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Product Preview

LV52511MNZ Application Manual

- Function
  24ch Output LED Driver
  It supports full color LED (RLED: 8ch, GLED: 8ch, BLED: 8ch)
- Output Current Setting
  Constant current output / open drain output can be selected. This can be selected by setting the external pin (OUTSCT).
  Constant current Io = 60 mA/ ch
  Open drain Io = 80 mA/ ch
  Output setting in which constant current + open drain are mixed is possible
  Built−in PWM Brightness 0%～99.6% 8 bit (256 step)
  24ch independent setting possible
- Output Current Value D / A Switching 5 bit (32 step)
  Adjustment of current value is possible for each R / G / B series
  0.82 mA min(00h)
  25.80 mA max(07h) The current value shown here is the case where 27 kΩ is connected to Iref_R
- Interface
  This can be selected by setting the external pin (CTLSCT).
  3−wire Serial Bus (SCLK, SDATA, SDEN)
  2−wire Serial Bus (SCLK, SDATA) : No Acknowledge
  I^2C Serial Bus (SCLK, SDATA) : Acknowledge Supports up to 56 multiple connections with slave pin support.

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APPLICATION NOTE

- Block Diagram

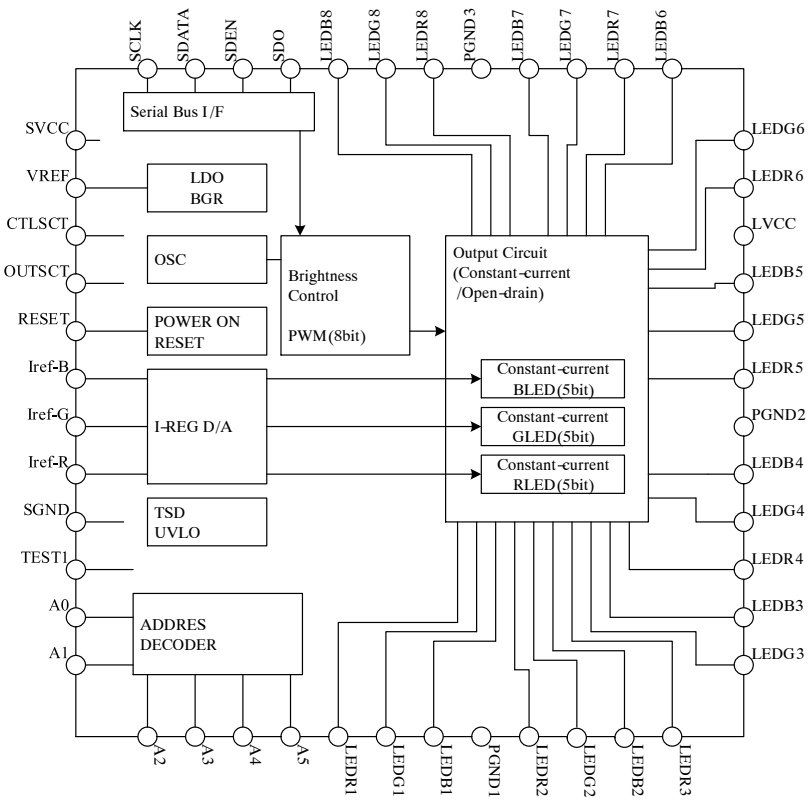

Figure 1. Block Diagram

- SVCC Input Power Supply

SVCC supports an input range of 3.0 V to 20 V.

The LV52511MNZ has a built−in LDO, and VREF outputs 5 V.

However, if the dropout voltage (SVCC = 5 V) or less is caused by the built−in MOS transistor, the output voltage decreases.

When using SVCC at 5 V or less, short SVCC and VREF and input the same potential.

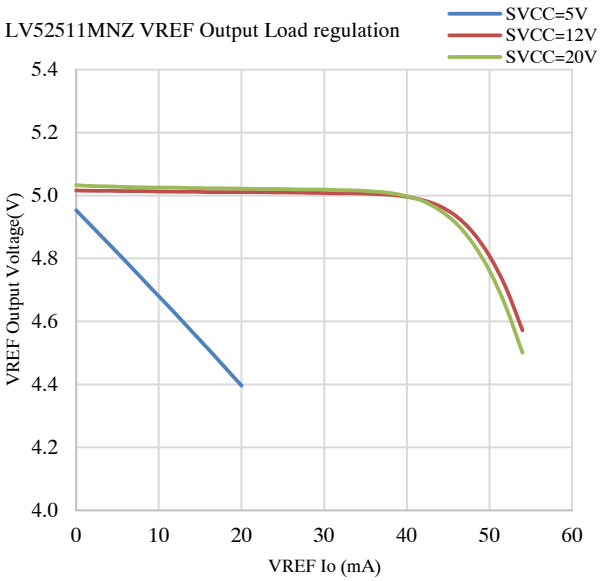

Figure 2.

- Output Current Setting

  Each mode can be set by setting OUTSCT terminal.

OUTSCT Terminal Setting	LEDR1	LEDR2	LEDR3	LEDR4	LEDR5	LEDR6	LEDR7	LEDR8
	LEDG1	LEDG2	LEDG3	LEDG4	LEDG5	LEDG6	LEDG7	LEDG8
	LEDB1	LEDB2	LEDB3	LEDB4	LEDB5	LEDB6	LEDB7	LEDB8
L	Constant current output						Constant current output	
M	Constant current output						Open drain output	
H	Open drain output						Open drain output	

- Serial Settings

  Each mode can be set by setting CTLSCT terminal.

CTLSCT Terminal Setting	Serial I/F Mode		Maximum SCLK	Acknowledge
L	3−wire SPI	SCLK, SDATA, SDEN	5 MHz	Incompatible
M	I^2C	SCLK, SDATA	3.4 Hz	Correspondence
H	2−wire SPI	SCLK, SDATA	5 MHz	Incompatible

When using I2C ,the ACK sink capability of the SDA pin is equal to FASTMODE,In case of requirement up to 20 mA, an external MOSFET is needed.

- Number of Connections on the same Bus Line
  - IC recognition is possible by setting the A0/ A1/ A2/ A3/ A4/ A5 pins and the serial (slave address) settings.

3−wire SPI,2−wire SPI	Up to 56 bus settings are possible
I^2C	Up to 48 bus settings are possible

- About the Output Malfunction Protection Function

  Thermal protection function

If the IC temperature rises, for example due to abnormal heat generation, the LEDO output is turned off. When the chip temperature inside the IC is 175°C, the protection function is activated, the temperature drops and the chip recovers at 125°C.

UVLO detection protection function

When the SVCC voltage drops, the LEDO output is turned off. The protection function is activated when SVCC falls below 2.3 V.

There is a hysteresis of 100 mV and it returns by retransmitting the register.

- MAX current setting at constant current output

MAX current can be set by connecting Iref_R, Iref_G, and Iref_B.

Current setting	“The resistance value connected to Iref_R determines the MAX current. The R / G / B unit (common 8ch) can be adjusted with the register setting.”	“The current is determined by the resistance value connected to Iref_R / Iref_G / Iref_B. The R / G / B unit (8 channels in common) determines the current independently by the connected resistors.”
Iref_R	Resistor (connected to GND)	Resistor (connected to GND)
Iref_G	Connect to VREF	Resistor (connected to GND)
Iref_B	Connect to VREF	Resistor (connected to GND)

Each RLED, GLED, BLED has a D/A circuit inside the IC.

Therefore, current values can be set independently for RGB. <Serial register setting: 00h, 01h, 02h> Connect a resistor to Iref−R only to determine the MAX current value.

In that case, the RGB current value can be adjusted by the register, and the resistor connected to Iref_R determines the current value of all RGB. MAX current is common to RGB.

In order to determine the current value in RGB units, the RGB current value is fixed by connecting a resistor to each current value setting terminal. However, the current value can’t be adjusted by the register.

- About the resistance value connected to Iref_R, Iref_G, Iref_B

The resistance value connected to Iref_R, Iref_G, Iref_B determines the MAX current.

$$\text{LED MAX Current (A)} = \frac{\text{1.2 (BGR Voltage)}}{\text{Resistance } (\Omega)} \times 580 \quad \text{(eq. 1)}$$

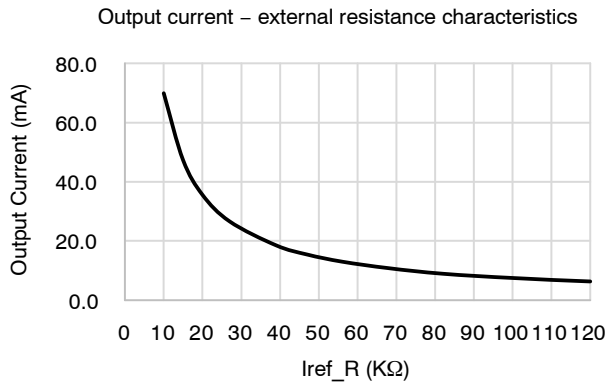

Figure 3.

- Output current characteristics

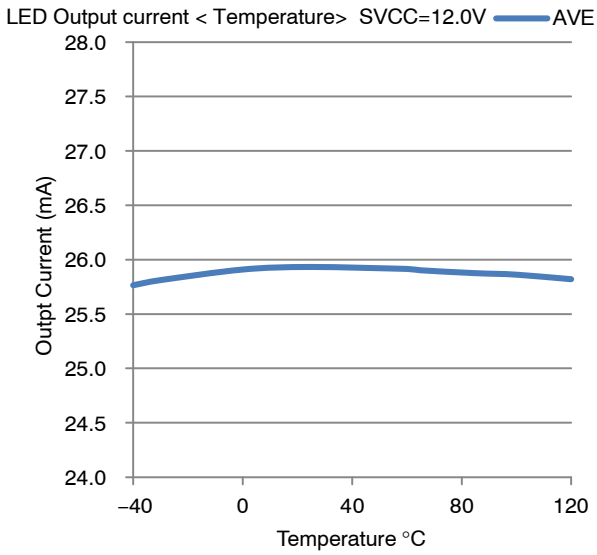

Figure 4. Constant Current Setting

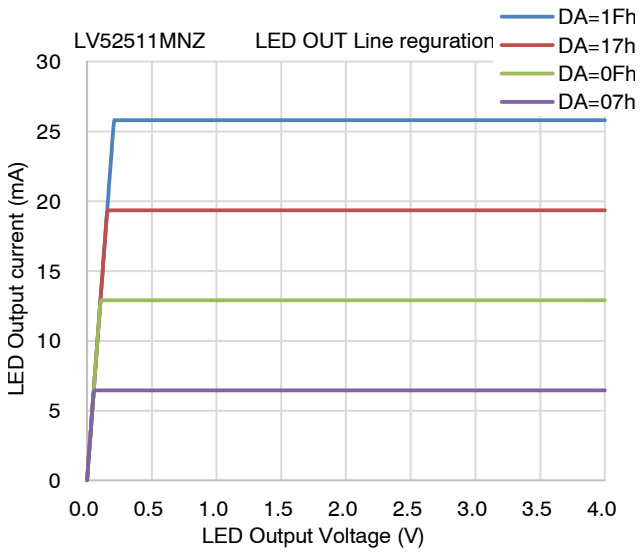

Figure 5. Output Saturation Characteristic by Current Value Setting

- LED output R−on characteristics

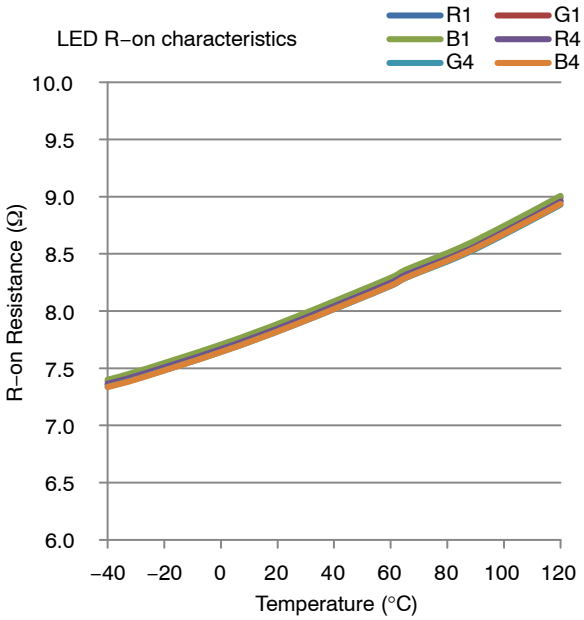

Figure 6. Open Drain Setting

- Power on reset

Reset Pin setting	
L	Reset state. The LED output terminal is off. No current is output. Serial data is reset and data can't be set.
H	Reset release. Power−on reset is enabled by connecting to VREF. The LED output terminal turns on and outputs current. Serial data can be set.

Reset release

It has a power on reset circuit.

By connecting the RESET pin to VREF, the resist data in the IC is reset when SVCC is turned on.

If you want to transmit data after releasing power on reset, wait 3 ms or more after confirming that LVCC has been activated.

Power−on reset is enabled when the power supply rises after SVCC is applied at 0 V. To restart, set SVCC = 0 V and then start up.

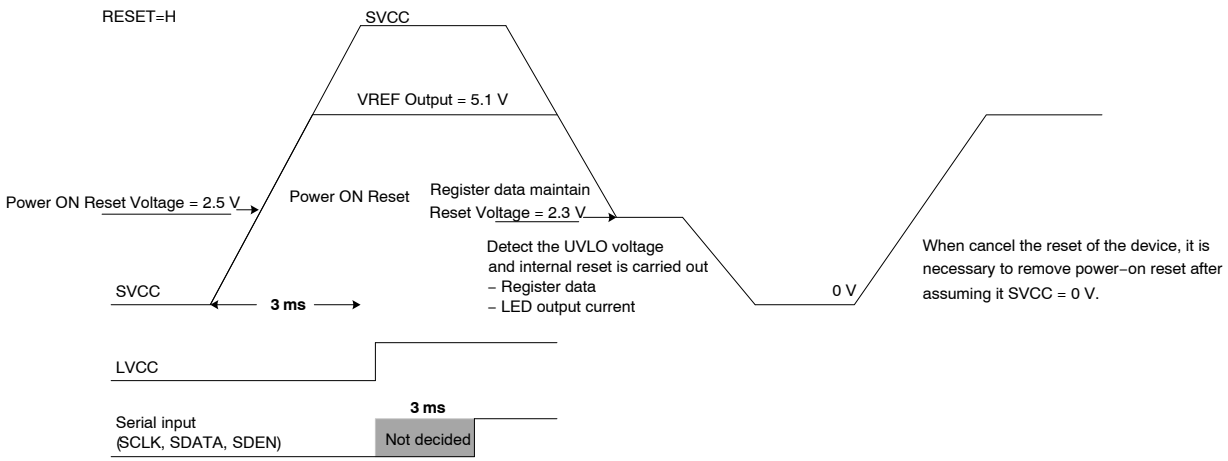

Figure 7. Power Supply Sequence when Power On Reset is Enabled

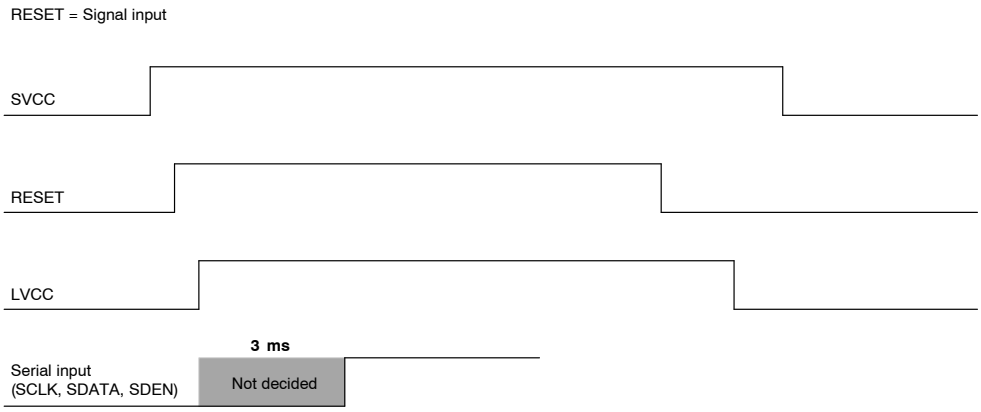

Figure 8. Power Supply Sequence when Power On Reset is Not Effective

- Description of serial register

Register address: 00h

LEDR current setting

The current value is set in 5 bits with respect to the maximum current value of LEDR 5bit: 0.82mA to 25.80 mA

Register address: 01h

LEDG current setting

The current value is set in 5 bits with respect to the maximum current value of LEDG. 5 bit: 0.82 mA to 25.80 mA

Register address: 02h

LEDB current setting

The current value is set in 5 bits with respect to the maximum current value of LEDB. 5 bit: 0.82 mA to 25.80 mA

Register address: 03h to 05h

100% Duty ON lighting setting of LED * R1OUT, G1OUT, B1OUT, R2OUT, ..., B8OUT Set each LED output ON / OFF in 100% Duty output mode.

LED_ON / OFF directly in serial setting. It does not become built−in PWM output. The register value of the PWM_Duty setting is ignored.

0 OFF

1 100%Duty ON

Register address: 06h to 1dh

LED * PWM_duty setting R1PWM, G1PWM, B1PWM, R2PWM, ..., B8PWM

Set PWM_Duty of each LED output. 8 bit: 256 gradation settings are possible. 8Bit: 0% to 99.6%

Register address: 20h to 26h

LED output PWM_Duty setting in group units

The duty set here rewrites the data of address 06h−1dh.

Conversely, the duty set on the individual channel rewrites the data of group setting.

Register address: 20h

LEDR1, LEDR2, LEDR3, LEDR4, LEDR5, LEDR6, LEDR7, LEDR8

Register address: 21h

LEDG1, LEDG2, LEDG3, LEDG4, LEDG5,LEDG6, LEDG7, LEDG8

Register address: 22h

LEDB1, LEDB2, LEDB3, LEDB4, LEDB5, LEDB6, LEDB7, LEDB8

Register address: 23h

LEDR1, LEDG1, LEDB1, LEDR2, LEDG2, LEDB2

Register address: 24h

LEDR3, LEDG3, LEDB3, LEDR4, LEDG4, LEDB4

Register address: 25h

LEDR5, LEDG5, LEDB5, LEDR6, LEDG6, LEDB6

Register address: 26h

LEDR7, LEDG7, LEDB7, LEDR8, LEDG8, LEDB8

Soft wafer reset in I^2C mode

In the case of I^2C communication, it is possible to reset by transmitting the following register.

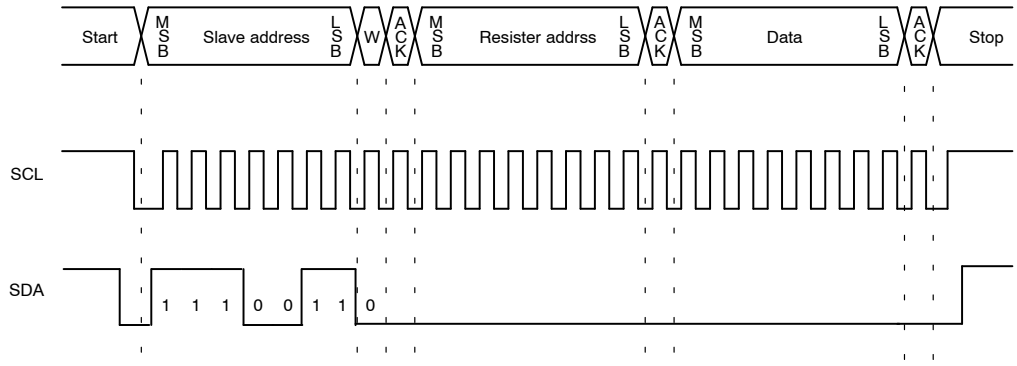

Figure 9.

Since the reset is enabled at 8 bits of slave address, the subsequent data does not matter.

- Recommended application schematic

Constant current output <OUTSCT=L>

RGB current value adjustable – RGB current value adjustable

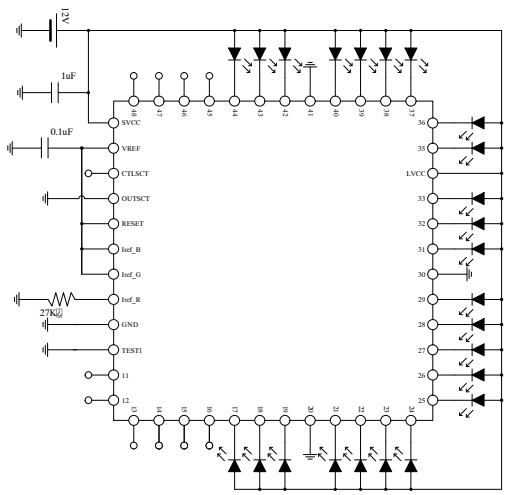

Figure 10. LV52511MNZ Application (SVCC = 12 V)

SVCC = 12 V

About setting MAX current

MAX current is common in RGB unit, and adjustment of current value is possible by register adjustment in RGB unit.

RGB current fixed

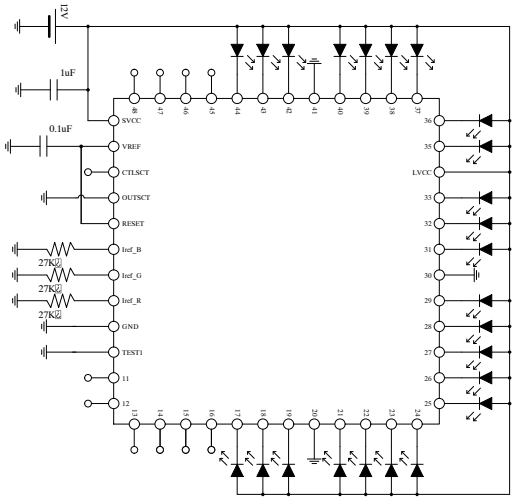

Figure 11.

SVCC = 12 V

About setting MAX current

MAX current is independent in RGB unit, and fixed in each resistance value in RGB unit.

The current value can not be adjusted by register adjustment.

Open drain output <OUTSCT=H>

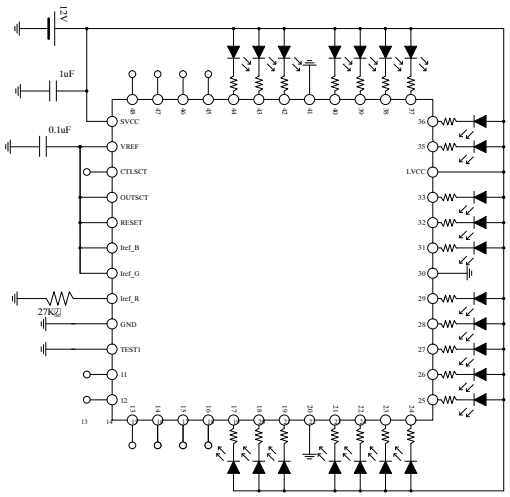

Figure 12.

SVCC = 12 V, LVCC = 12 V

The LED output current is determined by the limiting resistor connected to each output. Connect 27 KΩ to Iref_R.

The resistance value connected to Iref_R does not change the output current value.

- Recommended application schematic
  - SVCC = 5 V, LED anode voltage = 12 V (When using multiple power supplies)

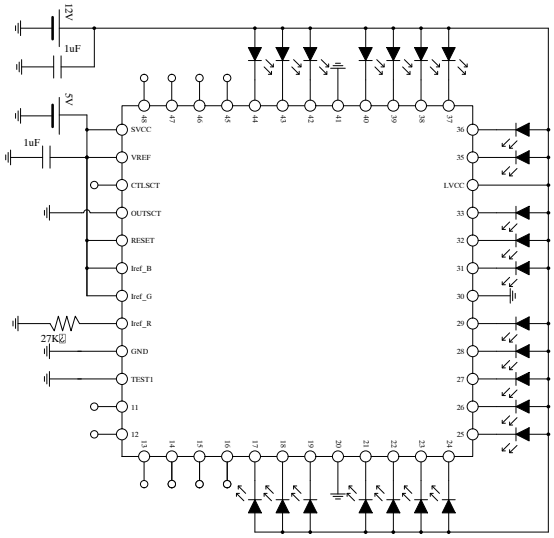

Figure 13.

If multiple potentials are mixed, connect the highest voltage source to LVCC. If the SVCC input is 5V or less, supply SVCC with a short circuit to VREF.

Otherwise, the MOS transistor will not be able to maintain regulation and the VREF output voltage will drop.

About LVCC

LVCC is a voltage supply source for the circuit that protects the LED output terminal.

Therefore, if LVCC is not supplied with voltage, the protection circuit may not function sufficiently and ESD tolerance may not be satisfied.

Also, if a voltage lower than the LED output terminal is connected, the LED will light up due to leakage current flowing to the LED output terminal.

Therefore, the LVCC pin needs to be fixed at a potential equal to or higher than the LED output pin.

About Exposed−PAD on the back of IC

The exposed Exposed−PAD on the back side is at GND. Therefore, when mounting on a board, connect to GND.

About using VREF terminal

The output load capacity of the VREF pin is Io = 30 mA.

The range to connect to the control terminal of the same IC is assumed.

When using the VREF output potential externally, design it to be used within the load capacity range.

If the load current exceeds the capacity, the VREF voltage drops and it is expected that the IC will not operate.

ON Semiconductor is licensed by the Philips Corporation to carry the I^2C bus protocol.

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