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.

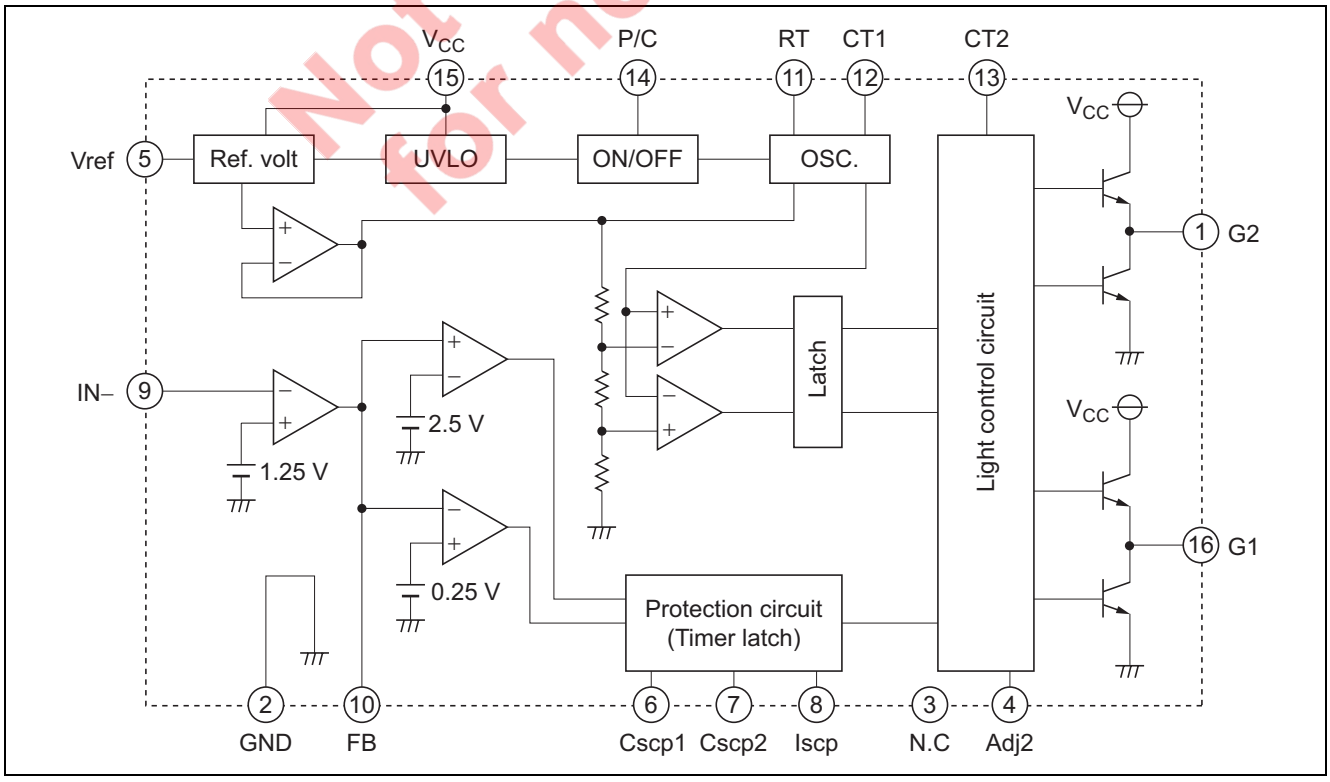
Features

- Direct drive to n-ch/p-ch MOSFET
- Fixed output duty: 45%
- Output current (peak): ±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)

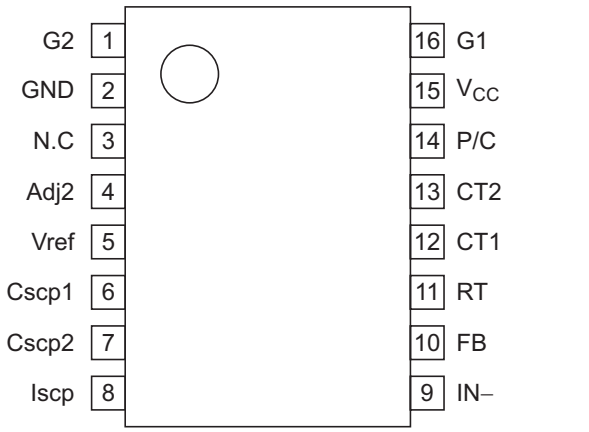
Application

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

Block Diagram



Pin Arrangement



(Top view) N.C: No connection

Outline: PLSP0016JA-A (16P2E-A)

Absolute Maximum Ratings

(Ta = 25°C, unless otherwise noted)

Item	Symbol	Ratings	Unit	Conditions
Supply voltage	V_{CC}	28	V	
Output current	I_{OUT}	±50	mA	Continuous
		±300	mA	Peak
Power dissipation	Pd	400	mW	Ta = 25°C
Operating temperature	Topr	–20 to +85	°C	
Storage temperature	Tstg	–40 to +125	°C	

Electrical Characteristics

(Ta = 25°C, V_{CC} = 15 V, unless otherwise noted)

Block	Item	Symbol	Limits			Unit	Test Conditions
			Min.	Typ.	Max.		
All	Operating supply voltage range	V_{CC}	3.6	—	26	V	
	Circuit current	I_{CC}	4.5	6	7.5	mA	
	Circuit current in power control state	I_{CC} (PC)	15	30	55	µA	
UVLO	ON threshold voltage	VTH ON	3.27	3.43	3.59	V	
	OFF threshold voltage	VTH OFF	—	3.36	—	V	
	Hysteresis	Vhys	35	70	140	mV	
OP. Amp.	Input bias current	IB	–500	–30	—	nA	
	Open loop gain	AV	—	80	—	dB	
	Gain bandwidth product	GB	—	0.6	—	MHz	
	Max. output voltage	VFB+	2.65	2.8	—	V	
	Min. output voltage	VFB–	—	100	200	mV	
	Max. sink current	IFB+	1	2	—	mA	
	Max. source current	IFB–	–50	–80	—	µA	
Ref. voltage	Reference voltage	Vref	2.40	2.50	2.60	V	
	Line regulation	LINE	—	5	—	mV	
	Max. load current	Iref (Max)	1	5	—	mA	
OSC.	Oscillating frequency	f_{OSC}	—	100	—	kHz	
	Max. oscillating frequency	f_{OSC} (Max)	—	—	200	kHz	
	RT terminal voltage	VRT	1.1	1.25	1.4	V	
Light control	Adj2 voltage at min. duty	VAdj2 (Min)	2.3	2.4	2.5	V	
	Min. duty for light control	Min Duty	5	10	15	%	VAdj2 = Vref
	Adj2 voltage at 100% duty	VAdj2 (Max)	0.1	0.2	0.3	V	
	Adj2 terminal current	IAdj2	–100	–10	+100	nA	
	Light control frequency	f_{OSC} (CT2)	—	1	—	kHz	f_{OSC} = 100 kHz
Protection	FB terminal H threshold volt.	FB VTH (H)	2.35	2.5	2.65	V	
	FB terminal L threshold volt.	FB VTH (L)	0.2	0.25	0.3	V	
	IscpL detection voltage.	Iscp VTH (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	CSCP1VTH	2.35	2.5	2.65	V	
	Cscp2 detection voltage	CSCP2VTH	1.1	1.25	1.4	V	
	Circuit current at timer-latch	Itimer-L	1.2	2.2	3.2	mA	
P/C	P/C terminal flow-in current	IP/C	1	2	4	µA	
	P/C threshold voltage	VTH (ON)	0.4	0.7	1.0	V	
Output	Output duty	Duty	42	45	48	%	R_T = 12.4 kΩ, C_{T1} = 470 pF
	Output low voltage	VOL	—	0.05	0.4	V	
	Output high voltage	VOH	13.0	13.5	—	V	

Function Description

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

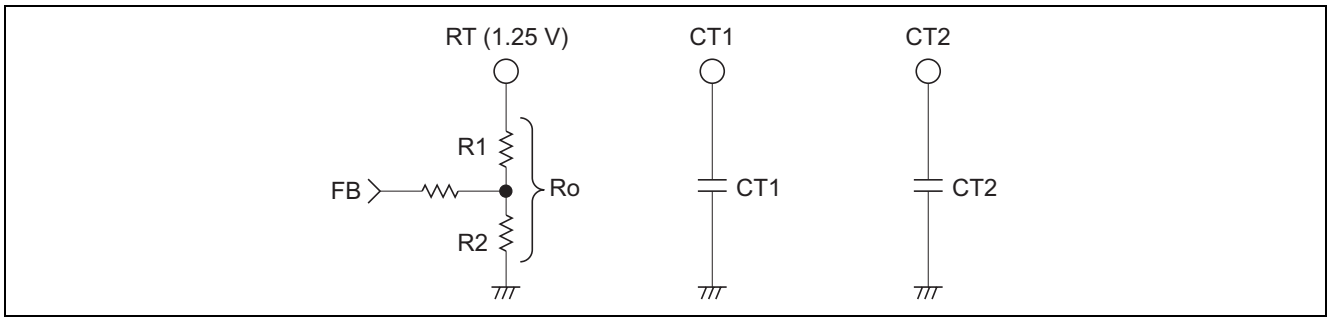


Figure 1 Connections of RT, CT1, CT2

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.

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

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

$$\text{Output freq. } (f_{OSC}) = \frac{1}{T} = \frac{1}{CT1 \bullet \frac{2}{\text{ICT1 charge}}}$$

$$\text{Tooth-wave freq. } (CT2_{OSC}) = \frac{1}{CT2 \bullet \frac{1}{\text{ICT2 charge}}}$$

$$\frac{\text{Tooth-wave freq. } (CT2_{OSC})}{\text{Output freq. } (f_{OSC})} \text{ (divided ratio)} = \frac{CT1}{CT2 \bullet 10}$$

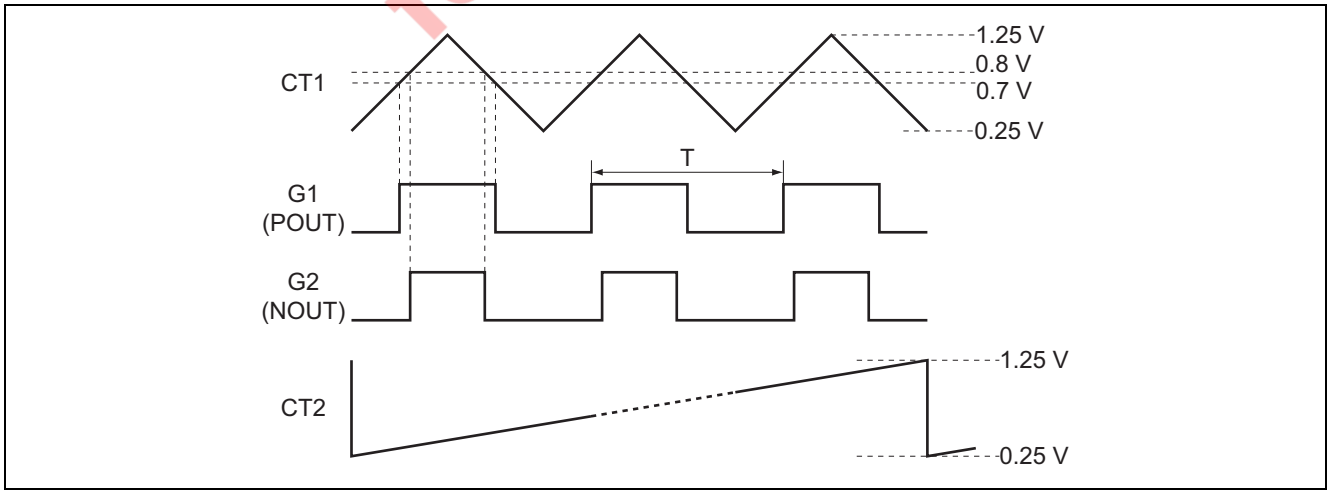


Figure 2 Waveform for CT1, CT2, and G1, G2

- ON/OFF control function (P/C)

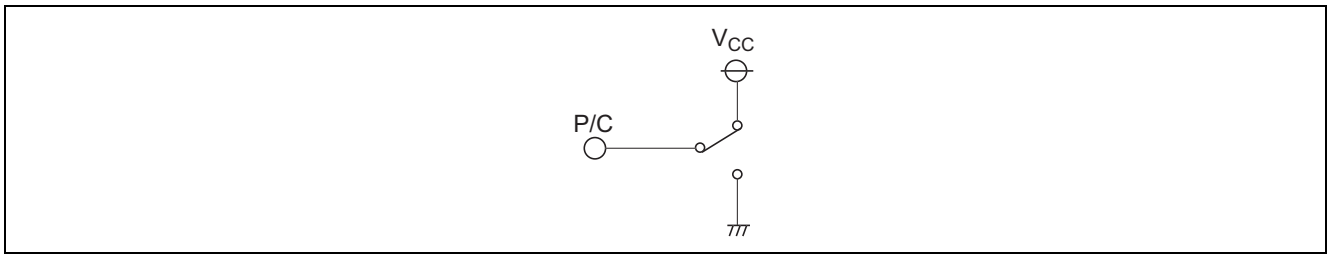


Figure 3 Connection Example for P/C

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.

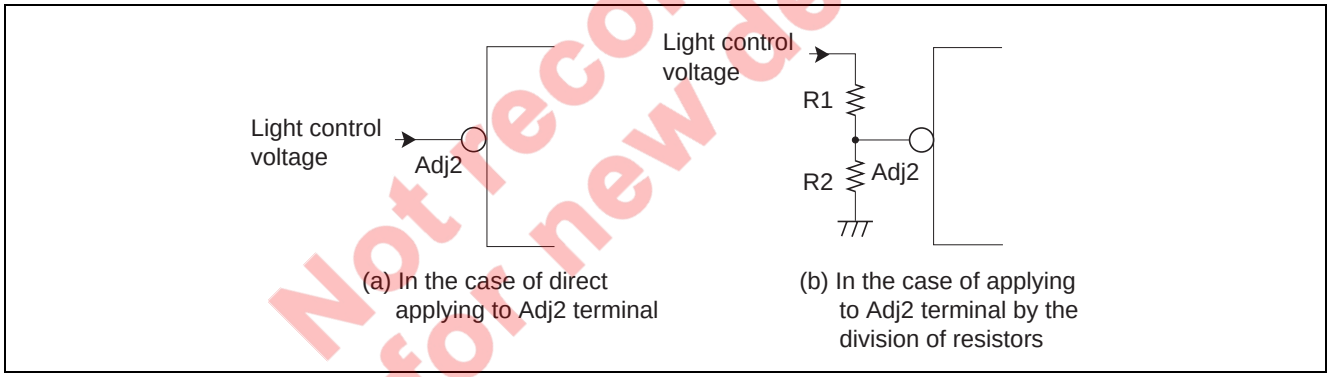


Figure 4 Connections of Adj2 Terminal

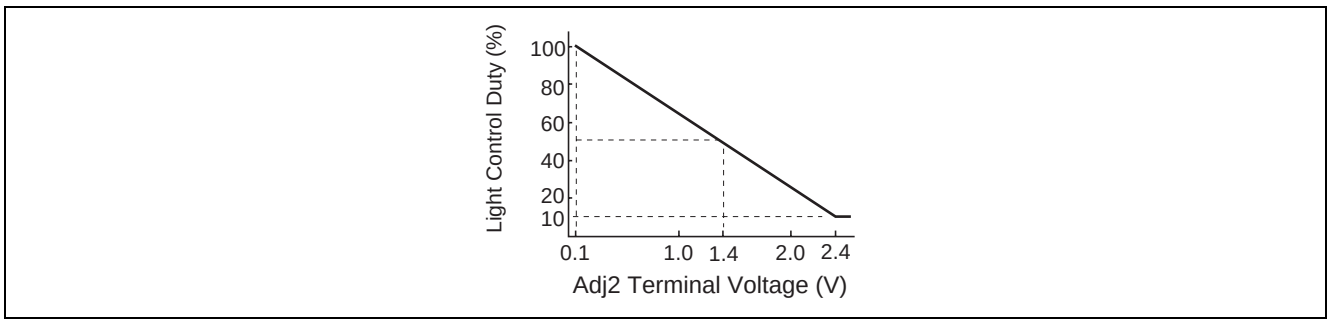


Figure 5 Adj2 Terminal Voltage-light Control Duty Characteristics

Formula for light control level by light control voltage

$$\text{ON Duty} = (100 - \text{ON Duty Min}) \times \frac{2.4 - \text{VAdj2}}{2.4} + \text{ON Duty Min (\%)}$$

VAdj2: Adj2 terminal voltage (V)
ON Duty Min = 10 (%)

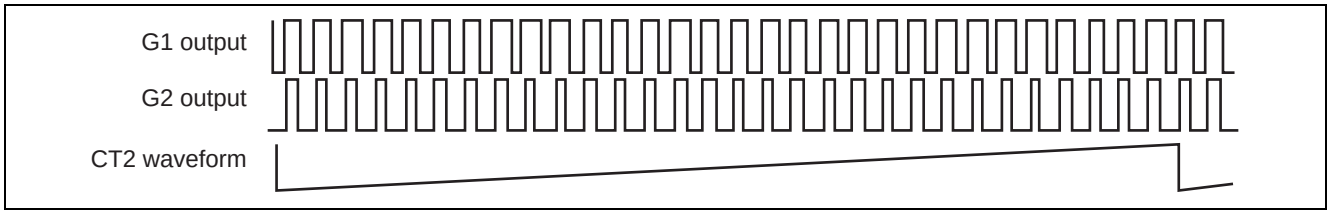


Figure 6 (a) 100% Light Control

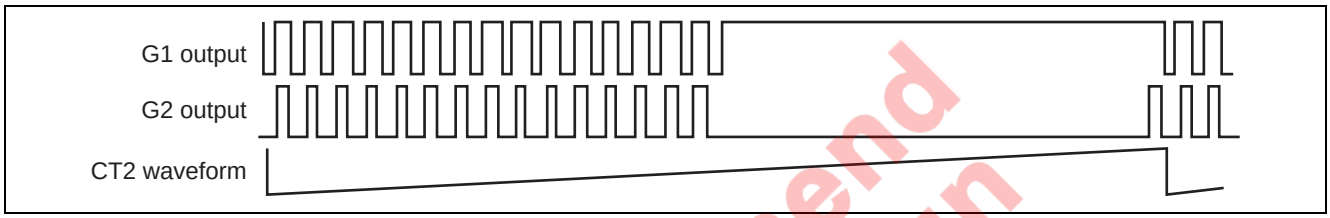


Figure 6 (b) 50% Light Control

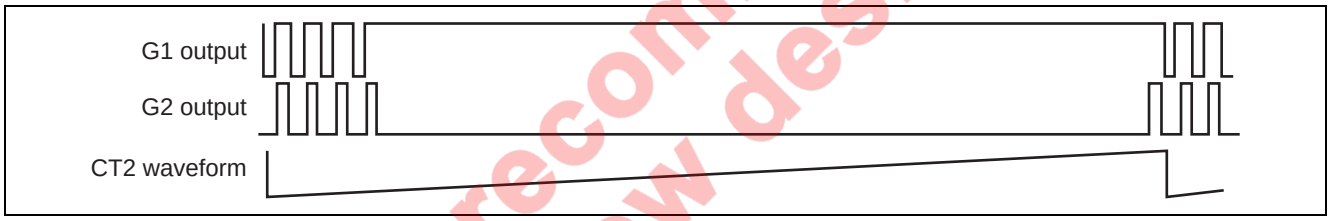


Figure 6 (c) 10% Light Control

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

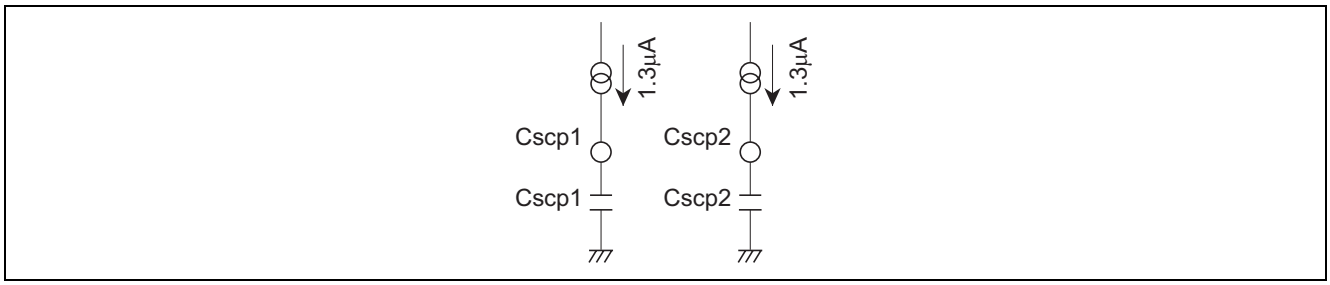


Figure 7 Connections of Cscp1, Cscp2

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)

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

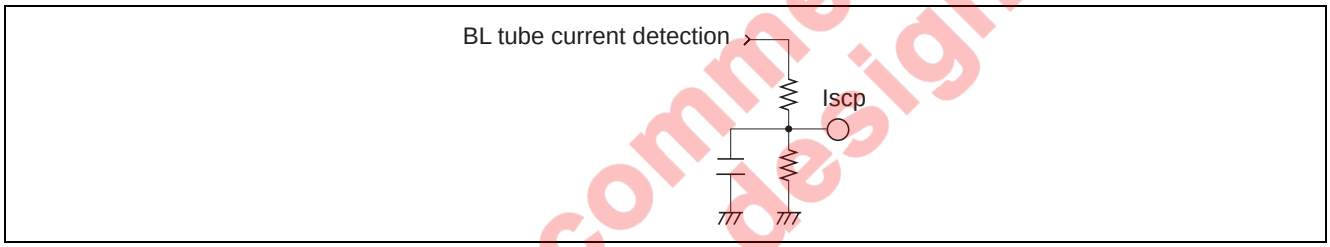


Figure 8 Connections of Iscp Terminal

— 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.

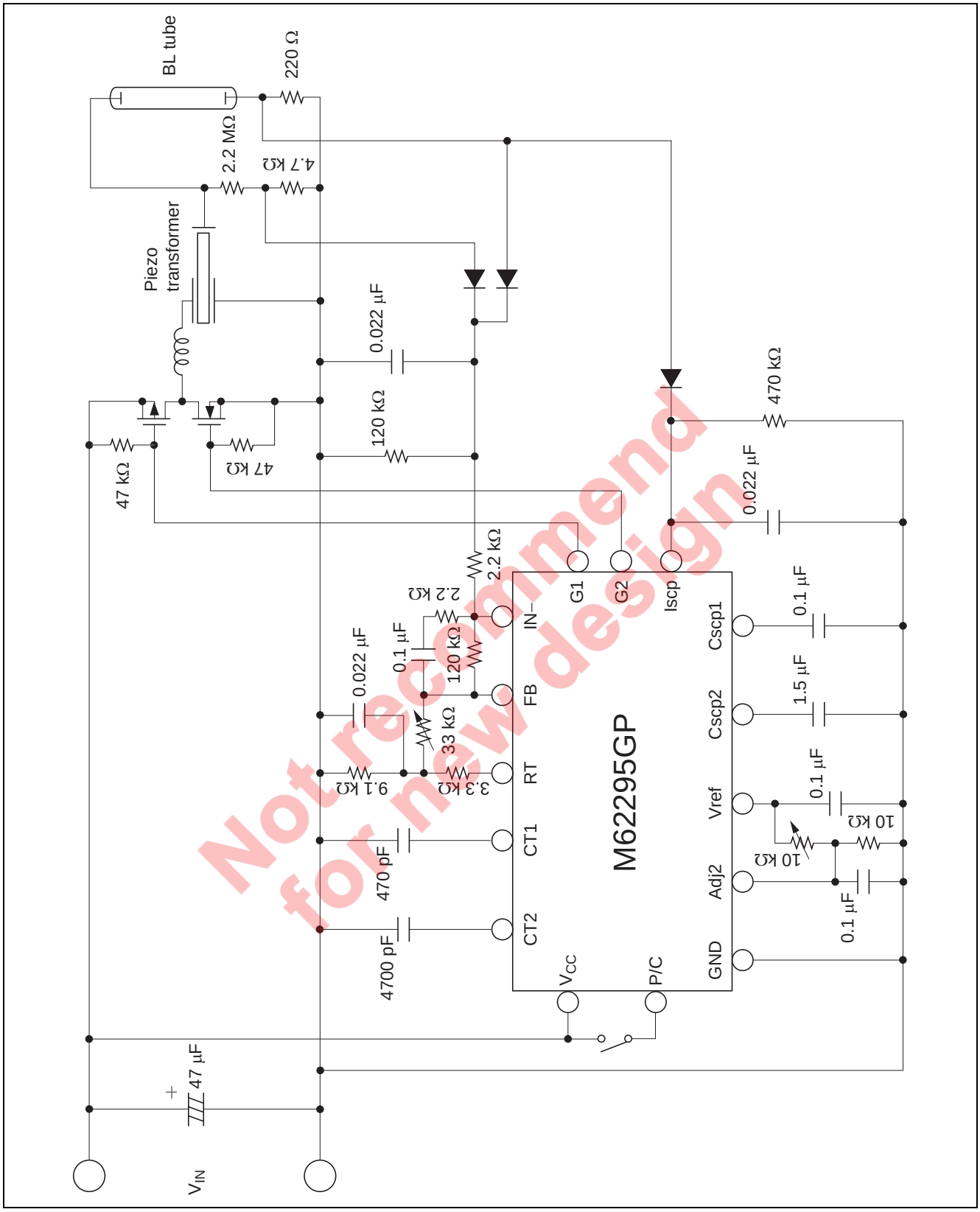
Table 1 Protection Operation Mode at a Glance

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

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

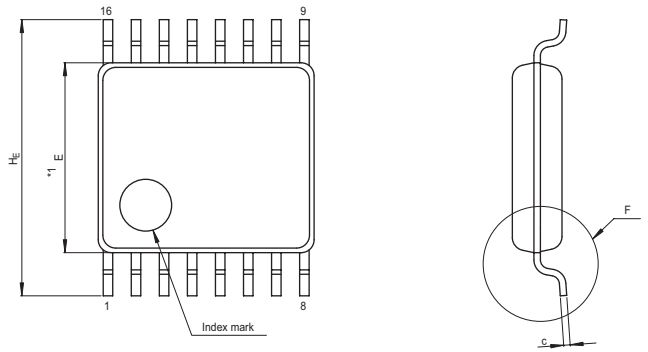
2. Amp. output is "H" when tube current Io equals to 0, "L" when it is at its minimum. Detection voltage is 2.5 V ("H" side), 0.25 V ("L" side).

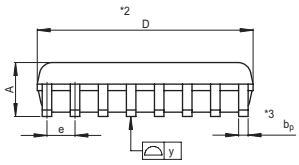
BL Back-light Control Application Example

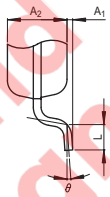


Package Dimensions

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_2	—	1.15	—
A	—	—	1.45
A_1	0	0.1	0.2
b_p	0.17	0.22	0.32
c	0.13	0.15	0.2
θ	0°	—	10°
H_E	6.2	6.4	6.6
e	0.53	0.65	0.77
y	—	—	0.10
L	0.3	0.5	0.7

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