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Modified Energy Efficient Compact Fluorescent Lamp

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Abstract: ***In the current electricity demand, the usage of normal bulbs extensively consumes more power for the usage. India being a moderate country of power generation of about 335 GW, it would be very efficient to replace normal bulbs by CFL bulbs. This paper deals with reduction of electronic waste by replacing blow out cflinplace of tube light choke. CFLs can be screwed into the same sockets as other light bulbs and provide very comparable lighting. One of the greatest benefits of compact fluorescent light bulbs is energy efficiency. A CFL uses 50 to 80 percent less energy than other light bulbs.***

Kewords: This, cflinplace, CFLs, efficiency. about 335, GW, India

I. INTRODUCTION

CFL bulbs utilise quarter the consumption of electricity than a normal bulb. It contains a small amount of mercury in vapour form that is primarily used to produce light. The inner colour coating of the glass makes it light variant products. Usually, about 5 milligrams is used to manufacture a CFL bulb, which is quite low on the scale compared to other bulbs.

The compact fluorescent lamp is energy conserving, occupies lesser space, and holds the design so as to replace incandescent lamp [1]. The base of the lamp is of compact electronic equilibrium and a tube to fit as the lamp's body [2-4].When compared to incandescent lamps, CFL bulb reduces the electric consumption by 4 times and has the capability to last long for about fifteen times the incandescent lamps [5-7].Though CFL bulbs have higher initial cost price, it can save over 5 times the value in electricity consumption. The working of CFL remains same as other fluorescent lights, except the fact that it radiates a different spectral power with better phosphor formulations.

II. DESIGN AND OPERATION OF PROPOSED CFL BULBS

CFL bulbs are categorised into two types – integrated, non–integrated. Integrated lamps contains a combination of ballast and tube in a single module. Integrated lamps fit into the same standard fixture of incandescent lamps. Non-integrated design has permanently fixed ballast, replacement of lamps only at life exhaust[8-9].They are longer in life, little more expensive and sophisticated than integrated ones. Two types of tubes include bi-pin with integrated starter and quad-pin. The two major components of a CFL bulb include electronic or magnetic ballast and one gas bulb (tube). The ballast consists of small circuit panel including bridge rectifiers, switching transistors and filter capacitors. The supply AC current converted to DC and frequency is increased when inverted to AC again. The lamp tube is supplied with high frequency. The light output of the CFL is proportional to surface area of phosphor composition.

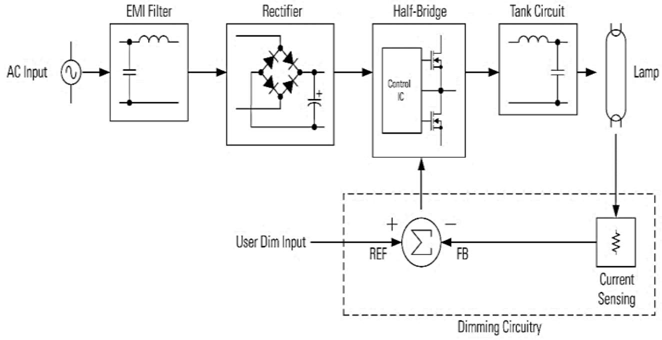

Fig 1: CFL electronic ballast block diagram

Hence some CFLs are not suitable for pendant sized lamps.CFL electronic ballast block diagram illustrated in figure 1.

The diagram includes AC input line voltage, generally 120VAC/60 Hz, EMI filter to avoid switching noise generated by the circuit , rectifier and capacitor, half-bridge inverter , resonant tank, feedback circuit for dimming applications.the operational timing diagram are illustated in figure 2.

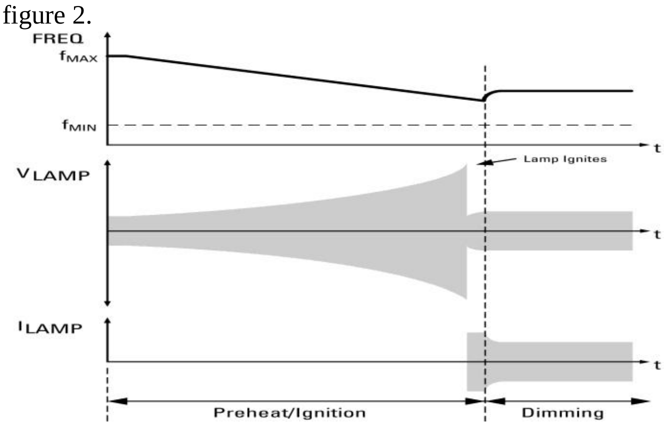

Fig. 2: Operational timing diagram

The lamp is provided with current to preheat the filaments, ignited by a high voltage, AC current with high frequency at running condition. At pre-ignition, series LC network as a resonant tank with higher Q factor is active. At running condition, series L and parallel-RC network with moderate Q factor is active. When the lamp voltage increases, frequency becomes high, and the lamp is ignited.

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The current to the lamp is controlled for various brightness levels, assisted by the feedback network and adjusting the operation of half-bridge frequency. The IC IRS2530D Dimming Control includes feedback control, functions of pre-heating and lamp ignition. The dimming of the lamp is brought out by measurement of AC current with reference DC voltage by coupling sensing resistor through CFB feedback capacitor and RFB resistor. Operational timing diagram and 3-way dimming CFL circuit diagram are demonstrated in figure 3.

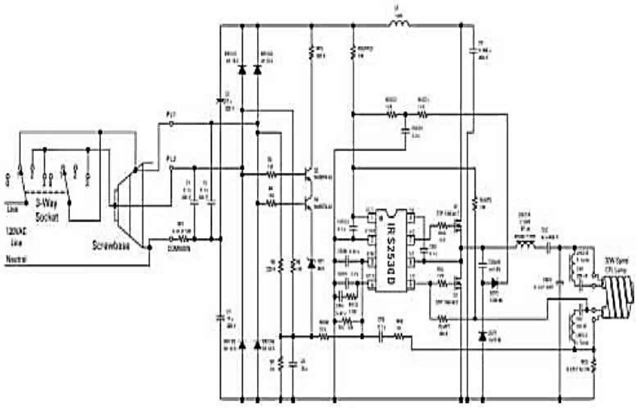


Fig 3: 3-way dimming CFL circuit

The regulation of AC and DC signal for COM is done by the feedback circuit, by adjusting the frequency of half bridge circuit, level of DC dimming is increased and decreased. The increase in DC reference will proportionally increase current in the lamp, also the amplitude of AC+DC signal in the DIM node, and vice versa happens when decreased. Three way dimming method is used for 3-way sockets. It consists of two filaments and a pair of connection to base of lamp screw. The following three waveforms show current in the lamp at every brightness setting. Figure 4 shows the Non-integrated bi-pin double turn CFL.

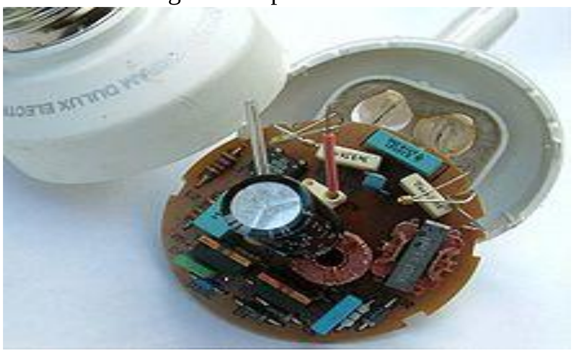
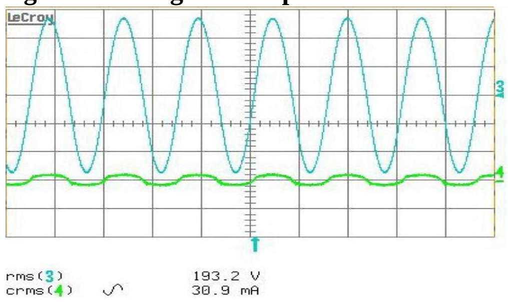


Fig.4. Non-integrated bi-pin double turn CFL



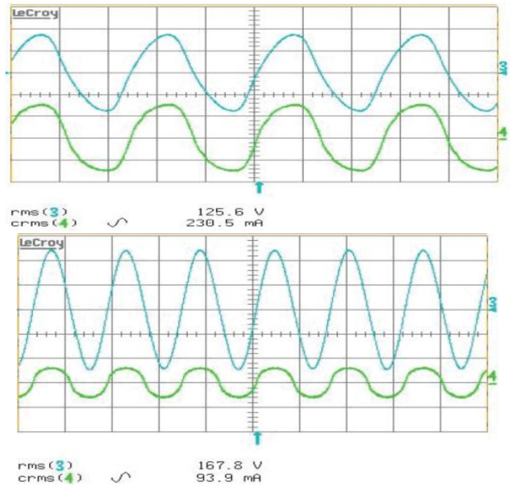


Fig 5: IRS2530D AC+DC dimming control method

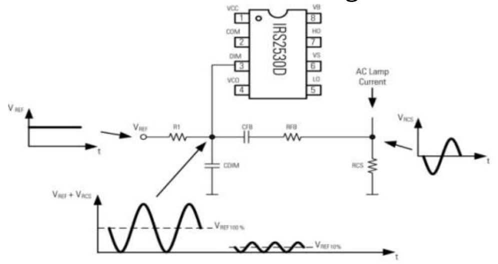


Fig.6: Lamp voltage

The position of first socket is off, no other filaments are in connection, second one connects with the first filament through AC , for low illumination and the third and fourth filament connects for moderate and high brightness respectively. The voltage doubler circuit and the rectifier (D1,D2,D3,D4,C3,C4), resonant tank, lamp-current feedback and sensing circuit, half bridge control network, MOSFETs (IRS2530D, Q1 and Q2), 3-way interfacing circuit (R3,R4,R5,R6, R7, RPU, Q3, Q4, DZ1 and C5).When a change is detected in every dim setting, change of voltage at two input screw bases (PL1 & PL2) is done by resistor voltage divider circuit (R5,R6 & R7).The dimming setting function at each set holds different CFL applications. The control loop required for regulating lamp current is primarily same. The dimming design lays simple for the IRS2530D, enabling easy CFL functions, hence being a good competitor to incandescent bulbs in form factor and also economical.IRS2530D AC+DC dimming control method and lamp voltage are illustrated in figure 5 and 6 respectively.

III. HARDWARE RESULTS AND DISCUSSION

Most of the defective CFL lamps are still useable when only the bulb is defected are shown in figure 7.. Hence the circuit is used for replacement of two florescent tube light.

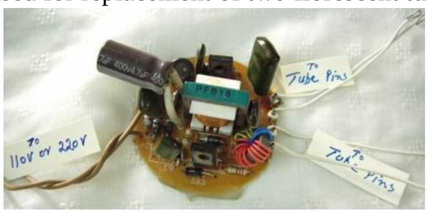


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Fig.7: Proposed Efficient CFL Diagram

Fig.8: Step by step implementation of proposed efficient CFL

After disassembling, the electronic module is taken from it. Multimeter is used to check the connectivity. An easy process to utilize CFL to reproduce CLL (Compact LED Lamp). The ballast is removed and electrodes are carefully removed from the glass tube and the choke. Arrange LEDs according to the length of the exhausted CFL and carefully soldered. The bridge rectifier is used to improve life and the circuit is closed and AC supply is given. Production of greenhouse gases is minimised when compared to analysis of heat produced on the illumination of incandescent bulbs. Since CFL bulbs consumes lesser power , usage of power production for illumination is reduced .Though CFL contains a small amount of mercury (about 4-5 milligrams) , it doesn't cause any harm to the surrounding at times of breakage as most of it bound to the lamp and about 1.4mg is broken out.

This will not cause much danger to the area of exposure. Step by step implementation of proposed efficient CFL are demonstrated in figure 8.

A good product for energy conservation. Higher usage of CFL will reduce emissions of Carbon dioxide. LED incorporated CFLs totally reduces the risk of mercury. At consumers side, find a nearest return centre and handover the bulbs. For consumers who could not locate the centre can mail RECYCLEABULB.COM for assistance.

Table 1: Comparison of propoesd cfl with other bulbs

Comparison							
	Incandescent	Halogen	Fluorescent	LED (Generic)	LED (Philips)	LED (Philips L Prize)	LED Daylight (TCP)
Electrical power (W)	60	42	14	10	12.5	9.7	9.8
Light output (lm)	860	650	800	800	800	910	950
Luminous efficacy (lm/W)	14.3	14.42	57.14	80	64	93.4	96.94
Color temperature (K)	2700	3100[96]	2700	3000	2700	2727	5000
CRI	100	100	>75	>85	85	93	not listed
Lifespan (h)	1,000	2,500	8,000	25,000	25,000	30,000	25,000

Betterment in lessening the usage of mercury, making the bulb more efficient contributes a good share to the industry. The collection of bulbs by the recycling program has also been successful. Stay updated with information in various languages through websites, centres and other media. To avoid confusion among consumers, consistent advice is developed.CFL giveaways awareness programmes have to be adopted. Safe clean-up activities have to be taken over. Collaboration with research developers and lighting industries is appreciated for trash processing and other issues.

IV. CONCLUSION

The modified efficient fluorescent lamp minimises the overall e-waste and promotes energy conservation, being less power consuming and eco-friendly in nature. Also, the amount of mercury was not harmful for the environment and the human body in the project.

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