

# M62295GP

## LCD Back-light Control IC

REJ03D0856-0201

Rev.2.01

Nov 14, 2007

### Description

M62295GP is a semiconductor integrated circuit designed for PC back-light control, which employs 2 output totempole output circuit specifically suitable for inverter drive with piezo device.

Such necessary functions as light control, protection circuit are housed in 16-pin SSOP package. This allows for simplified peripheral circuit as well as compact and thin set design.

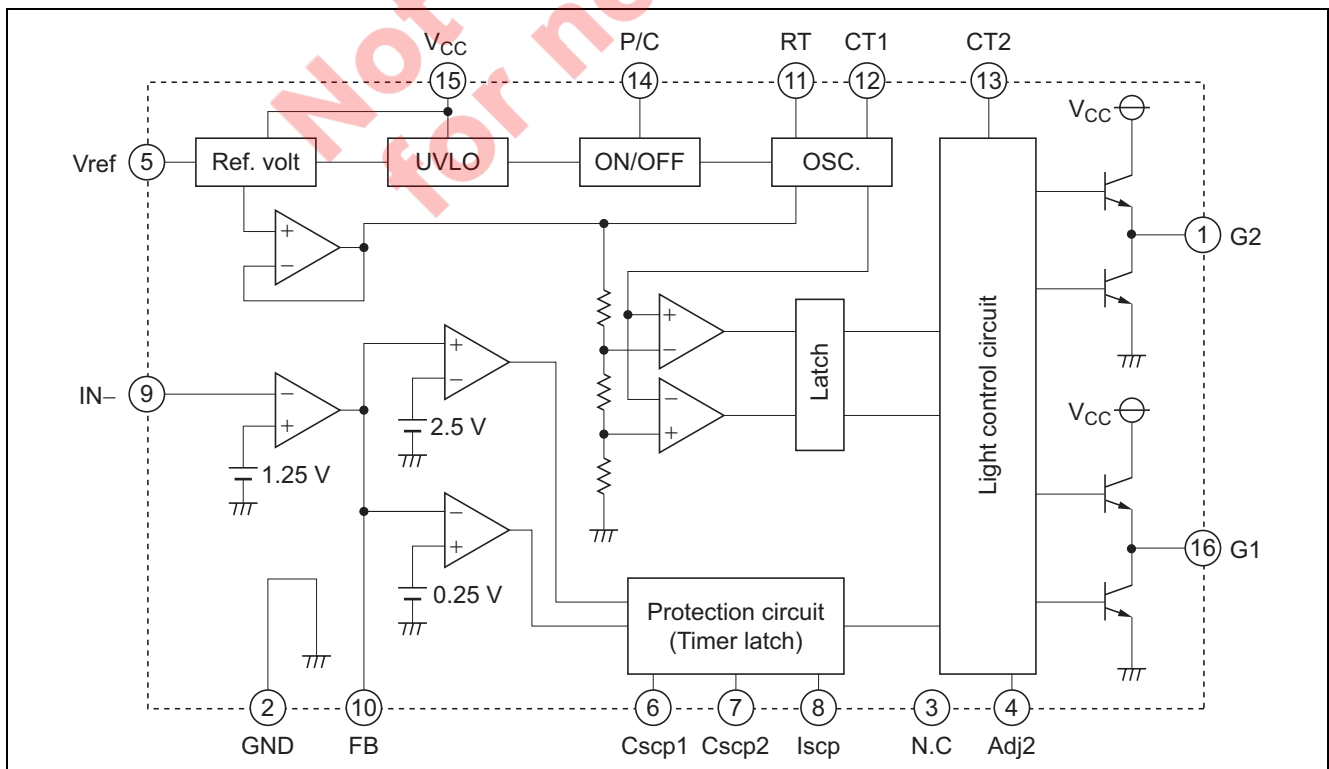
### Features

- Direct drive to n-ch/p-ch MOSFET
- Fixed output duty: 45%
- Output current (peak):  $\pm 300$  mA
- Light control
  - Pulse synchronous control  
Output OFF period is adjusted synchronous with the OSC frequency. (1 kHz-200 kHz)
  - Light control available from 10% (Min.) up to 100% by the voltage applied from outside. (Adj2 terminal)
- Protection functions
  - 2 kinds of timer-latch time setting available by 3 triggers  
(few seconds, several tens of seconds set by external capacitor)

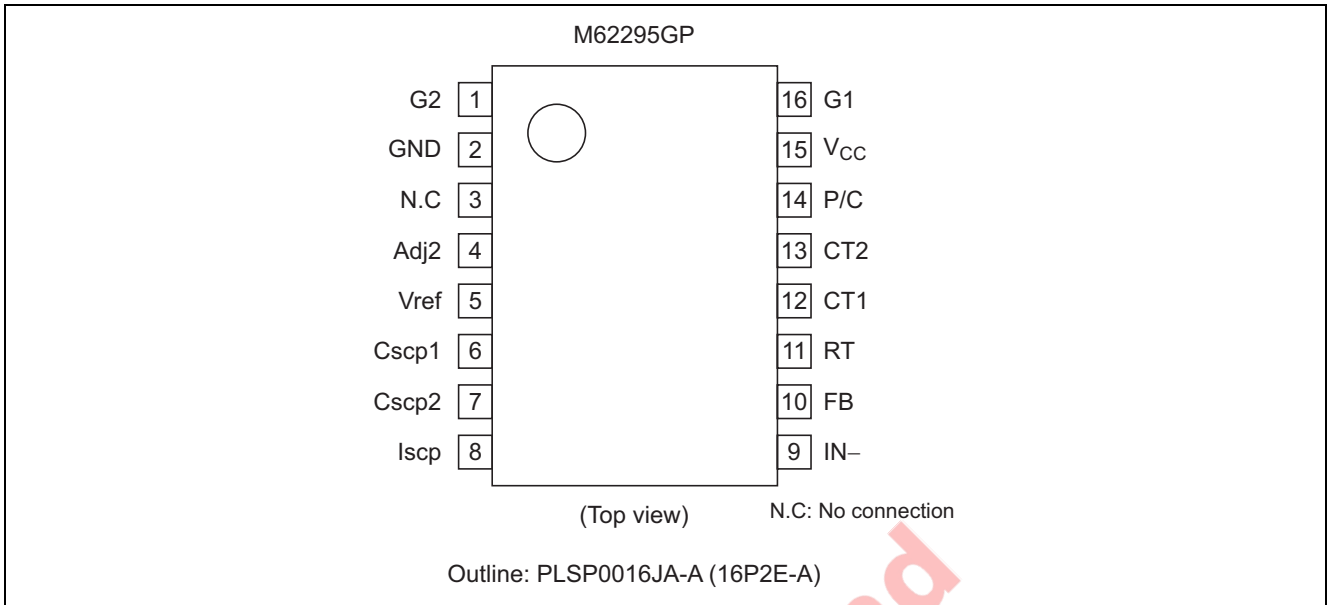
### Application

LCD Back-light control for Note P.C etc.

### Block Diagram



### Pin Arrangement



Not recommend  
for new design

## Absolute Maximum Ratings

(Ta = 25°C, unless otherwise noted)

| Item                  | Symbol           | Ratings     | Unit | Conditions |
|-----------------------|------------------|-------------|------|------------|
| Supply voltage        | V <sub>CC</sub>  | 28          | V    |            |
| Output current        | I <sub>OUT</sub> | ±50         | mA   | Continuous |
|                       |                  | ±300        | mA   | Peak       |
| Power dissipation     | P <sub>d</sub>   | 400         | mW   | Ta = 25°C  |
| Operating temperature | T <sub>opr</sub> | -20 to +85  | °C   |            |
| Storage temperature   | T <sub>stg</sub> | -40 to +125 | °C   |            |

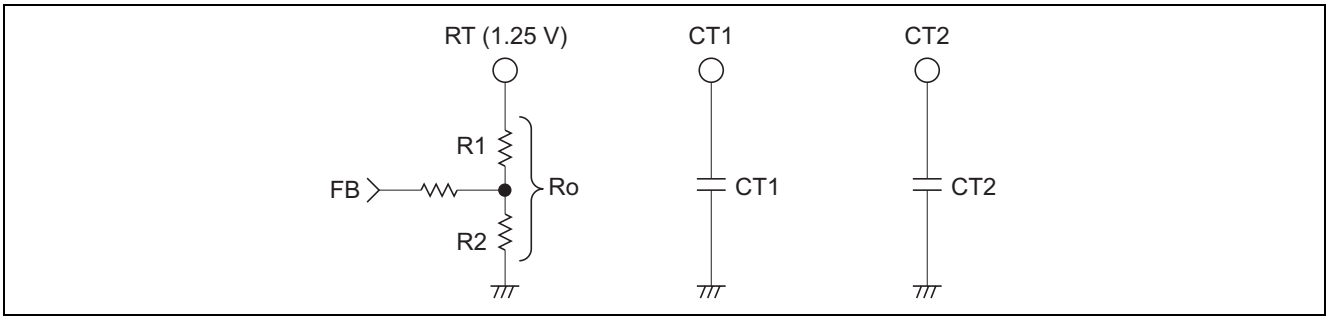
## Electrical Characteristics

(Ta = 25°C, V<sub>CC</sub> = 15 V, unless otherwise noted)

| Block         | Item                                   | Symbol                   | Limits |      |      | Unit | Test Conditions                                       |
|---------------|--|--------------------------|--------|------|------|------|---|
|               |  |                          | Min.   | Typ. | Max. |      |   |
| All           | Operating supply voltage range         | V <sub>CC</sub>          | 3.6    | —    | 26   | V    |   |
|               | Circuit current                        | I <sub>CC</sub>          | 4.5    | 6    | 7.5  | mA   |   |
|               | Circuit current in power control state | I <sub>CC</sub> (PC)     | 15     | 30   | 55   | μA   |   |
| UVLO          | ON threshold voltage                   | V <sub>TH ON</sub>       | 3.27   | 3.43 | 3.59 | V    |   |
|               | OFF threshold voltage                  | V <sub>TH OFF</sub>      | —      | 3.36 | —    | V    |   |
|               | Hysteresis                             | V <sub>hys</sub>         | 35     | 70   | 140  | mV   |   |
| OP. Amp.      | Input bias current                     | I <sub>B</sub>           | -500   | -30  | —    | nA   |   |
|               | Open loop gain                         | A <sub>V</sub>           | —      | 80   | —    | dB   |   |
|               | Gain bandwidth product                 | GB                       | —      | 0.6  | —    | MHz  |   |
|               | Max. output voltage                    | V <sub>FB+</sub>         | 2.65   | 2.8  | —    | V    |   |
|               | Min. output voltage                    | V <sub>FB-</sub>         | —      | 100  | 200  | mV   |   |
|               | Max. sink current                      | I <sub>FB+</sub>         | 1      | 2    | —    | mA   |   |
|               | Max. source current                    | I <sub>FB-</sub>         | -50    | -80  | —    | μA   |   |
| Ref. voltage  | Reference voltage                      | V <sub>ref</sub>         | 2.40   | 2.50 | 2.60 | V    |   |
|               | Line regulation                        | LINE                     | —      | 5    | —    | mV   |   |
|               | Max. load current                      | I <sub>ref</sub> (Max)   | 1      | 5    | —    | mA   |   |
| OSC.          | Oscillating frequency                  | f <sub>osc</sub>         | —      | 100  | —    | kHz  |   |
|               | Max. oscillating frequency             | f <sub>osc</sub> (Max)   | —      | —    | 200  | kHz  |   |
|               | RT terminal voltage                    | V <sub>RT</sub>          | 1.1    | 1.25 | 1.4  | V    |   |
| Light control | Adj2 voltage at min. duty              | V <sub>Adj2</sub> (Min)  | 2.3    | 2.4  | 2.5  | V    |   |
|               | Min. duty for light control            | Min Duty                 | 5      | 10   | 15   | %    | V <sub>Adj2</sub> = V <sub>ref</sub>                  |
|               | Adj2 voltage at 100% duty              | V <sub>Adj2</sub> (Max)  | 0.1    | 0.2  | 0.3  | V    |   |
|               | Adj2 terminal current                  | I <sub>Adj2</sub>        | -100   | -10  | +100 | nA   |   |
|               | Light control frequency                | f <sub>osc</sub> (CT2)   | —      | 1    | —    | kHz  | f <sub>osc</sub> = 100 kHz                            |
| Protection    | FB terminal H threshold volt.          | FB V <sub>TH</sub> (H)   | 2.35   | 2.5  | 2.65 | V    |   |
|               | FB terminal L threshold volt.          | FB V <sub>TH</sub> (L)   | 0.2    | 0.25 | 0.3  | V    |   |
|               | IscpL detection voltage.               | Iscp V <sub>TH</sub> (L) | 1.1    | 1.25 | 1.4  | V    |   |
|               | Cscp1 charge current                   | ICSCP1                   | -0.8   | -1.3 | -1.8 | μA   |   |
|               | Cscp2 charge current                   | ICSCP2                   | -0.8   | -1.3 | -1.8 | μA   |   |
|               | Cscp1 detection voltage                | CSCP1V <sub>TH</sub>     | 2.35   | 2.5  | 2.65 | V    |   |
|               | Cscp2 detection voltage                | CSCP2V <sub>TH</sub>     | 1.1    | 1.25 | 1.4  | V    |   |
|               | Circuit current at timer-latch         | I <sub>timer-L</sub>     | 1.2    | 2.2  | 3.2  | mA   |   |
| P/C           | P/C terminal flow-in current           | I <sub>P/C</sub>         | 1      | 2    | 4    | μA   |   |
|               | P/C threshold voltage                  | V <sub>TH</sub> (ON)     | 0.4    | 0.7  | 1.0  | V    |   |
| Output        | Output duty                            | Duty                     | 42     | 45   | 48   | %    | R <sub>T</sub> = 12.4 kΩ,<br>C <sub>T1</sub> = 470 pF |
|               | Output low voltage                     | V <sub>OL</sub>          | —      | 0.05 | 0.4  | V    |   |
|               | Output high voltage                    | V <sub>OH</sub>          | 13.0   | 13.5 | —    | V    |   |

### Function Description

- Output oscillation circuit and tooth-wave generating circuit for light control (RT, CT1, CT2)



**Figure 1 Connections of RT, CT1, CT2**

As shown in Figure 1, charge/discharge current for each oscillation circuit is set by connecting resistors to RT terminal.

RT terminal is connected to FB terminal by resistor to control the frequency for light control.

CT1 is the terminal for connecting capacitor for output oscillation circuit, generating triangular-wave oscillating between lower limit (approx. 0.25 V) and upper limit (approx. 1.25 V) by the charge current set at RT terminal.

CT2 is the terminal for connecting capacitor for tooth-wave for light control, into which one twentieth of charge current of CT1 terminal flows generating tooth-wave oscillating between lower limit (approx. 0.25 V) and upper limit. (approx. 1.25 V)

Each charge current and oscillation frequency is decided by the formula shown below.

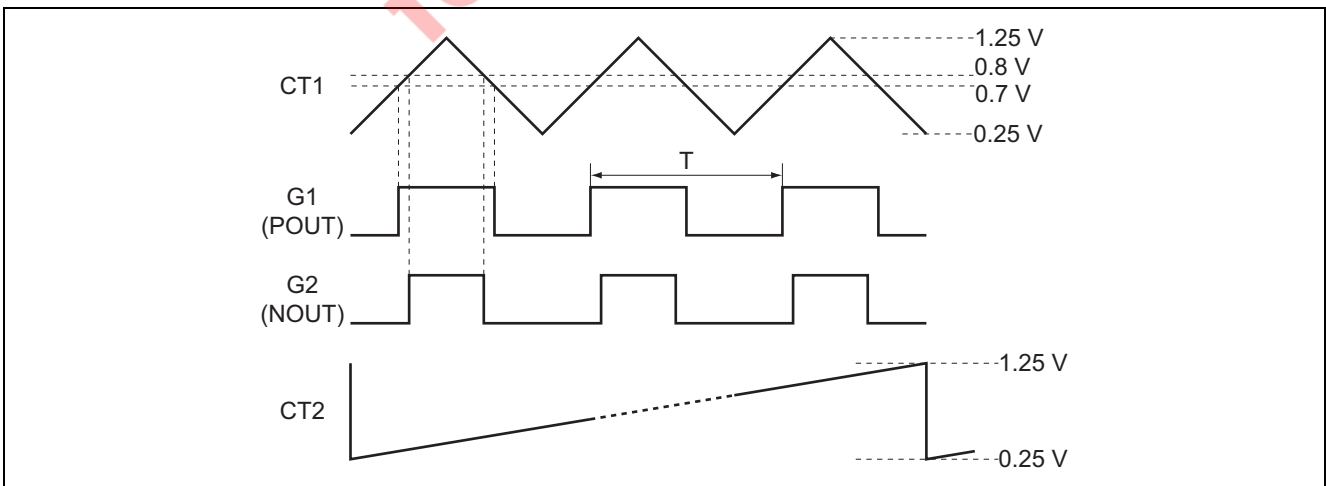
$$\text{CT1 charge / Discharge current (ICT1 charge)} = \frac{1.25}{R_o}$$

$$\text{CT2 charge / Discharge current (ICT2 charge)} = \frac{1.25}{R_o} \cdot \frac{1}{20}$$

$$\text{Output freq. (f}_{osc}) = \frac{1}{T} = \frac{1}{CT1 \cdot \frac{2}{ICT1 \text{ charge}}}$$

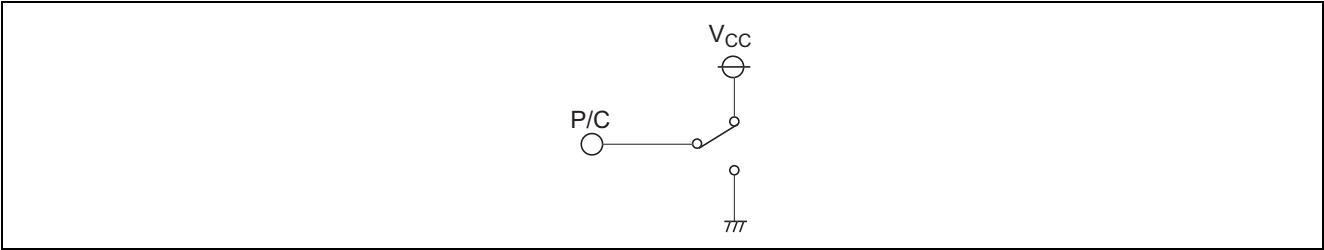
$$\text{Tooth-wave freq. (CT2}_{osc}) = \frac{1}{CT2 \cdot \frac{1}{ICT2 \text{ charge}}}$$

$$\frac{\text{Tooth-wave freq. (CT2}_{osc})}{\text{Output freq. (f}_{osc})} \text{ (divided ratio)} = \frac{CT1}{CT2 \cdot 10}$$



**Figure 2 Waveform for CT1, CT2, and G1, G2**

- ON/OFF control function (P/C)



**Figure 3 Connection Example for P/C**

ON/OFF control is available using P/C terminal. As shown in Figure 3, ON/OFF control is made by connecting P/C terminal to  $V_{CC}$  or GND or by making P/C terminal open.

P/C =  $V_{CC}$ : IC in normal operation mode  
 P/C = GND & OPEN: IC operation at halt

- Light control function (Adj2)

Figure 4 shows the connections of Adj2 terminal.

When the light control voltage is 2.4 V or more, divided voltage by the resistors is applied. Light control is decided by the OSC. frequency of CT2 and the applied voltage to Adj2 terminal.

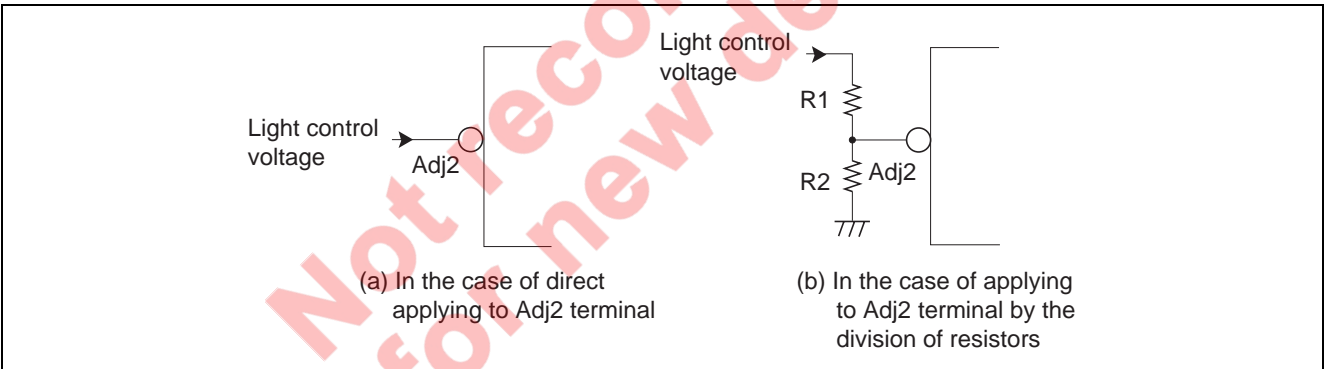
Figure 5 shows how the applied voltage to Adj2 terminal relates itself to light control.

The voltage range of Adj2 terminal available for light control is 0.1 V to 2.4 V.

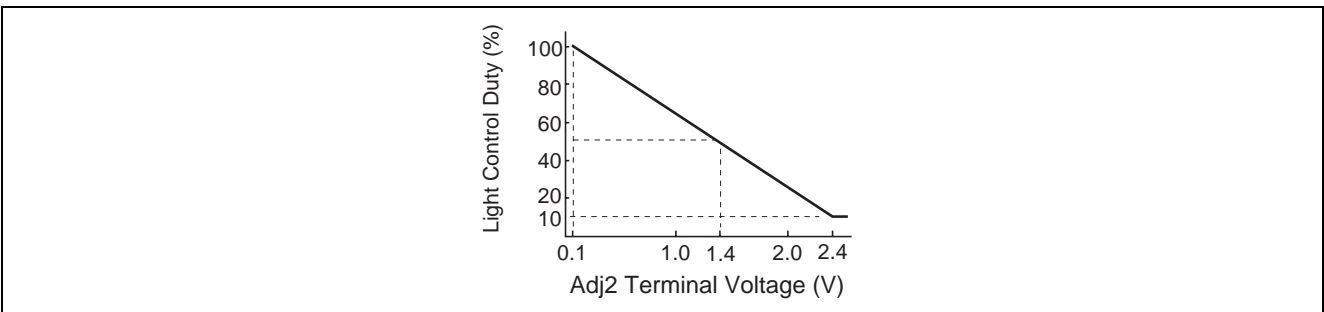
When the voltage is 2.4 V or more, light control duty becomes minimum (10%), and when it is 0.1 V or less, light control duty becomes 100%.

Minimum duty is available by connecting Adj2 terminal to Vref terminal.

Output waveform on above mentioned stage is shown in Figure 6 (a) to Figure 6 (c). Figure 6 (a) shows 100% light controlled state, Figure 6 (b) middle state (50% light controlled), Figure 6 (c) minimum duty state.



**Figure 4 Connections of Adj2 Terminal**



**Figure 5 Adj2 Terminal Voltage-light Control Duty Characteristics**

Formula for light control level by light control voltage

$$\text{ON Duty} = (100 - \text{ON Duty Min}) \times \frac{2.4 - V_{\text{Adj2}}}{2.4} + \text{ON Duty Min} (\%)$$

V<sub>Adj2</sub>: Adj2 terminal voltage (V)

ON Duty Min = 10 (%)

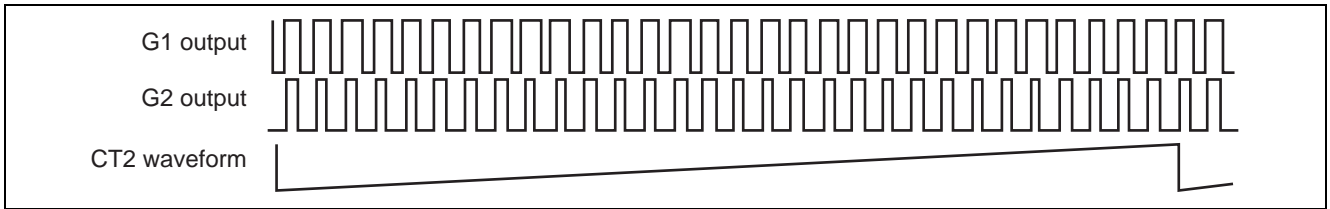


Figure 6 (a) 100% Light Control

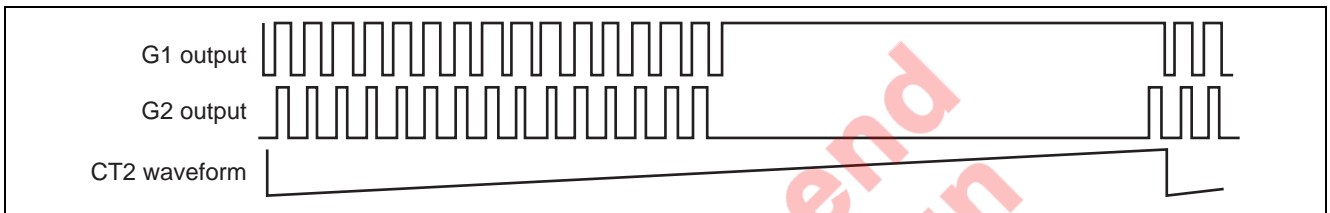


Figure 6 (b) 50% Light Control

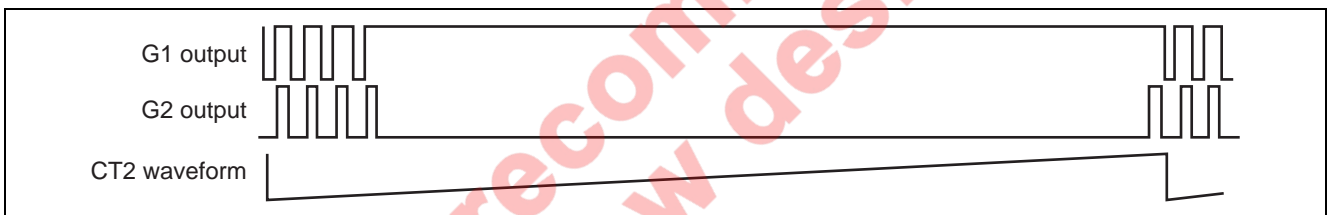
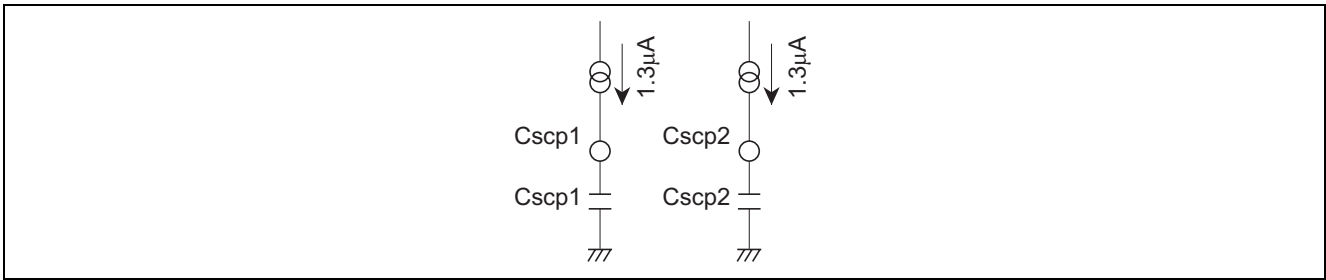


Figure 6 (c) 10% Light Control

Not recommend  
for new design

- Protection function (timer-latch) (Cscp1, Cscp2, Iscp)



**Figure 7 Connections of Cscp1, Cscp2**

Application for timer-latch by detecting tube current and feedback voltage is available by using Iscp, Cscp1, Cscp2 terminal.

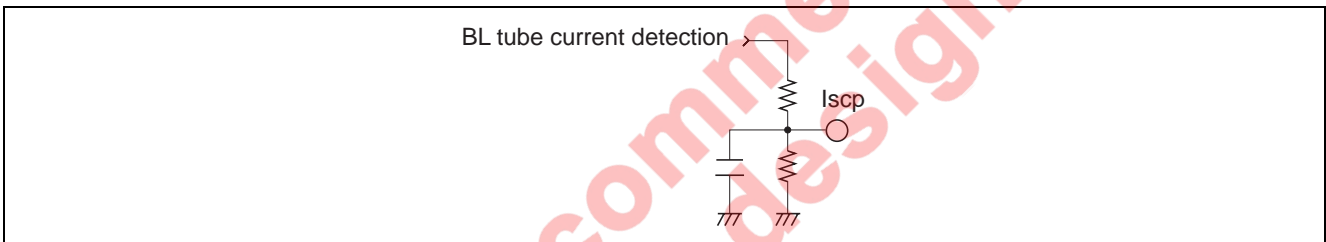
Two kinds of setting for timer-latch time is available by the setting of Cscp1, Cscp2. Each timer-latch time is set by the formula below.

— Cscp1: Terminal for capacitance for timer-latch set (few second)

$$\text{Timer-L (Cscp1)} = \text{Cscp1} \times \frac{2.5}{1.3 \times 10^{-6}}$$

— Cscp2: Terminal for capacitance for timer-latch set (few millisecond)

$$\text{Timer-L (Cscp2)} = \text{Cscp2} \times \frac{1.25}{1.3 \times 10^{-6}}$$



**Figure 8 Connections of Iscp Terminal**

Not recommended for new design

## — Detection of tube current

Detection of tube current is made by Iscp terminal.

Detection voltage for Iscp terminal is set 1.25 V.

After power is on, when Iscp voltage does not rise up to 1.25 V by timer-L (Cscp1) time, or when Iscp voltage becomes 1.25 V or less after start-up, abnormality is detected to move on to the protection operation mode in Figure 1.

If Iscp voltage is less than 1.25 V, light control is not made. (100%)

## — Detection of feedback voltage

Detection of feedback voltage is made by FB terminal.

When FB terminal voltage goes down to FB low detection voltage (0.25 V) or less, or when it rise up to FB terminal high detection voltage or more, abnormality is detected to move on to the protection operation mode in Figure 1.

**Table 1 Protection Operation Mode at a Glance**

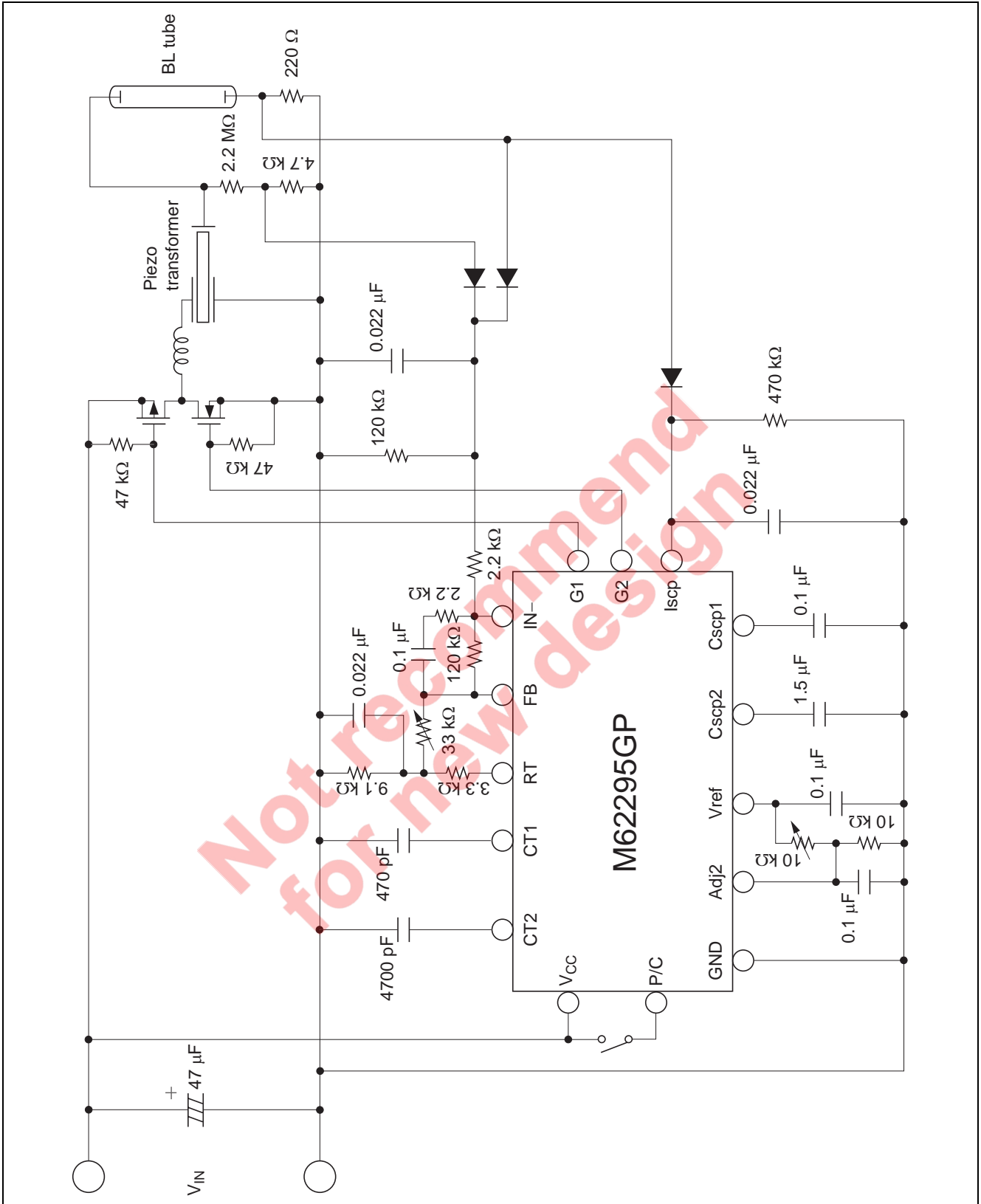
| Operation State                  |                      | Protection Operation Mode                      | Triggers for Protection Operation |              |                    | Timer-latch Time |       |
|----------------------------------|----------------------|--|-----------------------------------|--------------|--------------------|------------------|-------|
|                                  |                      |  | Ampout = "H"                      | Ampout = "L" | I <sub>o</sub> = 0 | 2 s              | 10 ms |
| Normal start-up                  |                      | —  | —                                 | —            | —                  | —                | —     |
| Start-up in shortcircuited state | I <sub>o</sub> = Max | Operation stop after 10 ms                     |                                   | ○            |                    |                  | ○     |
|                                  | I <sub>o</sub> = 0   | Operation stop instantaneously                 | ○                                 |              | ○                  |                  | ○     |
| Start-up in open state           |                      | Operation stop after 2 s.                      |                                   |              | ○                  | ○                |       |
| Start-up in black mode           | OFF                  | Operation stop after 2 s.                      |                                   |              | ○                  | ○                |       |
|                                  | ON                   | Normal start-up if turn-on is made within 2 s. |                                   |              | Δ                  | ○                |       |
| Shortcircuit while in operation  | I <sub>o</sub> = Max | Operation stop instantaneously                 |                                   | ○            |                    |                  | ○     |
|                                  | I <sub>o</sub> = 0   | Operation stop instantaneously                 | ○                                 |              | ○                  |                  | ○     |
| Open while in operation          |                      | Operation stop instantaneously                 |                                   |              | ○                  |                  | ○     |

Notes: 1. Timer-latch time refers to the time under Cscp = 1 μF, Cscp2 = 0.1 μF.

2. Amp. output is "H" when tube current I<sub>o</sub> equals to 0, "L" when it is at its minimum. Detection voltage is 2.5 V ("H" side), 0.25 V ("L" side).

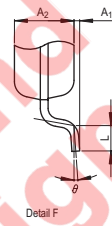
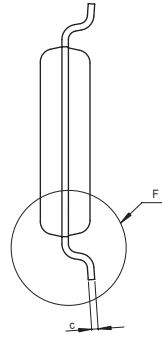
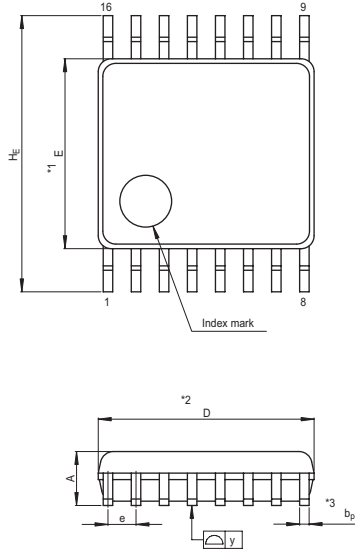


BL Back-light Control Application Example



### Package Dimensions

|                      |              |               |            |
|----------------------|--------------|---------------|------------|
| JEITA Package Code   | RENESAS Code | Previous Code | MASS[Typ.] |
| P-LSSOP16-4.4x5-0.65 | PLSP0016JA-A | 16P2E-A       | 0.06g      |



NOTE)  
 1. DIMENSIONS \*\*1\* AND \*\*2\* DO NOT INCLUDE MOLD FLASH.  
 2. DIMENSION \*\*3\* DOES NOT INCLUDE TRIM OFFSET.

| Reference Symbol | Dimension in Millimeters |      |      |
|------------------|--------------------------|------|------|
|                  | Min                      | Nom  | Max  |
| D                | 4.9                      | 5.0  | 5.1  |
| E                | 4.3                      | 4.4  | 4.5  |
| A <sub>2</sub>   | —                        | 1.15 | —    |
| A                | —                        | —    | 1.45 |
| A <sub>1</sub>   | 0                        | 0.1  | 0.2  |
| b <sub>p</sub>   | 0.17                     | 0.22 | 0.32 |
| c                | 0.13                     | 0.15 | 0.2  |
| θ                | 0°                       | —    | 10°  |
| H <sub>E</sub>   | 6.2                      | 6.4  | 6.6  |
| e                | 0.53                     | 0.65 | 0.77 |
| y                | —                        | —    | 0.10 |
| L                | 0.3                      | 0.5  | 0.7  |

Not recommended for new design

Notes:

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