Development of Multimedia CRTs Using Low-Voltage-Drive Electron Guns

OKUDA Soichiro, SHIROISHI Tetsuya, and NAKATA Shuhei
Advanced Technology R&D Center, Mitsubishi Electric Corporation
8-1-1 Tsukaguchi-Honmachi, Amagasaki, Hyogo, 661-8661, Japan
Phone: +81-6-6497-7707, E-mail: Okuda.Soichiro@wrc.melco.co.jp

OONO Katsumi, MURAKAMI Fumiaki, and ITOH Hideya
Display Devices Works, Mitsubishi Electric Corporation
1 Baba-Zusho, Nagaoka-kyo, Kyoto, 617-0828, Japan

Abstract

Mitsubishi Electric Corporation has marketed a series of multimedia CRTs enabling bright picture windows in a high-resolution date display screen. The key components of the multimedia CRTs named Diamondtron M² are a high-gm (low drive-voltage) electron gun and an aperture grille mask. A high-gm electron gun has been developed by designing a beam forming region with high-gm configuration combining with a high current-density cathode. The development of next generation high-gm guns are also introduced

1. Introduction

CRTs have been dominating the display market due to the low cost and high performance features. CRTs will keep to dominate in TV applications of natural and moving picture, since they have excellent performance of high peak brightness and quick response time.

On the other hand, CRTs are losing market in the data display applications due to the improved performance and price reduction of TFT-LCDs. In order to compete with TFT-LCDs, CRTs have to claim the features in natural and moving picture even in the data display applications. Fortunately, there arises the demand of multimedia applications such as watching movies from DVD installed in the computer, and delivering product catalogues through internets.

The difficulty in displaying TV pictures in data display tubes lies in driving the electron gun by high frequency signals. The solution would be developing a high-gm electron gun that operates with lower drive-voltage. Although there have been several trials for inventing a high-gm guns, they have not been put into product, because the high-gm performance contradicts the focus performance in general.

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We have succeeded in developing a high-gm electron gun with comparable focus performance. By using this high-gm gun, Mitsubishi Electric Corporation marketed 17-in., 19-in., and 22-in. multimedia CRTs.

In this paper we will describe our series of multimedia CRTs and high-gm guns and aperture grille considerations for realizing them. The development for the next generations will also be discussed.

2. High-gm Electron Gun

A high-gm performance was achieved by modifying the dimensions of the electrodes in the beam-forming region [1]. By reducing the cut-off voltage, the gm, i.e. the sensitivity of the emission current by the driving voltage increases. The focus degradation by decreasing cut-off voltage was compensated by reducing the G1 diameter.

A tungsten-film coated oxide cathode [2] with high current density ability was applied to this high-gm electron gun for enduring the increased cathode loading.

Another issue in multimedia application is how to suppress the leakage current caused by increasing the beam current. The leakage current was suppressed by decreasing the beam divergence angle, and optimizing the dimensions of grid electrodes.

3. Aperture Grille Mask

Since Diamondtron CRTs uses aperture grille for the mask, they are basically free from doming. However, the local doming effect by a high-brightness picture should be examined for multimedia applications. The amount of doming caused by a partial bright area was measured for various local patterns and with increased beam current. The experimental result showed that the amount of doming is acceptable levels.

Another local high current test was conducted to examine if there is the vibration due to the tension relaxation of grille caused by local thermal expansion. The experiment showed no vibration in the designed current region.

4. Current Products

By using the developed high-gm guns and aperture grille mask, Mitsubishi Electric Corporation marketed a series of Diamondtron M^2 tubes for multimedia applications. The first 17-in. M^2 tube was marketed in April 2001. This tube is the first multimedia tube with peak brightness 300cd/m^2.

Following to 17-in., a 19-in. tube was marketed in August 2001, a 22-in. tube in December 2001, which completed the series of multimedia monitor tubes.

For increasing the peak brightness, further development was conducted on high-gm electron guns and aperture-grille masks. In April 2002, we have succeeded to develop the 17-in. tube with peak brightness 500 cd/m^2. This peak brightness was realized by optimizing the dimensions of gun electrodes, including the aperture of G1. The drive voltage characteristics of this new M^2 gun is shown in Fig.1, compared with the conventional and the first M^2 gun.

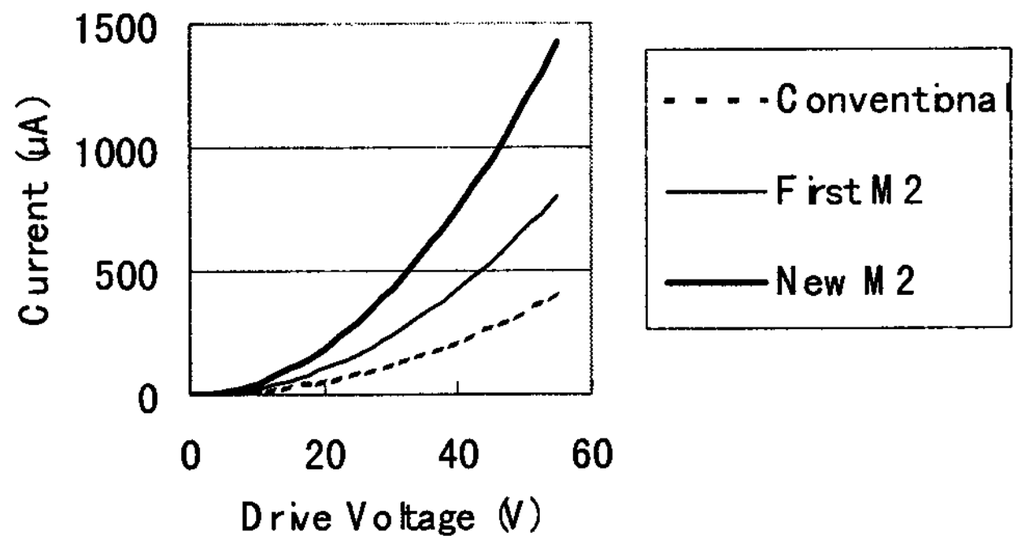

Figure 1 Current versus drive-voltage of hi-gm guns compared with conventional gun

The specifications of 17-in. and 19-in. Diamondtron M^2 tubes are summarized in Table1.

Table 1 Specifications of 17-in. and 19-in. Diamondtron M2 tubes

	NF17	NF19
Panel	Natural Flat	Natural Flat
Peak Brightness	500 cd/cm2	250 cd/cm2
Pixel Pitch	0.25mm	0.25-0.27mm
Anode Voltage	25kV	25kV

5. Next Generations

Next generation of multimedia tubes require higher gm (higher current sensitivity of drive voltage) electron guns.

We developed a higher-gm gun by shielding the low-level emission current with triode electrodes [3]. For increasing the gm, we also developed another scheme of driving the electron guns [4].

By applying the newly developed high-gm guns, next generation M2 tubes will be developed and let us enjoy the high quality high resolution pictures.

6. References

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