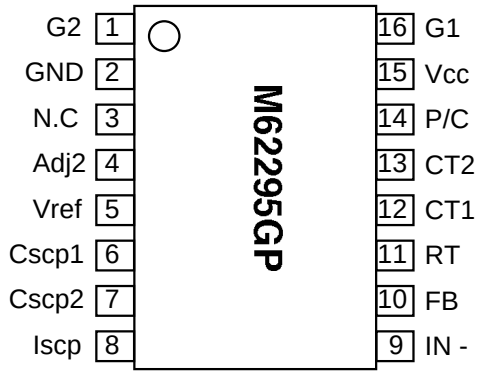
M62295GP

LCD BACK-LIGHT CONTROL IC

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 16pin SSOP package. This allows for simplified peripheral circuit as well as compact and thin set design.

PIN CONFIGURATION (TOP VIEW)



Outline 16P2E-A

N.C : NO CONNECTION

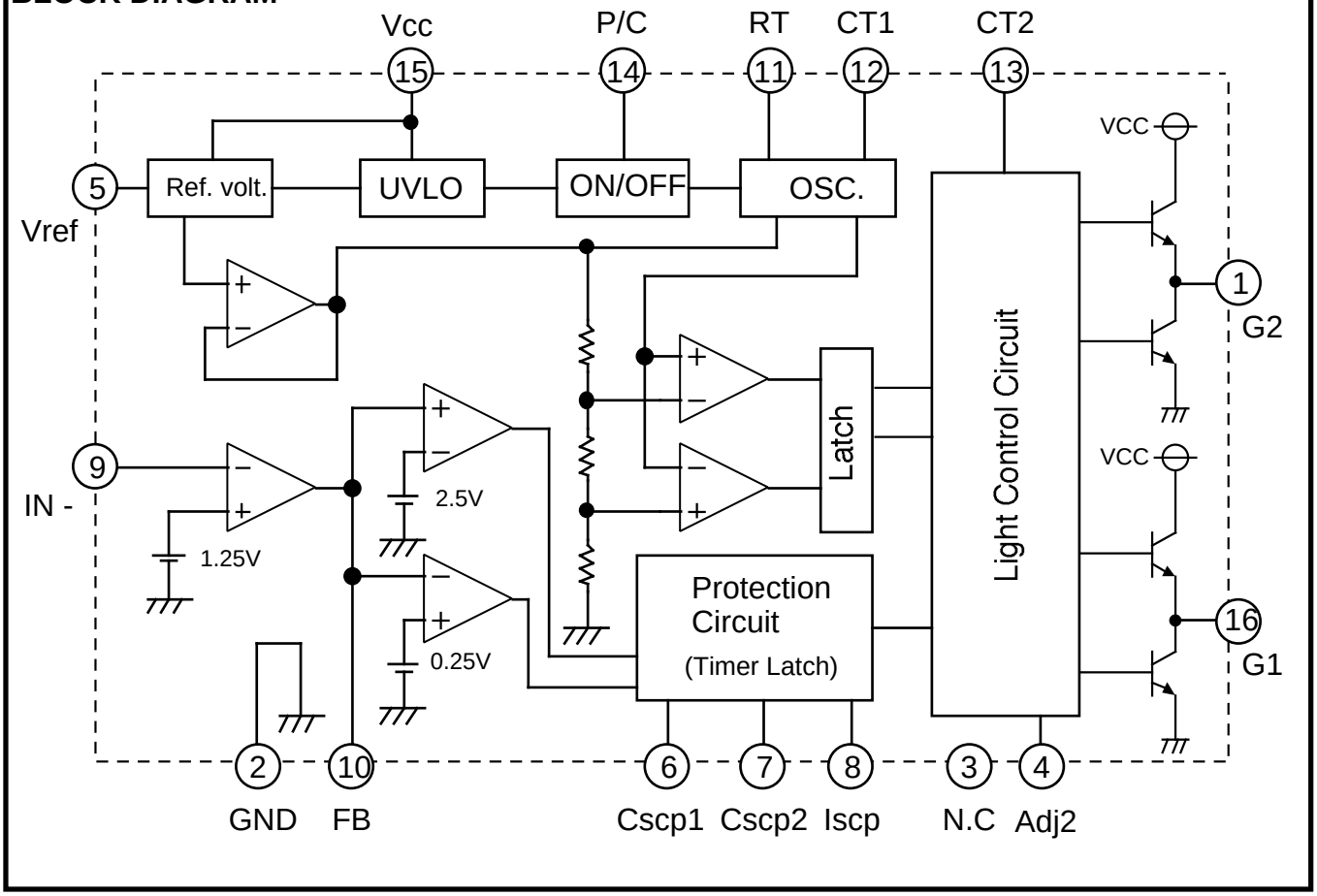
FEATURES

- Direct drive to n-ch/ p-ch MOSFET
- Fixed output duty: 45%
- Output current (peak) : ± 300mA
- Light control
  - Pulse synchronous control
    Output OFF period is adjusted synchronous with the OSC frequency (1kHz-200kHz).
  - 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

- CLD Back-light contorol for Note P.C etc.

BLOCK DIAGRAM



ABSOLUTE MAXIMUM RATINGS (Ta=25°C, unless otherwise noted)

Symbol	Parameter	Conditions	Ratings	Unit
Vcc	Supply voltage		28	V
IOUT	Output current	Continuous	± 50	mA
		Peak	± 300	mA
Pd	Power dissipation	Ta=25°C	400	mW
Topr	Operating temperature		-20 ~ +85	°C
Tstg	Storage temperature		-40 ~ +125	°C

ELECTRICAL CHARACTERISTICS (Ta=25°C, Vcc=15V, unless otherwise noted)

Block	Symbol	Parameter	Test conditions	Limits			Unit
				Min.	Typ.	Max.	
All	Vcc	Operating supply voltage range		3.6		26	V
	Icc	Circuit current		4.5	6	7.5	mA
	Icc(PC)	Circuit current in power control state		15	30	55	µA
UVLO	VTH ON	ON threshold voltage		3.27	3.43	3.59	V
	VTH OFF	OFF threshold voltage			3.36		V
	Vhys	Hysterisis		35	70	140	mV
OP. Amp.	IB	Input bias current		-500	-30		nA
	AV	Open loop gain			80		dB
	GB	Gain bandwidth product			0.6		MHz
	VFB+	Max. output voltage		2.65	2.8		V
	VFB-	Min. output voltage			100	200	mV
	IFB+	Max. sink current		1	2		mA
	IFB-	Max. source current		-50	-80		µA
Ref. voltage	VREF	Reference voltage		2.40	2.50	2.60	V
	LINE	Line regulation			5		mV
	Iref(Max)	Max. load current		1	5		mA
OSC.	fosc	Oscillating frequency			100		KHz
	fosc(Max)	Max. oscillating frequency				200	KHz
	VRT	RT termina voltage		1.1	1.25	1.4	V
Light control	VAdj2(Min)	Adj2 voltage at min. duty		2.3	2.4	2.5	V
	Min Duty	Min. duty for light control	VAdj2=Vref	5	10	15	%
	VAdj2(Max)	Adj2 voltage at 100% duty		0.1	0.2	0.3	V
	IAdj2	Adj2 terminal current		-100	-10	+100	nA
	fosc(CT2)	Light control frequency	fosc = 100KHz		1		KHz
Protection	FB VTH(H)	FB terminal H threshold volt.		2.35	2.5	2.65	V
	FB VTH(L)	FB terminal L threshold volt.		0.2	0.25	0.3	V
	Iscp VTH(L)	IscpL detection voltage.		1.1	1.25	1.4	V

ELECTRICAL CHARACTERISTICS (Ta=25°C, Vcc=15V, unless otherwise noted)

Block	Symbol	Parameter	Test conditions	Limits			Unit
				Min.	Typ.	Max.	
Protection	ICSCP1	CSCP1 charge current		-0.8	-1.3	-1.8	µA
	ICSCP2	CSCP2 charge current		-0.8	-1.3	-1.8	µA
	CSCP1VTH	CSCP1 detection voltage		2.35	2.5	2.65	V
	CSCP2VTH	CSCP2 detection voltage		1.1	1.25	1.4	V
	Itimer-L	Circuit current at timer-latch		1.2	2.2	3.2	mA
P/C	IP/C	P/C terminal flow-in current		1	2	4	µA
	VTH(ON)	P/C threshold voltage		0.4	0.7	1.0	V
Output	Duty	Output duty	RT=12.4KΩ, CT1= 470pF	42	45	48	%
	VOL	Output Low voltage			0.05	0.4	V
	VOH	Output High voltage		13.0	13.5		V

Function description

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

As shown in Fig.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. 0.25V) and upper limit (approx. 1.25V) 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. 0.25V) and upper limit (approx. 1.25V).
Each charge current and oscillation frequency is decided by the formula shown below.

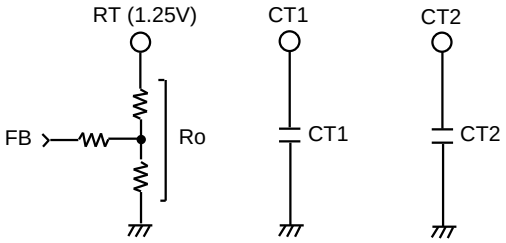


Fig.1 Connections of RT,CT1, CT2

$$\text{CT1 charge/ discharge current (ICT1charge)} = \frac{1.25}{Ro}$$

$$\text{CT2 charge/ discharge current (ICT2charge)} = \frac{1.25}{Ro} * \frac{1}{20}$$

$$\text{Output freq. (Fosc)} = \frac{1}{T} = \frac{1}{CT1 * \frac{2}{ICT1charge}}$$

$$\text{Tooth - wave freq. (CT2osc)} = \frac{1}{CT2 * \frac{1}{ICT2charge}}$$

$$\frac{\text{Tooth - wave freq. (CT2osc)}}{\text{Output freq. (Fosc)}} \text{ (divided ratio)} = \frac{CT1}{CT2 * 10}$$

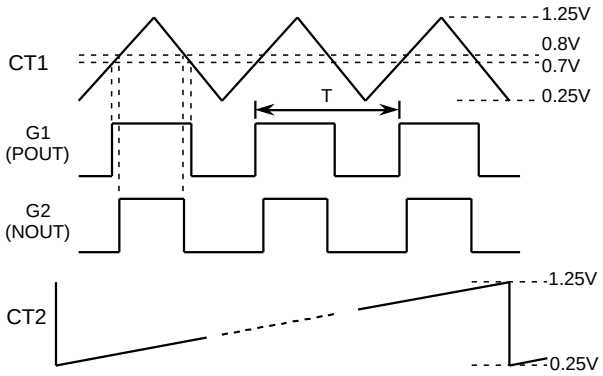


Fig.2 Waveform for CT1, CT2, and G1, G2

• ON/OFF control function (P/C)

ON/OFF control is available using P/C terminal. As shown in Fig.3, ON/OFF control is made by connecting P/C terminal to Vcc or GND or by making P/C terminal open.

P/C = Vcc : IC in normal operation mode

P/C = GND&OPEN : IC operation at halt

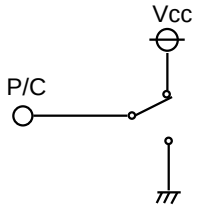
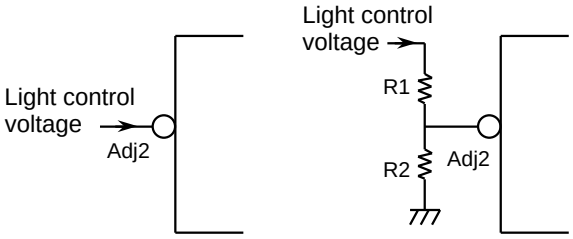


Fig.3 Connection example for P/C

• Light control function (Adj2)

Fig.4 shows the connections of Adj2 terminal.
When the light control voltage is 2.4V 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.
Fig.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 0.1V to 2.4V.
When the voltage is 2.4V or more, light control duty becomes minimum(10%), and when it is 0.1V 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 Fig.6(a) to Fig.6(c). Fig6(a) shows 100% light controlled state, Fig.6(b) middle state (50% light controlled), Fig6(c) minimum duty state.



(a). In the case of direct applying to Adj2 terminal

(b). In the case of applying to Adj2 terminal by the division of resistors

Fig.4 Connections of Adj2 terminal

Formula for light control level by light control voltage

$$ONDuty = (100 - ONDutyMin) * \frac{2.4 - VAdj2}{2.4} + ONDutyMin\ (\%)$$

VAdj2 : Adj2 terminal voltage (V)
ONDutyMin = 10 (%)

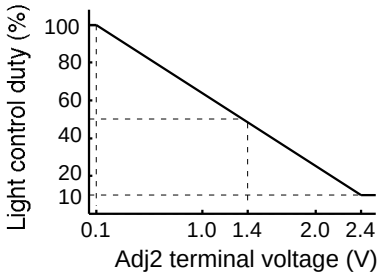


Fig.5 Adj2 terminal voltage-
light control duty characteristics

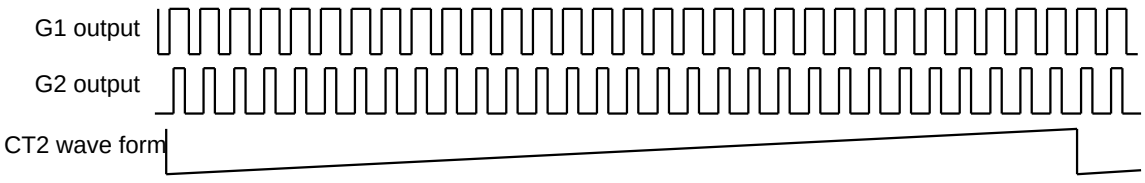


Fig.6(a) 100% light control

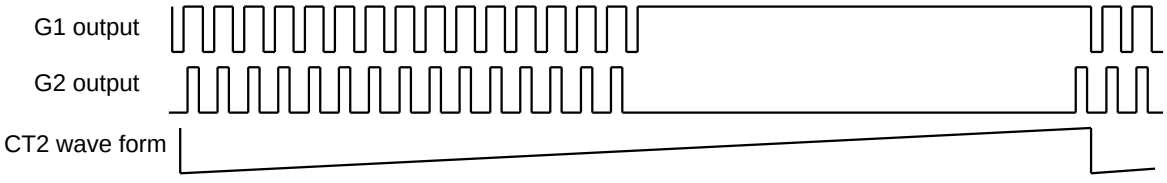


Fig.6(a) 50% light control

Fig.6(a) 10% light control

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

Application for timer-latch by detecting tube current and feecback 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 sec.)

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

Cscp2 :

Terminal for capacitance for timer-latch set (few msec.)

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

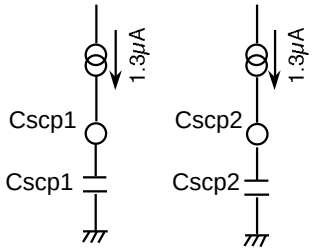


Fig.7 Connections of Cscp1, Cscp2

Detection of tube current

Detection of tube current is made by Iscp terminal.

Detection voltage for Iscp terminal is set 1.25V.

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

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

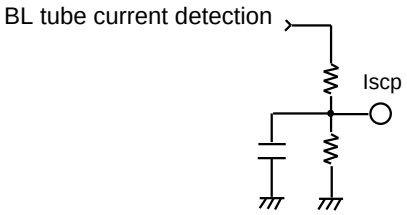


Fig.8 Connections of Iscp terminal

Detection of feedback voltage

Detection of feedback voltage is made by FB terminal.

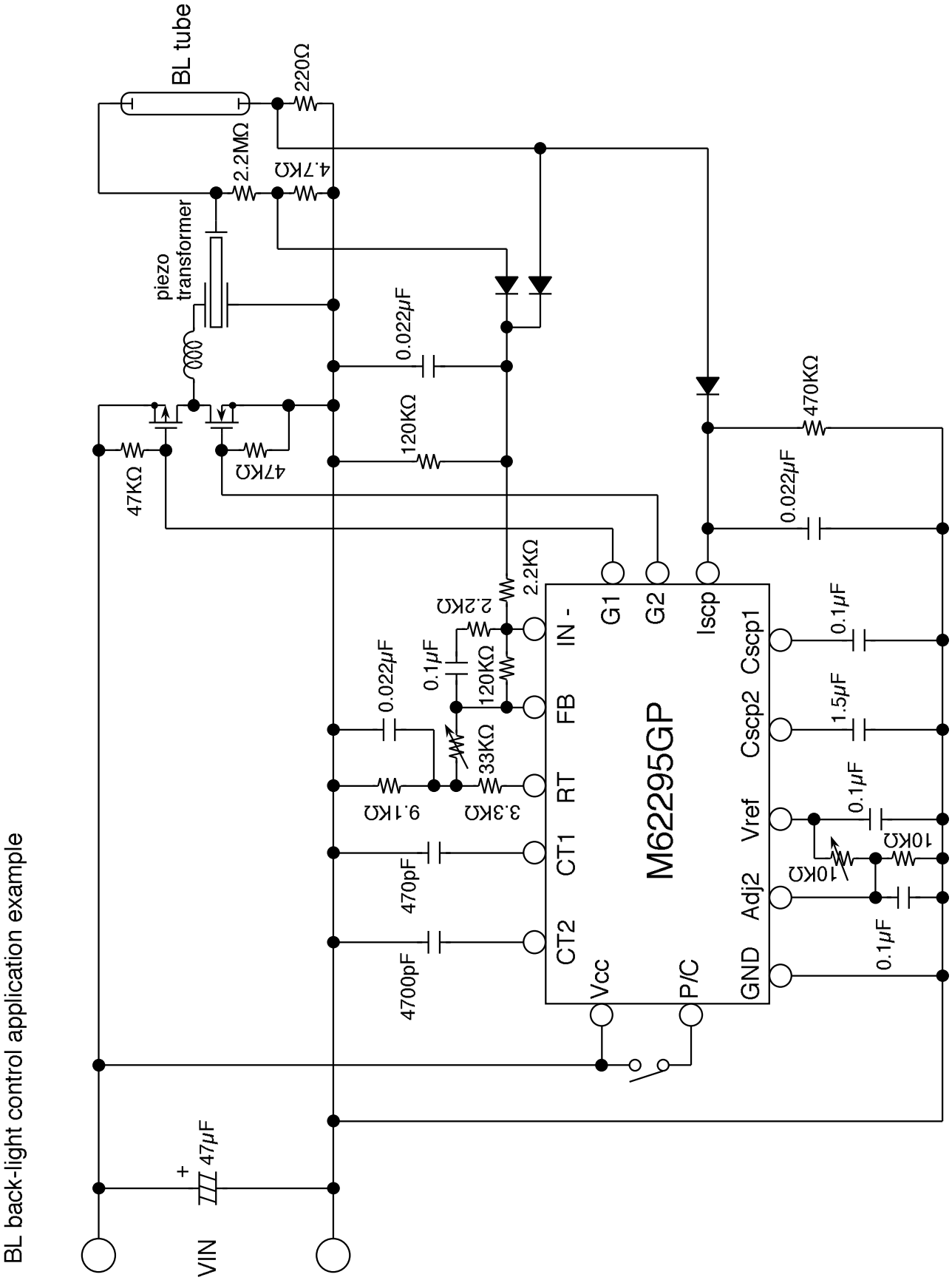
When FB terminal voltage goes down to FB low detection voltage (0.25V) or less, or when it rise up to FB terminal high detection voltage or more, abnormality is detected to move on to the protection operation mode in Fig.1.

Operation state		Protection operation mode	Triggers for protection operation			Timer-latch time	
			Ampout="H"	Ampout="L"	Io=0	2sec	10msec
Normal start-up		———	———	———	———	———	———
Start-up in shortcircuited state	Io=Max	Operation stop after 10ms		○			○
	Io=0	Operation stop instantaneously	○		○		○
Start-up in open state		Operation stop after 2sec.			○	○	
Start-up in black mode	OFF	Operation stop after 2sec.			○	○	
	ON	Normal start-up if turn-on is made within 2sec.			△	○	
Shortcircuit while in operation	Io=Max	Operation stop instantaneously		○			○
	Io=0	Operation stop instantaneously	○		○		○
Open while in operation		Operation stop instantaneously			○		○

Table 1. Protection operation mode at a glance

Note 1. Timer-latch time refers to the time under Cscp=1uF, Cscp2=0.1uF.

2. Amp. output is "H" when tube current I_0 equals to 0, "L" when it is at its minimum. Detection voltage is 2.5V("H" side), 0.25V("L" side).


BL back-light control application example
BL tube
220Ω
2.2MΩ
4.7KΩ
piezo transformer
0.022μF
120KΩ
47KΩ
47KΩ
470KΩ
0.022μF
2.2KΩ
2.2KΩ
0.1μF
120KΩ
0.022μF
33KΩ
9.1KΩ
3.3KΩ
470pF
4700pF
47μF
VIN
M62295GP
IN -
FB
RT
CT1
CT2
Vcc
G1
G2
Iscp
Cscp1
Cscp2
Vref
Adj2
GND
P/C
0.1μF
1.5μF
0.1μF
10KΩ
10KΩ
0.1μF