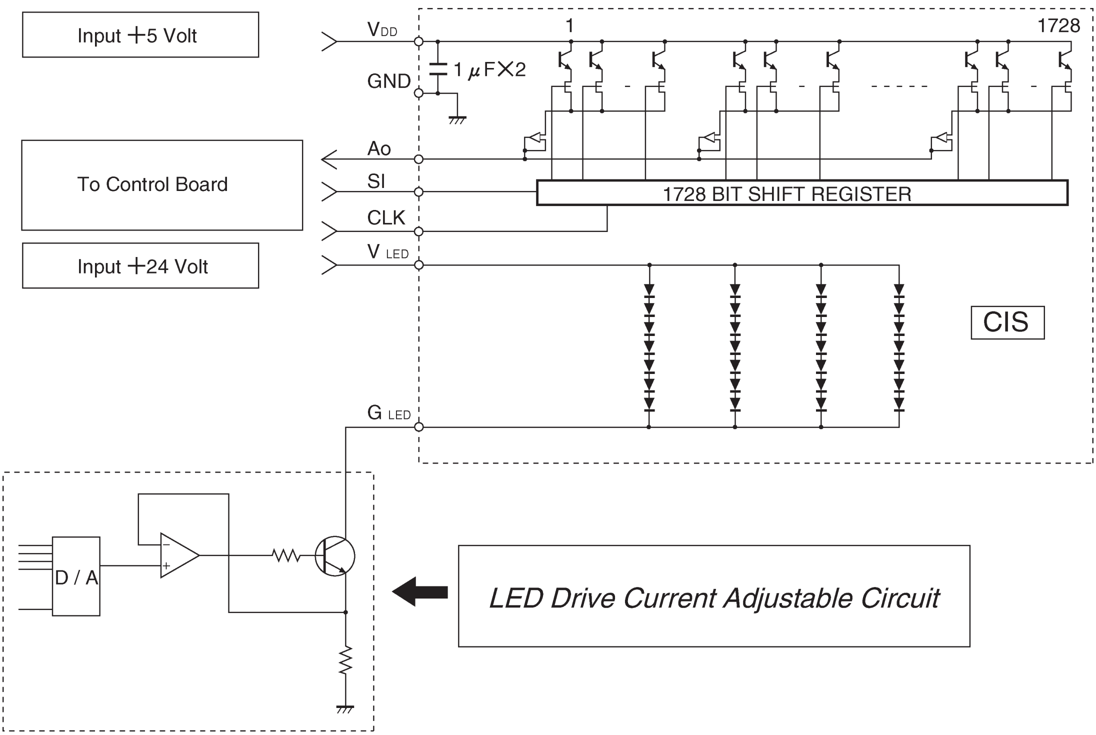
4. Operating method

(1) Resolution (pixel / mm; dpi)
The resolution of the image can be expressed by either the number of pixels per millimeter (pixels / mm), or by the number of pixels per inch (pixels / inch or dpi). The relationship between the two is expressed in the formula below.

$$\frac{dot}{mm} = \frac{25.4dot}{inch}$$

(2) LED chip light intensity setting
1) For monochrome types
For ROHM CISs, ROHM requests that you use a constant current drive for the LED light source. Also, since there may be variations in the light intensity from the separate LEDs in the light source array, if it is used without performing the required adjustments, there will be large variations in the analog output values. Consequently, accurate gradation from a CIS with a low output value may be lost.
Therefore, in order to maintain a constant output value, ROHM recommends that for each CIS, the LED current and the time for which the LEDs are lit should be properly adjusted. An example of such an adjustment circuit is given below.



2) Color type (LED light source)

As mentioned earlier, there will be variations in the light intensity from the separate LEDs in the LED array light source, and those variations are as much as ± 50%. ROHM CISs are equipped with LED chip arrays for the three colors red, green, and blue. Before scanning an original, it is necessary to set the duration of time the separate LEDs will light.

1. Setting the LED current

The LED current must not exceed the duty ratio vs. allowable forward current specifications shown in Graph-1. Select a duty ratio according to the scanning speed.

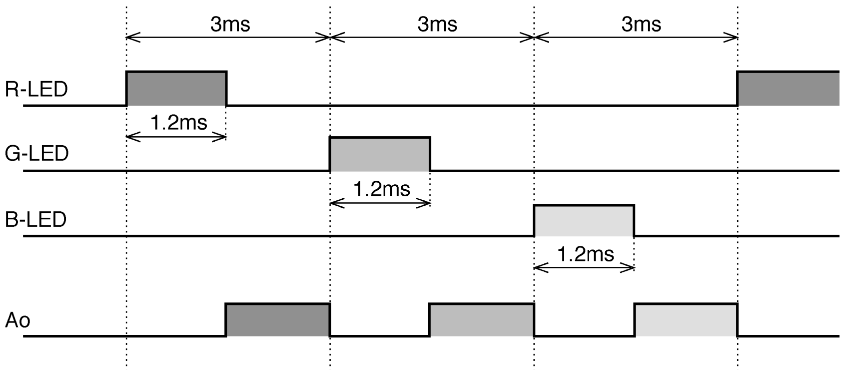
(How to compute the duty ratio)

The duty ratio is calculated by the formula shown below.

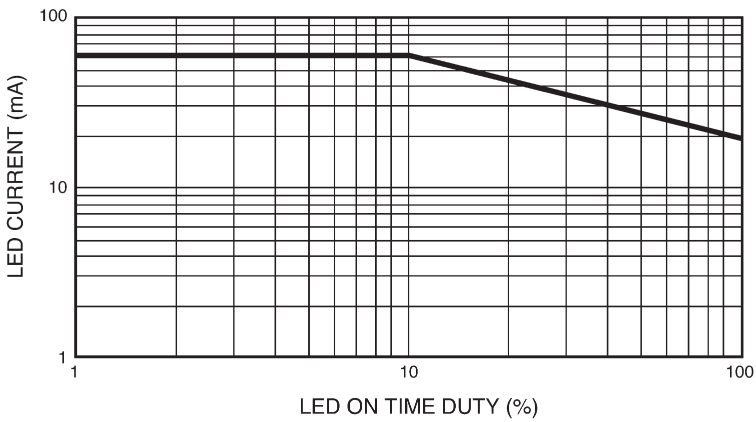
$$\text{Duty ratio} = \frac{\text{Maximum duration of illuminated time for one LED color}}{\text{Scanning time for one line of the three colors}} \times 100$$

Example

$$\text{Duty ratio} = \frac{1.2\text{ms}}{3\text{ms} \times 3 = 9\text{ms}} \times 100 = 13\%$$



Graph-1 LED ON TIME DUTY vs MAXIMUM LED CURRENT



2. LED drive circuit

As shown in Fig. 6, in one ROHM CIS, LEDs of the three colors red, green, and blue, are built into the CIS. To drive the CIS, separate drive circuits for the separate LEDs are necessary. The LED drive circuits consist of an adjustment resistor and a RGB switching circuit. Select an adjustment resistor so that the current obtained equals that determined in 1. Setting the LED current above. To ensure a stable scanning quality, be sure to supply a regulated voltage.

Since R-LEDs have nearly twice the photoelectric transfer efficiency than the G and B-LEDs, set the current for the R-LEDs to one-half that for the G and B-LEDs.

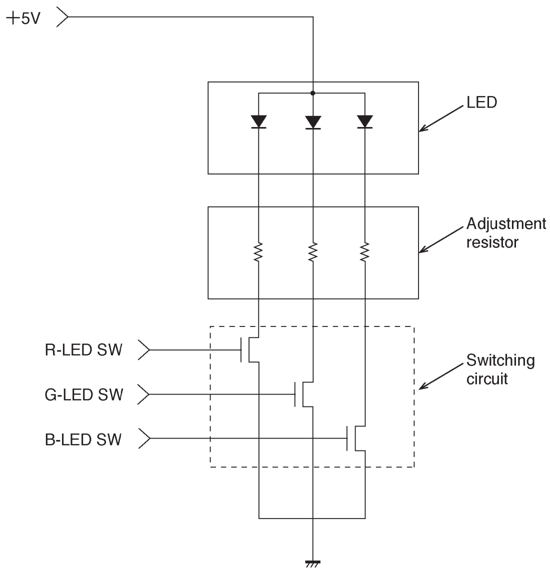


Fig.6

3. Adjusting the LED on time

Adjust the duration of time that the LEDs are turned on by following the flowchart given in Fig. 7. The LED light intensities will differ for the separate CISs. For initial settings, it is recommended to follow the sequence below so that the adjustment operations are begun automatically.

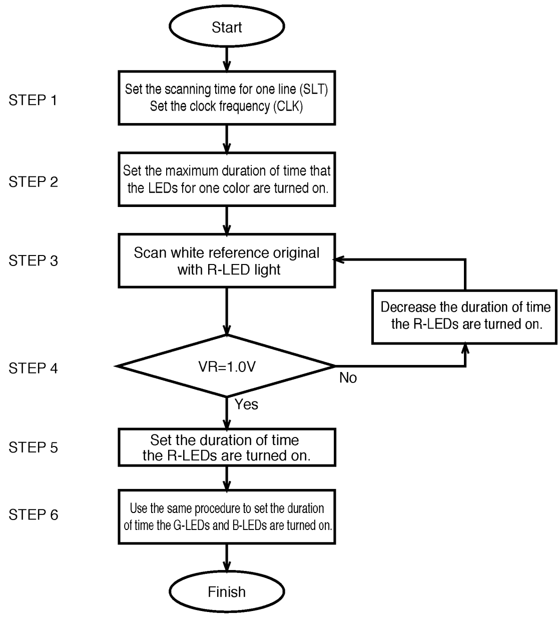


Fig.7

4. The adjustment timing for the duration of time the LEDs are turned on

Refer to the timing shown in Fig. 8 below when setting the duration of time the LEDs are to be turned on. Adjust the "Ton" value until Vp equals near 1.5 V.

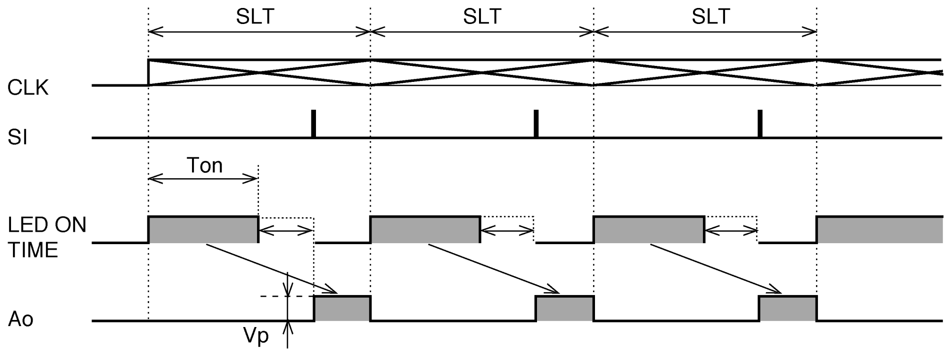


Fig.8

(3) Analog output correction

It is necessary to correct the analog output from ROHM CISs as shown in the flowchart of Fig. 9. The user is required to prepare the circuits and software needed for the correction procedure.

Steps 1 through 3 or 4 can be performed using the image sensor processor IC and steps 5 and 6 can be performed by using a microcomputer or application software. For more information regarding the above mentioned IC, contact your nearest ROHM sales office or representative.

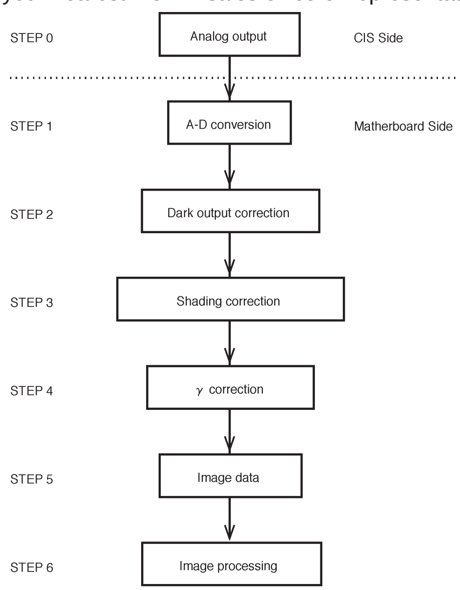


Fig.9

1) A-D conversion

Determine the bit number for the A-D conversion for the number of color shades and gradations that you want to display. The number of reproducible colors is related to the bit number as shown below.

Bit number	Number of colors
6bit	260,000 colors
8bit	16,770,000 colors
10bit	1 billion colors

2) Dark output correction

Dark output correction is performed by subtracting the scanned data from the "black reference data" that was stored beforehand. Calculate the "black reference data" by the procedure given below.

(Creating the black reference data)

Turn off all the LEDs, and store in memory the output voltage from every pixel that is output. Repeat this procedure eight or more times and then store the average of all the values in memory.

3) Shading correction

Shading correction is performed by computations with the "white reference data" made after dark output correction. Shading correction should be performed for each color red, green, and blue.

(Creating the white reference data)

Turn on the R-LEDs and scan the white reference original and store in memory the output voltages from every pixel. Repeat this procedure eight or more times and then store the average of all the values in memory. This output voltage value is then called the "R-Vow." Then repeat this procedure for the G-LEDs and B-LEDs and store in memory the output voltages from every pixel. These output voltages are then called the "G-Vow" and "B-Vow" respectively.

White reference data (Vsw)

= Scanned data from white reference original - black reference data

= (R-Vow or G-Vow or B-Vow) –Vsd

(Calculation for shading correction)

Dark output correction data (Vp)

= Scanned data from original – black reference data

Shading correction data (Vo)

$$= \frac{Vp}{Vsw} \times (2^n - 1)$$

(n = A-D conversion bit number)

4) γ correction

Normally, when displaying the scanned image on a CRT, the dark portions tend to stand out and the screen tends to appear black. By performing the γ correction, the displayed image will appear closer to that of the actual origin. In order to perform this γ correction, it is recommended to have the design such that any desired γ correction can be performed.

5) Image processing

Perform the edge emphasis and vividness control and other image processing procedures as necessary.

(4) Installing the contact image sensor head

For contact image sensor heads, their applications can be classified into two main types.

The first type is where the image is scanned by the contact image sensor head contacting the original. For this type, the contact image sensor head is held stationary and the original fed across it. This type of contact image sensor head is called a sheet-feed type.

The second type, scans the original without directly touching it, but by scanning it through some other media such as glass. For this type, the original is stationary and the contact image sensor head is moved across. This type of contact image sensor head is called a flatbed type.

ROHM provides contact image sensor heads for both of these types of applications. Here is a brief explanation of the installation requirement for each type.

For the sheet-feed type, platen rollers are used to feed the original across the CIS as shown below in Fig. 10.

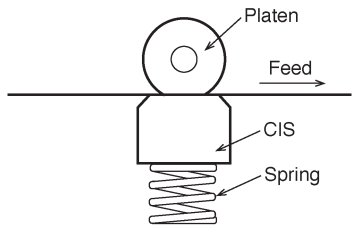


Fig.10

The contact image sensor head is held stationary by pressure from the platen roller. In normal situations, the contact image sensor head is pressed on the back against the original by a coil spring or flat spring. Also, the scanning line of the contact image sensor head and the center of the platen roller must be fixed where they match and the spring pressure and position must be adjusted so that the original does not rise off of the glass surface of the CIS.

For the flatbed type, as shown below in Fig. 11, the original is placed on top of a glass sheet and a small gap between the glass and contact image sensor head is maintained. The unit must be designed so that this gap "d" from the glass surface is always held constant.

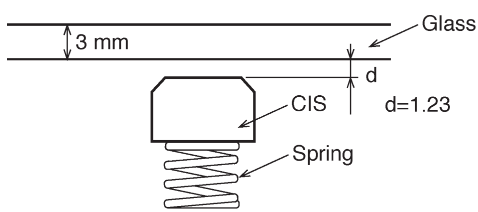


Fig.11

In normal applications, a spacer made of a slippery material is placed between the contact image sensor head and the glass to maintain the gap at a constant distance.

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 with 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.