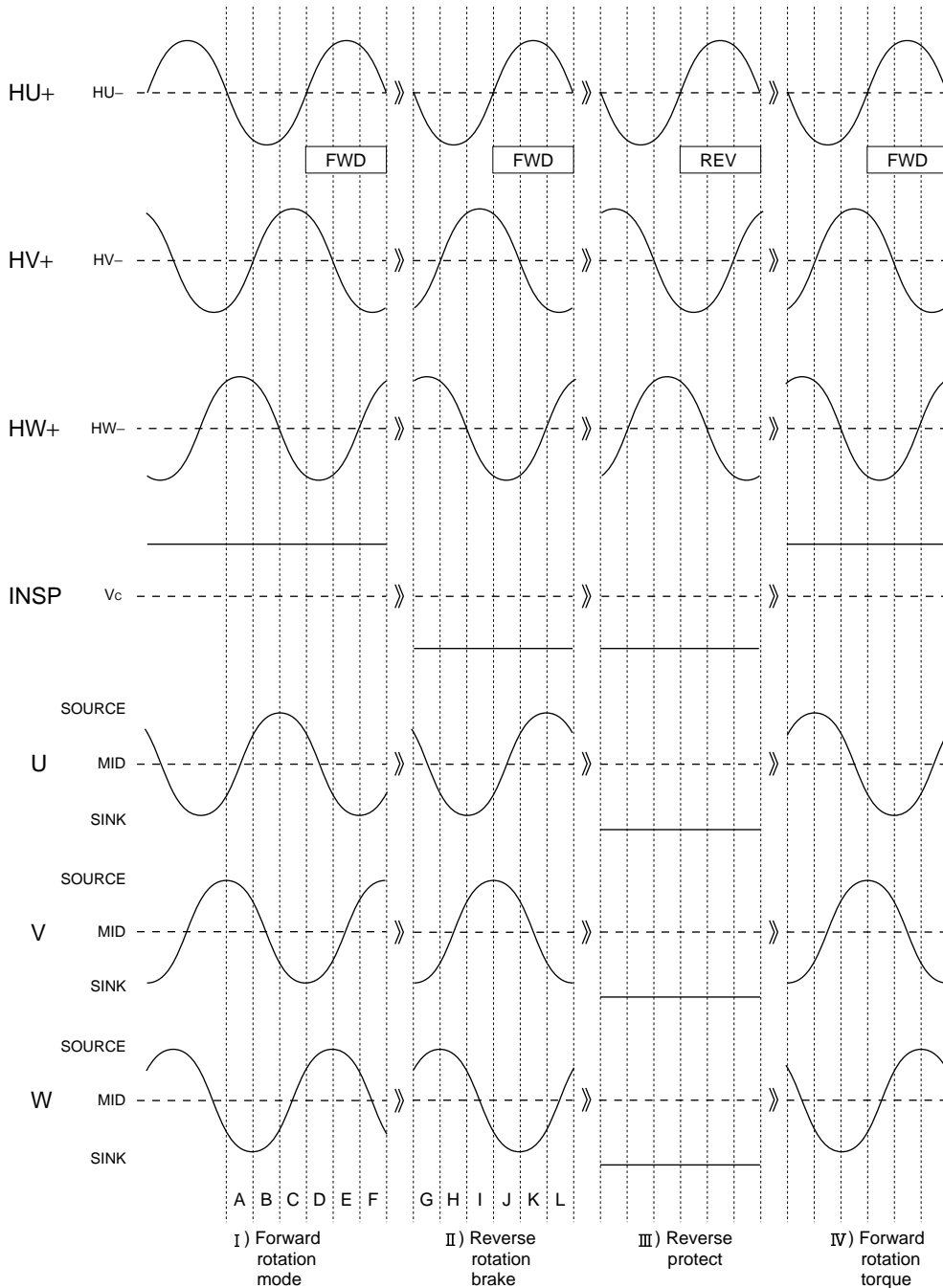
A reverse-rotation torque is applied when  $SPIN < V_c$ .

Reverse-rotation is detected with SPIN input and Hall input. If the spindle detects reverse rotation when  $SPIN < V_c$ , all the outputs are shorted out to GND.

4) Short-circuit braking mode (spindle)

All the spindle driver outputs are shorted out to GND when  $SPIN < V_c$ .

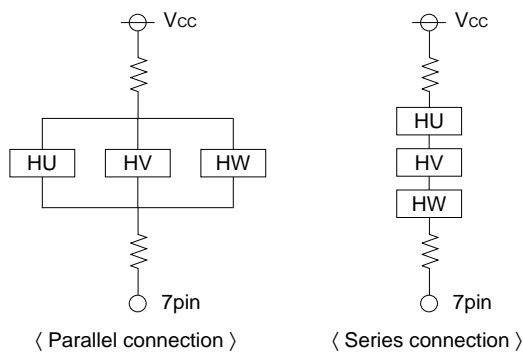
2. Input/output timing chart



## Optical disc ICs

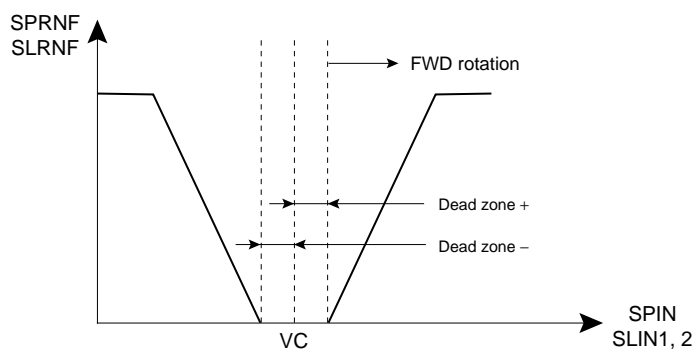
## 3. Hall inputs (pin 1 to 6) and Hall bias (pin 7) (Spindle)

Hall elements can be connected either in series or in parallel. Set the Hall input voltage to 1.0 to 4.0V and larger than 100mV<sub>PP</sub>.



## 4. Torque command (spindle: pin 24, sled motor: pin 28 and 29) / output current detection terminals (spindle: pin 20, sled motor: pin 31 and 32)

The relation between the torque command input and the output current detection terminals input is expressed as shown below:



The input-output gain (gm) and the output-limit current (ILIM) depend on the resistance of RNF (output current detection resistor). Please refer to the following expression.

The gain to drive the spindle or the sled motor can be decreased by connecting a resistor in series to each input terminal.

## ● Gain expression

|                              | Spindle (CTL1="H")   | Spindle (CTL1="L")  | Sled  |
|------------------------------|--|---|---|
| Input-output gain            | 0.33/RNF (Arms/V)  | 53.9/RNF (mArms/V)  | 0.65/RNF (A/V)  |
| Output-limit current         | 0.33/RNF (A)   | 96.8/RNF (mA)   | 0.5/RNF (A)   |
| Gain with the added resistor | $\frac{0.33 \times 112.5k}{\{SPRNF \times (Rin + 112.5k)\}}$<br>(Arms/V) | $\frac{53.9 \times 112.5k}{\{SPRNF \times (Rin + 112.5k)\}}$<br>(mArms/V) | $\frac{0.65 \times 47k}{\{SLRNF \times (Rin + 47k)\}}$<br>(A/V) |

Rin : added series resistor

## 5. PWM oscillation frequency

The PWM oscillation for driving the spindle and sled is free running. The oscillating frequency is 100kHz (typ.).

Optical disc ICs

6. Muting functions

a) V<sub>c</sub>-drop muting

When the voltage at V<sub>c</sub> terminal (pin 27) drops to a value lower than 0.7V (Typ.), the outputs of all the channels are turned off. Set the V<sub>c</sub> terminal voltage to larger than 1.0V.

b) V<sub>CC</sub>-drop muting

When the voltages at DV<sub>CC</sub> terminal (pin 54) and V<sub>CC</sub> terminal (pin 51) drop to lower than 3.8V (Typ.), the outputs of all the channels are turned off.

7. Thermal-shutdown

A thermal-shutdown circuit (over-temperature protection circuit) is built in to prevent the IC from thermal breakdown. Use the IC under the thermal loss allowed to the package. In case the IC is left running over the allowable loss, the junction temperature rises, and the thermal-shutdown circuit works at the junction temperature of 175°C (Typ.) (the outputs of all the channels are turned off). When the junction temperature drops to 150°C (Typ.), the IC start operating again.

●Application example

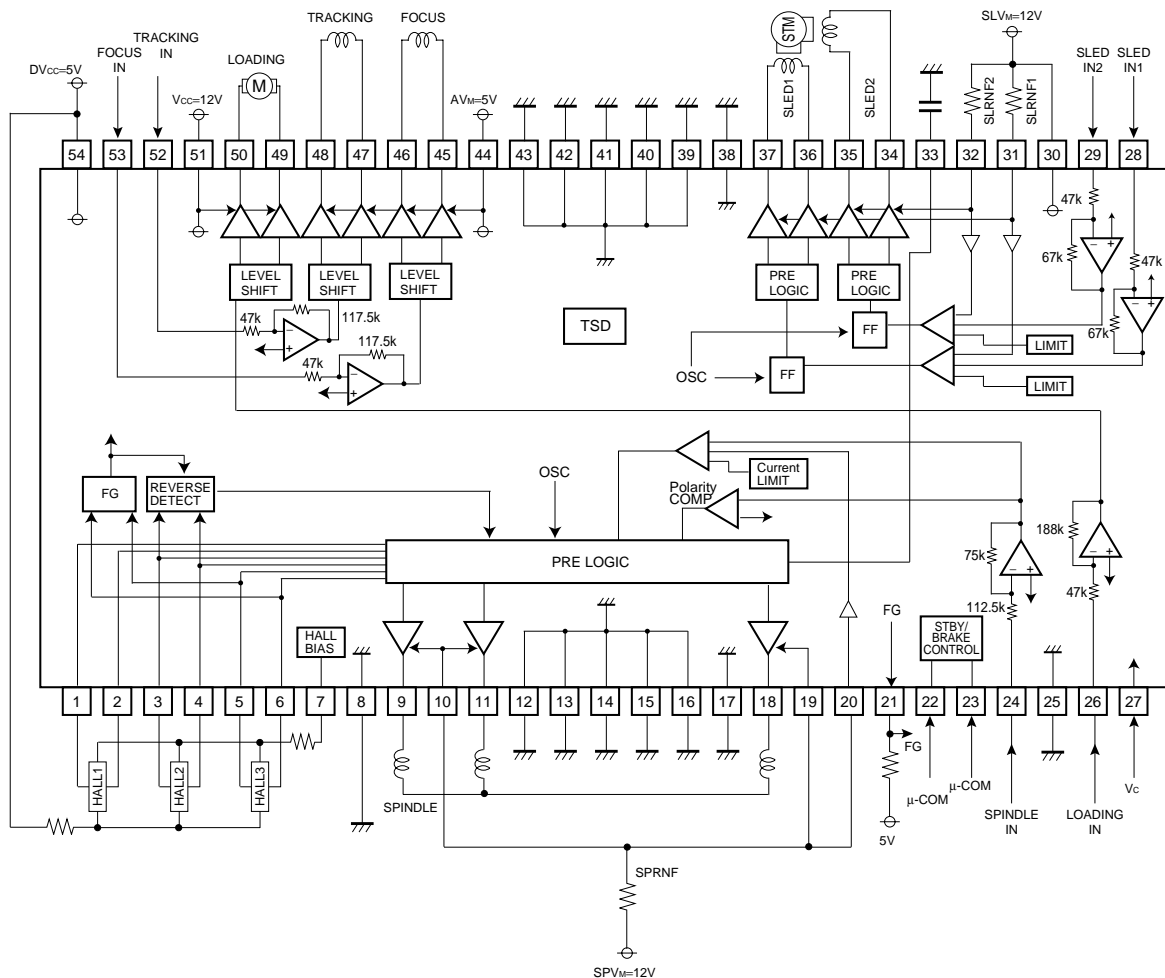


Fig.3

## Optical disc ICs

### ●Operation notes

#### (1) Wiring for SPRNF and SLRNF

Considering the wiring resistance, connect each detecting resistor as close as possible to the current detection terminals for the spindle drive SPRNF (pin 20) and the sled motor drive SLRNF 1 and 2 (pin 31 and 32) of the IC.

#### (2) Current detection reference voltage

The detection of current in the spindle and sled involves the detection of voltage between the detection resistances, but as the reference voltage of internal circuit, the voltage applied to  $V_{CC}$  (pin 51) is used by the spindle and that applied to  $SLV_{DD}$  (pin 30) by the sled.

For this reason, be sure to apply  $V_{CC}$  (pin 51) to the spindle and  $SLV_{DD}$  (pin 30) to the sled according to the corresponding power supply voltages to prevent voltage differences.

#### (3) Filtering capacitor

It is recommended to connect 0.01 $\mu$ F filtering capacitor to SPCNF terminals. This capacitor filters PWM output carrier frequency. Dispersion of the cut off frequency due to circuit board wiring layout is taken into consideration.

If it is difficult to filter at the recommended value due to circuit board wiring led round, the capacity can be increased. In this case, note that the output transmission delay time may be longer.

#### (4) Bypass capacitor

Please connect a bypass capacitor (0.1 $\mu$ F) across the supply voltage lines close to the IC pins.

#### (5) Supply fault, ground fault, and short-circuit between output terminals

Do not short-circuit between any output pin and supply pin (supply fault) or ground (ground fault), or between any output pins (load short-circuit). When mounting the IC on the circuit board, be extremely cautious about the orientation of the IC. If the orientation is mistaken, the IC may break down, and produce smoke in some cases.

### ●Electrical characteristic curves

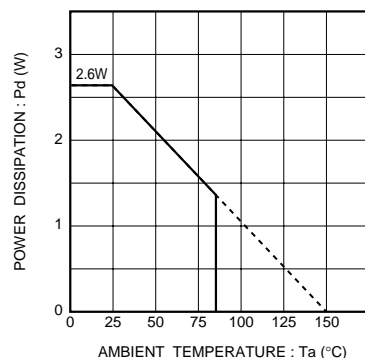
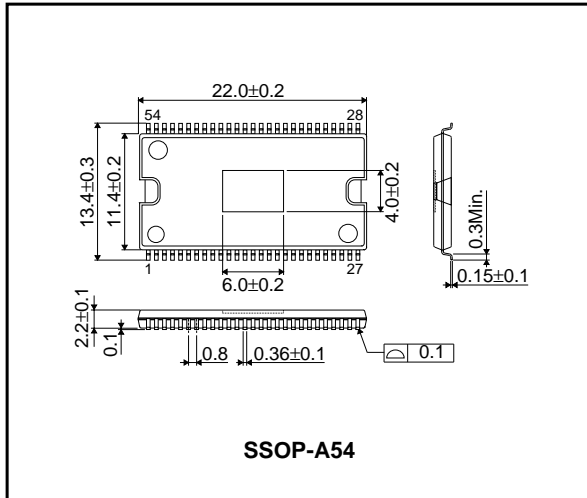


Fig.4 Power dissipation

Optical disc ICs

●External dimensions (Units : mm)



### Notes

- No technical content pages of this document may be reproduced in any form or transmitted by any means without prior permission of ROHM CO.,LTD.
- The contents described herein are subject to change without notice. The specifications for the product described in this document are for reference only. Upon actual use, therefore, please request that specifications to be separately delivered.
- Application circuit diagrams and circuit constants contained herein are shown as examples of standard use and operation. Please pay careful attention to the peripheral conditions when designing circuits and deciding upon circuit constants in the set.
- Any data, including, but not limited to application circuit diagrams information, described herein are intended only as illustrations of such devices and not as the specifications for such devices. ROHM CO.,LTD. disclaims any warranty that any use of such devices shall be free from infringement of any third party's intellectual property rights or other proprietary rights, and further, assumes no liability of whatsoever nature in the event of any such infringement, or arising from or connected with or related to the use of such devices.
- Upon the sale of any such devices, other than for buyer's right to use such devices itself, resell or otherwise dispose of the same, no express or implied right or license to practice or commercially exploit any intellectual property rights or other proprietary rights owned or controlled by
- ROHM CO., LTD. is granted to any such buyer.
- Products listed in this document use silicon as a basic material.  
Products listed in this document are no antiradiation design.

The products listed in this document are designed to be used with ordinary electronic equipment or devices (such as audio visual equipment, office-automation equipment, communications devices, electrical appliances and electronic toys).

Should you intend to use these products with equipment or devices which require an extremely high level of reliability and the malfunction of which would directly endanger human life (such as medical instruments, transportation equipment, aerospace machinery, nuclear-reactor controllers, fuel controllers and other safety devices), please be sure to consult with our sales representative in advance.

#### About Export Control Order in Japan

Products described herein are the objects of controlled goods in Annex 1 (Item 16) of Export Trade Control Order in Japan.

In case of export from Japan, please confirm if it applies to "objective" criteria or an "informed" (by MITI clause) on the basis of "catch all controls for Non-Proliferation of Weapons of Mass Destruction.