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(54) **DRIVING METHOD AND DRIVING CHIP FOR ORGANIC LIGHT-EMITTING DISPLAY PANEL, AND DISPLAY DEVICE**

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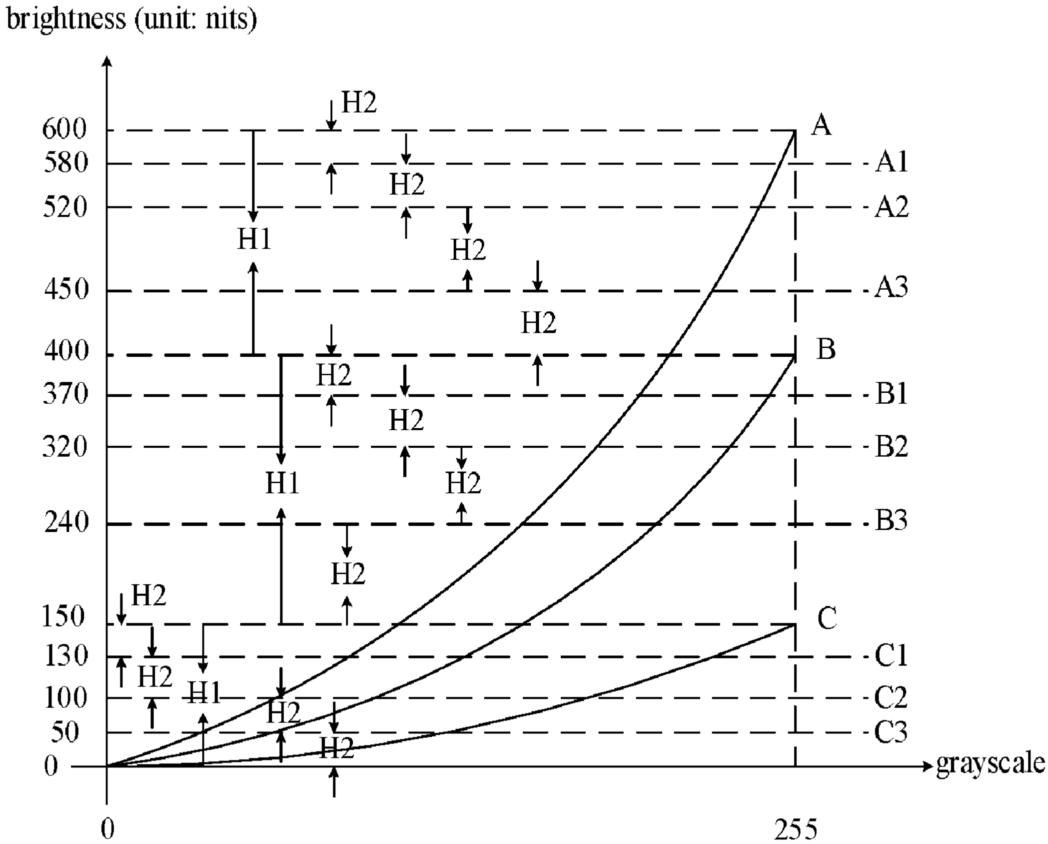
(57) **ABSTRACT**

A driving method and a driving chip for an organic light-emitting display panel, and a display device are provided. The method includes: acquiring a target brightness; determining a rank corresponding to the target brightness, each rank including a first brightness range, and the first brightness ranges being different and having no overlapping, the first brightness range including the target brightness, and each rank having a Gamma curve corresponding to a maximum brightness of the first brightness range in the rank, determining, in the rank, a duty ratio corresponding to the target brightness, the duty ratio being an effective pulse duty ratio of a light-emitting control signal, and the maximum brightness of the first brightness range in each rank corresponding to a same duty ratio; and driving the organic light-emitting display panel based on the Gamma curve and the duty ratio corresponding to the target brightness in the rank.



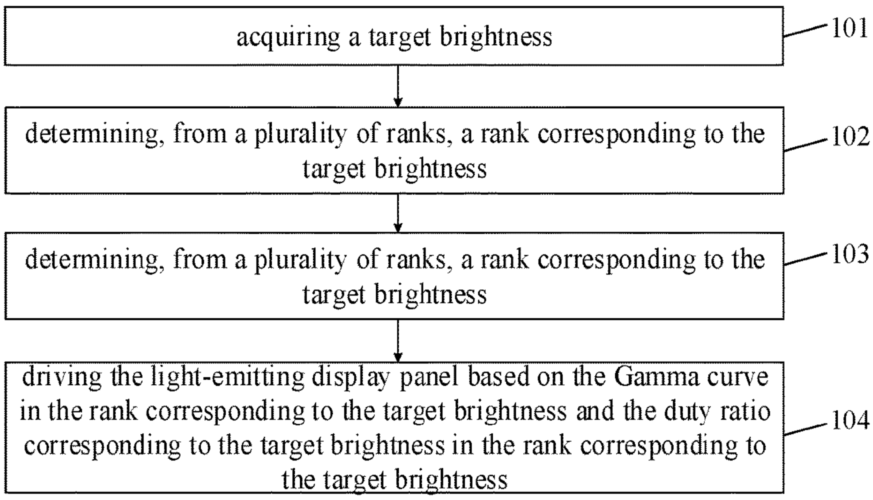

acquiring a target brightness
101
determining, from a plurality of ranks, a rank corresponding to the target brightness
102
determining, from a plurality of ranks, a rank corresponding to the target brightness
103
driving the light-emitting display panel based on the Gamma curve in the rank corresponding to the target brightness and the duty ratio corresponding to the target brightness in the rank corresponding to the target brightness
104

FIG. 1

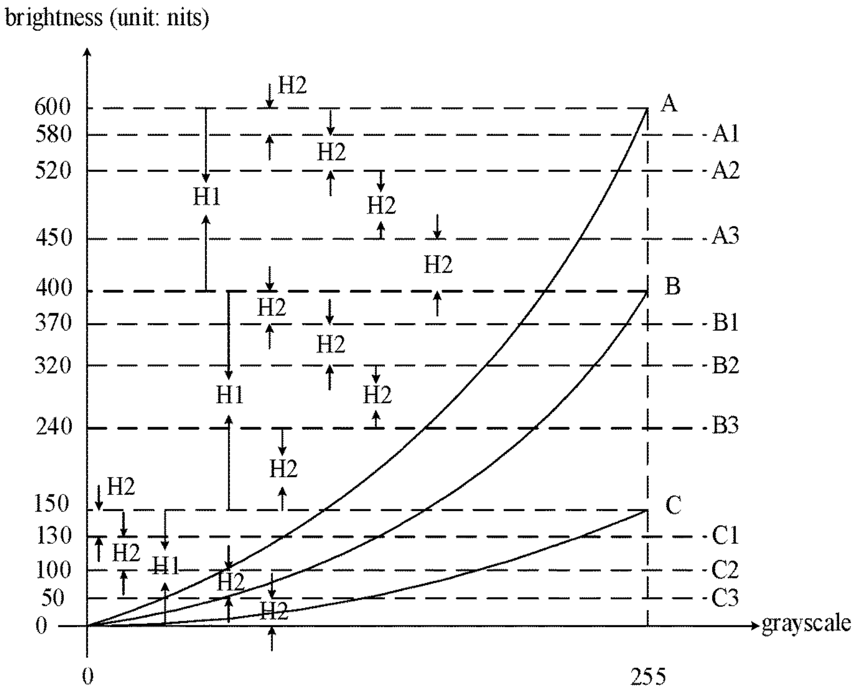

brightness (unit: nits)
600
580
520
450
400
370
320
240
150
130
100
50
0
A
A1
A2
A3
B
B1
B2
B3
C
C1
C2
C3
H1
H2
grayscale
0
255

FIG. 2

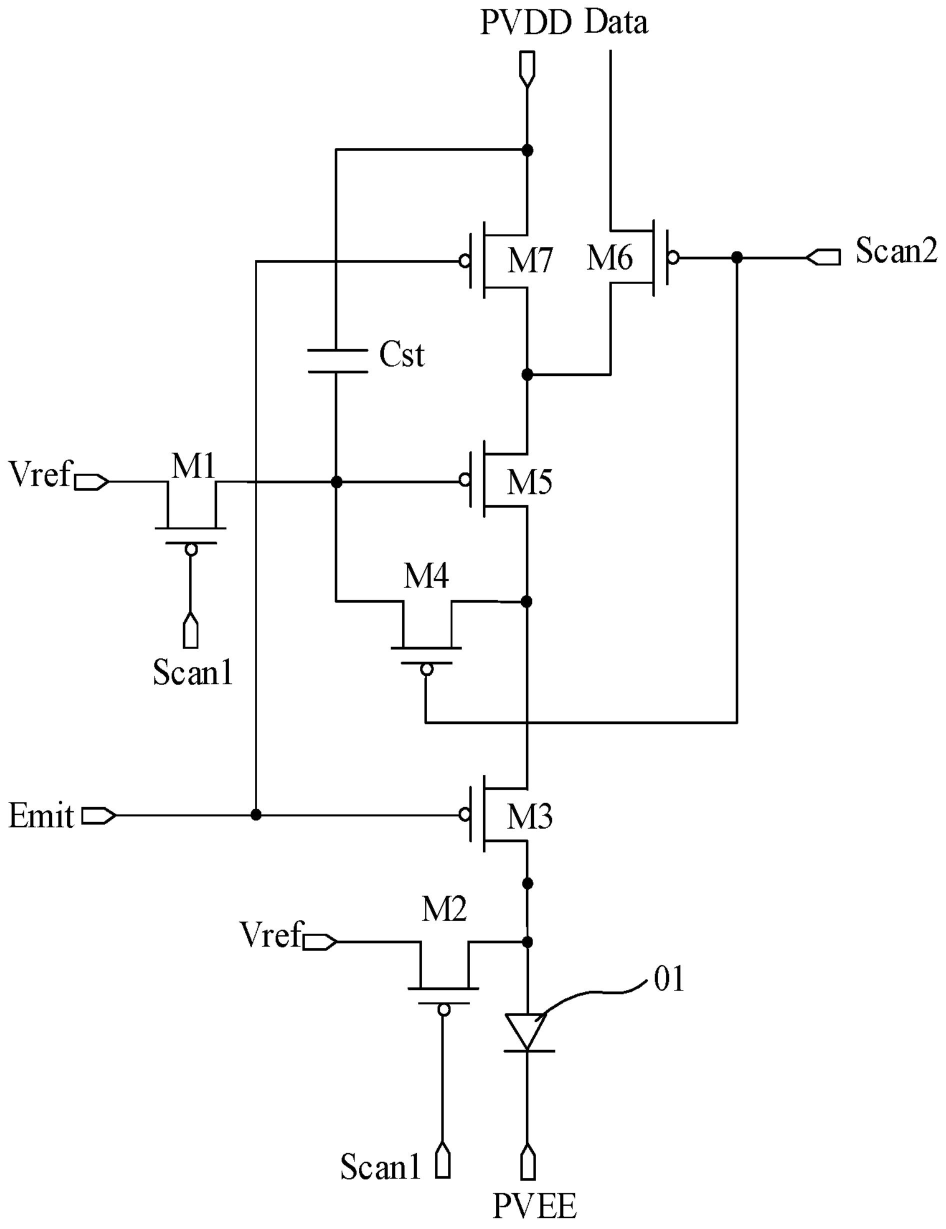

PVDD
Data
M7
M6
Scan2
Cst
Vref
M1
M5
M4
Scan1
Emit
M3
M2
Vref
01
Scan1
PVEE

FIG. 3

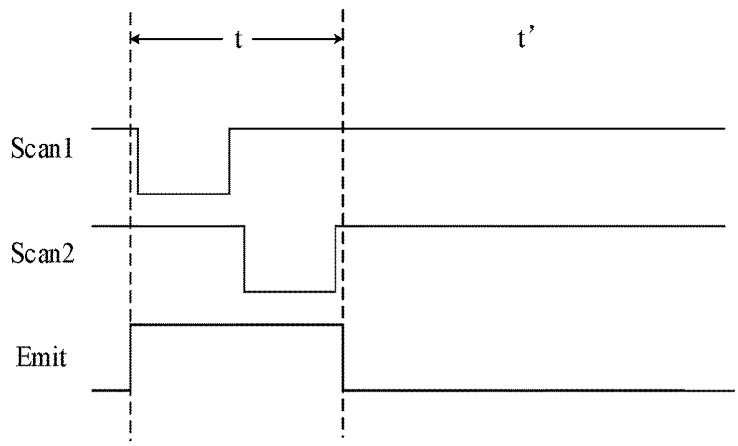

t
t'
Scan1
Scan2
Emit

FIG. 4

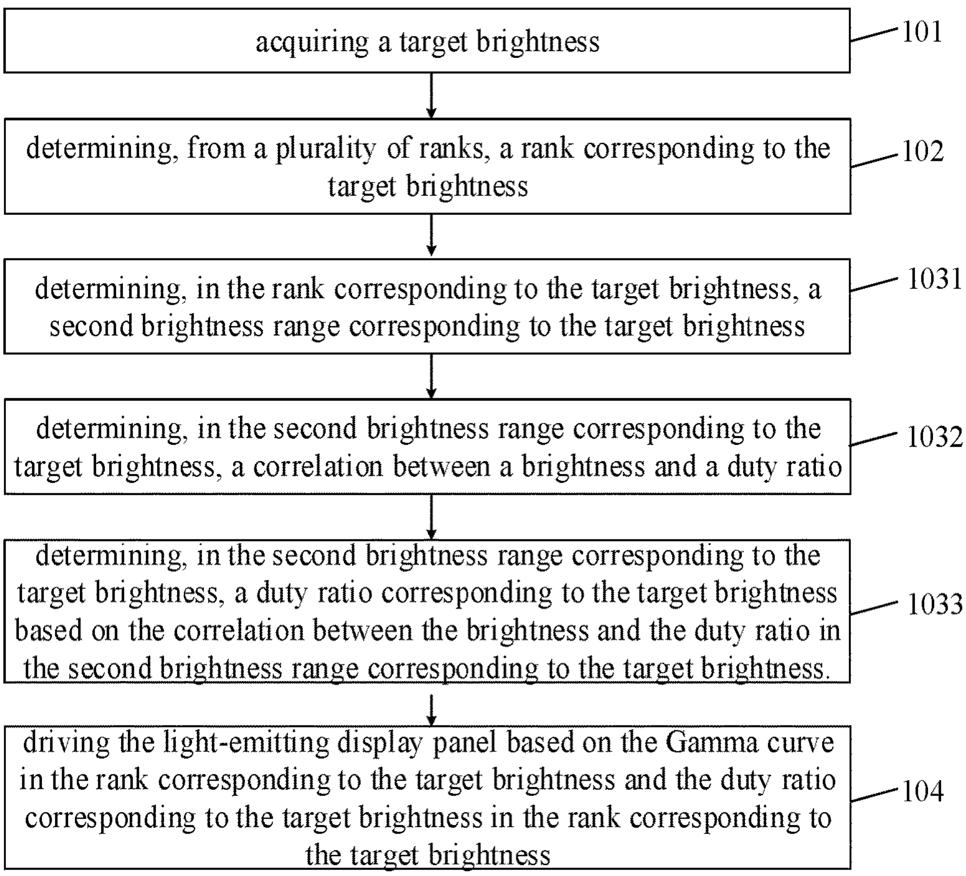

acquiring a target brightness
101
determining, from a plurality of ranks, a rank corresponding to the target brightness
102
determining, in the rank corresponding to the target brightness, a second brightness range corresponding to the target brightness
1031
determining, in the second brightness range corresponding to the target brightness, a correlation between a brightness and a duty ratio
1032
determining, in the second brightness range corresponding to the target brightness, a duty ratio corresponding to the target brightness based on the correlation between the brightness and the duty ratio in the second brightness range corresponding to the target brightness.
1033
driving the light-emitting display panel based on the Gamma curve in the rank corresponding to the target brightness and the duty ratio corresponding to the target brightness in the rank corresponding to the target brightness
104

FIG. 5

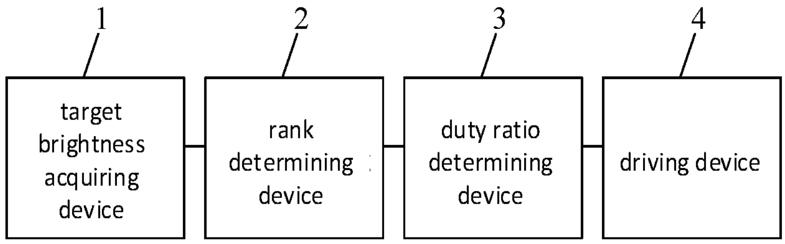


FIG. 6

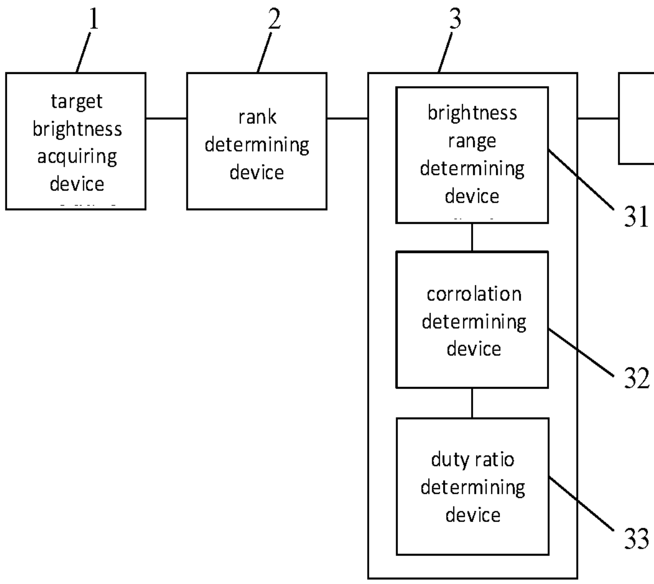


FIG. 7

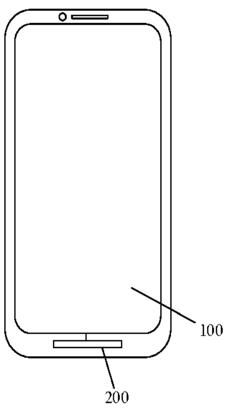


FIG. 8

DRIVING METHOD AND DRIVING CHIP FOR ORGANIC LIGHT-EMITTING DISPLAY PANEL, AND DISPLAY DEVICE

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] The present application claims priority to Chinese Patent Application No. 201811130640.9, filed on Sep. 27, 2018, the content of which is incorporated herein by reference in its entirety.

FIELD

[0002] The present disclosure relates to the field of display technologies, and in particular, to a driving method for an organic light-emitting display panel, a driving chip for an organic light-emitting display panel, and a display device.

BACKGROUND

[0003] At present, display technologies have been applied to every aspect of people's daily life, and accordingly, more and more materials and technologies have been used for display screens. Today, display screens mainly include liquid crystal display panels and organic light-emitting display panels. The organic light-emitting display panel has more and more applications due to its high color saturation, high brightness, high contrast, fast response, and small thickness and the like. In order to make the displayed image to be better adapted to human visual feelings, it is necessary to correct the image according to Gamma curve.

[0004] However, the Gamma curve is a curve within a specific brightness range. After adjusting brightness of an organic light-emitting display panel, the displayed image will deviate from a preset Gamma curve, resulting in poor brightness adjustment.

SUMMARY

[0005] The present disclosure provides a driving method for an organic light-emitting display panel, a driving chip for an organic light-emitting display panel, and a display device, for improving the brightness adjustment.

[0006] In one embodiment, the present provides a driving method for an organic light-emitting display panel, and the driving method includes: acquiring a target brightness; determining a rank, from a plurality of ranks, corresponding to the target brightness, and each of the plurality of ranks includes a first brightness range, and the first brightness ranges of any two ranks of the plurality of ranks are different from each other and have no overlapping, the first brightness range of the rank corresponding to the target brightness includes the target brightness, and each of the plurality of ranks has a Gamma curve corresponding to a maximum brightness of the first brightness range of the rank, determining, in the rank corresponding to the target brightness, a duty ratio corresponding to the target brightness, and the duty ratio is an effective pulse duty ratio of a light-emitting control signal, and the maximum brightness of the first brightness range of each of the plurality of ranks corresponds to a same duty ratio; and driving the organic light-emitting display panel based on the Gamma curve of the rank corresponding to the target brightness and the duty ratio corresponding to the target brightness in the rank corresponding to the target brightness.

[0007] In another embodiment, the present disclosure provides a driving chip, and the driving chip includes: a target brightness acquiring device configured to acquire a target brightness; a rank determining device configured to determine a rank corresponding to the target brightness from a plurality of ranks, and each of the plurality of ranks includes a first brightness range, the first brightness ranges of any two ranks of the plurality of ranks are different from each other and have no overlapping, the first brightness range of the rank corresponding to the target brightness includes the target brightness, each of the plurality of ranks has a Gamma curve corresponding to a maximum brightness of the first brightness range of the rank; a duty ratio determining device configured to determine a duty ratio corresponding to the target brightness in the rank corresponding to the target brightness, and the duty ratio is an effective pulse duty ratio of a light-emitting control signal, and the maximum brightness of the first brightness range in each of the plurality of ranks corresponds to a same duty ratio; and a driving device configured to drive the organic light-emitting display panel based on the Gamma curve of the rank corresponding to the target brightness and the duty ratio corresponding to the target brightness in the rank corresponding to the target brightness.

[0008] In still another embodiment, the present disclosure provides a display device, and the display device includes a light-emitting display panel and any of the driving chips disclosed in the present disclosure.

BRIEF DESCRIPTION OF DRAWINGS

[0009] Embodiments of the present disclosure or in the related art, the accompanying drawings used in the embodiments and in the related art are briefly introduced as follows.

[0010] FIG. **1** is a flowchart of a driving method for an organic light-emitting display panel according to an embodiment of the present disclosure;

[0011] FIG. **2** is a schematic diagram illustrating respective Gamma curves of different ranks according to an embodiment of the present disclosure;

[0012] FIG. **3** is a schematic structural diagram of a pixel driving circuit according to an embodiment of the present disclosure;

[0013] FIG. **4** is a timing signal diagram of the pixel driving circuit of FIG. **3**;

[0014] FIG. **5** is a flowchart of another driving method for an organic light-emitting display panel according to an embodiment of the present disclosure;

[0015] FIG. **6** is a structural block diagram of a driving chip for an organic light-emitting display panel according to an embodiment of the present disclosure;

[0016] FIG. **7** is a structural block diagram of another driving chip for an organic light-emitting display panel according to an embodiment of the present disclosure; and

[0017] FIG. **8** is a schematic structural diagram of a display device according to an embodiment of the present disclosure.

DESCRIPTION OF EMBODIMENTS

[0018] The embodiments of the present disclosure are described in the following with reference to the accompanying drawings. It should be understood that the described embodiments are merely exemplary embodiments of the present disclosure, which shall not be interpreted as providing limitations to the present disclosure.

[0019] The terms used in the embodiments of the present disclosure are merely for the purpose of describing particular embodiments but not intended to limit the present disclosure. Unless otherwise noted in the context, the singular form expressions "a", "an", "the" and "said" used in the embodiments and appended claims of the present disclosure are also intended to represent plural form expressions thereof.

[0020] FIG. **1** is a flowchart of a driving method for an organic light-emitting display panel according to an embodiment of the present disclosure. As shown in FIG. **1**, an embodiment of the present disclosure provides a driving method for an organic light-emitting display panel, and the driving method includes following steps.

[0021] Step **101**: a target brightness is acquired.

[0022] In one embodiment, the target brightness is a maximum brightness of the display panel that a user can reach by adjustment. For example, a maximum brightness range of the display panel is 0-600 nits, that is, the maximum brightness that the display panel can display is 600 nits and the minimum brightness that the display panel can display is 0 nits. For example, if the user adjusts the brightness of the displayed image of the display panel within a range of 0-600 nits, the target brightness is 600 nits; if the user adjusts the brightness of the displayed image of the display panel within a range of 0-300 nits, the target brightness is 300 nits.

[0023] Step **102**: a rank corresponding to the target brightness is determined from a plurality of ranks, each rank includes a respective first brightness range, the first brightness ranges of any two ranks are different from each other and have no overlapping, the first brightness range in the rank corresponding to the target brightness includes the target brightness, and each rank has a Gamma curve corresponding to the maximum brightness of the first brightness range in this rank.

[0024] In one embodiment, for example, as shown in FIG. **2**, which is a schematic diagram illustrating respective Gamma curves of different ranks according to an embodiment of the present disclosure, the maximum brightness range of the display panel is 0-600 nits, and this brightness range has three ranks: a first rank of 0-600 nits, a second rank of 0-400 nits, and a third rank of 0-150 nits. The first brightness range H**1** of the first rank is (400, 600], the first brightness range H**1** of the second rank is (150, 400], and the first brightness range H**1** of the third rank is (0, 150]. The first rank corresponds to a Gamma curve A, and the Gamma curve A is a Gamma curve corresponding to 600 nits, that is, the Gamma curve A represents a Gamma curve with a maximum grayscale value of 255 and a brightness of 600 nits. The second rank corresponds to a Gamma curve B, and the Gamma curve B is a Gamma curve corresponding to 400 nits, that is, the Gamma Curve B represents a Gamma curve with a maximum grayscale value of 255 and a brightness of 400 nits. The third rank corresponds to a Gamma curve C, and the Gamma curve C is a Gamma curve corresponding to 150 nits, that is, the Gamma curve C represents a maximum grayscale value of 255 and a brightness of 150 nits. It should be noted that FIG. **2** merely illustrates Gamma curves corresponding to one color, and different colors correspond to different Gamma curves. The driving method provided by the embodiment of the present disclosure is described herein by taking sub-pixels with only one color as an example, however, the driving method is also applied to sub-pixels with different colors, and the only difference lies in that the sub-pixel with different colors corresponds to different Gamma curves. For example, if the target brightness acquired at step **101** is 520 nits, then at step **102**, only the first brightness range H**1** of (400,600] includes 520 nits, so the rank corresponding to the target brightness of 520 nits is determined to be the first rank, i.e., 0-600 nits; if the target brightness acquired at step **101** is 240 nits, then at step **102**, only the first brightness range H**1** of (150,400] includes 240 nits, so the rank corresponding to the target brightness of 240 nits is determined to be the second rank, i.e., 0-400 nits.

[0025] Step **103**: in the rank corresponding to the target brightness, a duty ratio corresponding to the target brightness is determined, and the duty ratio is an effective pulse duty ratio of a light-emitting control signal, and the maximum brightness of the first brightness range in each rank corresponds to a same duty ratio;

[0026] In one embodiment, the light-emitting control signal is used to control whether the light-emitting device corresponding to the sub-pixels emits light or not. The larger the duty ratio is, the longer the light emission time of the light-emitting device is, and the higher the brightness is; otherwise, the smaller the duty ratio is, the shorter the light emission time of the light-emitting device is, and the lower the brightness is. When the duty ratio is 100%, it means that the light-emitting device has the largest light emission time. The correlation between the brightness and the duty ratio in each rank is set in advance, and the maximum brightness of the first brightness range in each rank corresponds to a same duty ratio. A possible setting manner is that, the duty ratio is adjusted from 100% to 0% according to data voltage values based on the maximum brightness of different Gamma curves, and the correlation between the brightness and the duty ratio is recorded. For example, a data voltage value is determined based on the maximum brightness of the Gamma curve A, and the brightness where the duty ratio is 100% is the maximum brightness 600 nits of the first brightness range H**1** of the first rank; next, the duty ratio is adjusted to 80%, and the brightness at this time is detected, which is, for example, 580 nits, and then 580 nits is a first node A**1** of the first rank; next, the duty ratio is adjusted to 60%, and the brightness at this time is detected, which is, for example, 520 nits, and then 520 nits is a second node A**2** of the first rank; next, the duty ratio is adjusted to 40%, and the brightness at this time is detected, which is, for example, 450 nits, and then 450 nits is a third node A**3** of the first rank; next, the duty ratio is adjusted to 20%, and the brightness at this time is detected, which is, for example, 400 nits. A data voltage value is determined based on the maximum brightness of the Gamma curve B, and the brightness where the duty ratio is 100% is the maximum brightness 400 nits of the first brightness range H**1** of the second rank; next, the duty ratio is adjusted to 80%, and the brightness at this time is detected, which is, for example, 370 nits, and then 370 nits is a first node B**1** of the second rank; next, the duty ratio is adjusted to 60%, and the brightness at this time is detected, which is, for example, 320 nits, and then 320 nits is a second node B**2** of the second rank; next, the duty ratio is adjusted to 40%, and the brightness at this time is detected, which is, for example, 240 nits, and then 240 nits is a third node B**3** of the second rank; next, the duty ratio is adjusted to 20%, and the brightness at this time is detected, which is, for example, 150 nits. A data voltage value is determined based on the maximum brightness of the Gamma curve C, and the brightness where the duty ratio is 100% is the maximum brightness 150 nits of the first brightness range H1 of the third rank; next, the duty ratio is adjusted to 80%, and the brightness at this time is detected, which is, for example, 130 nits, and then 130 nits is a first node C1 of the third rank; next, the duty ratio is adjusted to 60%, and the brightness at this time is detected, which is, for example, 100 nits, and then 100 nits is a second node C2 of the third rank; next, the duty ratio is adjusted to 40%, and the brightness at this time is detected, which is, for example, 50 nits, and then 50 nits is a third node C3 of the third rank. For example, if the target brightness acquired at step **101** is 520 nits, then it corresponds to the first rank. Based on the Gamma curve A in the first rank, the duty ratio corresponding to 520 nits is 60%, so the duty ratio corresponding to the target brightness is determined to be 60%. If the target brightness acquired at step **101** is 240 nits, then it corresponds to the second rank. Based on the Gamma curve B in the second rank, the duty ratio corresponding to 240 nits is 40%, so the duty ratio corresponding to the target brightness is determined to be 40%. Moreover, assuming that the target brightness is 400 nits, and the corresponding duty ratio of 400 nits of the first rank is 20% while the corresponding duty ratio of 400 nits of the second rank is 100%, in this case, since 400 nits does not belong to the range (400, 600] and belongs to the range (150,400], 400 nits does not belong to the first rank and belongs to the second rank, and it should correspond to the Gamma curve B in the second rank and the duty ratio of 100%.

[0027] Step **104**: an organic light-emitting display panel is driven based on the Gamma curve in the rank corresponding to the target brightness and the duty ratio corresponding to the target brightness in the rank corresponding to the target brightness.

[0028] In one embodiment, assuming that the target brightness is 520 nits, then the organic light-emitting display panel is driven based on the Gamma curve A and the duty ratio of 60%; assuming that the target brightness is 240 nits, then the organic light-emitting display panel is driven based on the Gamma curve B and the duty ratio of 40%.

[0029] FIG. **3** is a schematic structural diagram of a pixel driving circuit according to an embodiment of the present disclosure, and FIG. **4** is a timing signal diagram of the pixel driving circuit of FIG. **3**. It should be noted that, as shown in FIG. **3** and FIG. **4**, the organic light-emitting display panel includes a plurality of sub-pixels, and each sub-pixel corresponds to a pixel driving circuit. The pixel driving circuit includes an organic light-emitting device **01**, and the light-emitting device **01** is configured to implement color display corresponding to the sub-pixel. The pixel driving circuit includes first to seventh transistors, i.e., M**1** to M**7**. Here, the fifth transistor M**5** is a driving transistor, and the other transistors are all switching transistors. The first transistor M**1** and the second transistor M**2** each have a control terminal electrically connected to a first scan signal terminal Scan**1**. The third transistor M**3** and the seventh transistor M**7** each have a control terminal electrically connected to the light-emitting control signal terminal Emit. The sixth transistor M**6** has a control terminal electrically connected to a second scan signal terminal Scan**2**. For each sub-pixel, each frame of driving time includes a charging phase t and a non-charging phase t'. Here, the charging phase t refers to a charging phase during which a potential of a control terminal of the fifth transistor M**5** has a correlation with a data voltage transmitted by a data signal line Data under the action of the first scan signal terminal Scan**1**, the second scan signal terminal Scan**2**, a reference voltage signal terminal Vref, and the data signal line Data, and the fifth transistor M**5** generates a corresponding driving current by the control of the data voltage. During the charging phase t, the light-emitting control signal terminal Emit needs to output a non-enable level (for example, a high level as a non-enable level) to control the third transistor M**3** and the seventh transistor M**7** to be turned off, so that it is in an off-state between a first power supply voltage terminal PVDD and a second power supply voltage terminal PVEE during the charging phase t, and no current will pass through the light-emitting device **01**, that is, the light-emitting device **01** does not emit light. During the non-charging phase t', since charging has been completed and the potential of the control terminal of the fifth transistor M**5** can be kept constant under the action of a storage capacitor Cst, theoretically, the light-emitting control signal terminal Emit can always output an enable level during the non-charging phase t'. At this time, the light-emitting device **01** has a maximum brightness, that is, an effective pulse duty ratio of the light-emitting control signal is 100%. During the non-charging phase t', if the light-emitting control signal terminal Emit outputs a non-enable level and the light-emitting device **01** is controlled not to emit light, i.e., the effective pulse duty ratio of the light-emitting control signal becomes smaller.

[0030] In addition, it should be noted that in the organic light-emitting display panel, under a same duty ratio, the brightness of the sub-pixel is determined by the data voltage value. For example, in FIG. **2**, three Gamma curves each with a duty ratio of 100% are illustrated, and the respective maximum grayscale values of the three Gamma curves correspond to different brightness values, that is, the three Gamma curves have different correlations between respective grayscale values and respective data voltage values. For example, for the Gamma curve A, the grayscale value **255** corresponds to a brightness of 600 nits and a data voltage value of 5V; for the Gamma curve B, the grayscale value **255** corresponds to a brightness of 400 and a data voltage value of 4.2V. Therefore, under a same duty ratio, driving the display panel by using different Gamma curves means changing the brightness of the display panel by changing the data voltage value.

[0031] In an embodiment of the present disclosure, the driving method for the organic light-emitting display panel is driven based on the Gamma curve in the rank corresponding to the target brightness. That is, based on the target brightness, different Gamma curves are selected during a wide range of brightness adjustment, and the brightness is adjusted by adjusting a corresponding data voltage value, and then the brightness is finely adjusted by adjusting the duty ratio within a small range of variation based on the selected Gamma curve. On the one hand, the image can be closer to the Gamma curve when the brightness is adjusted within a large range of variation; and on the other hand, the brightness is finely adjusted by adjusting the duty ratio based on the selected Gamma curve, so that the transition effect of brightness adjustment between different Gamma curves can be improved.

[0032] In an embodiment, at the abovementioned step **103**, determining a duty ratio corresponding to the target brightness in the rank corresponding to the target brightness is:

determining, according to the preset correlation between the duty ratio and the brightness, a duty ratio corresponding to the target brightness in the rank corresponding to the target brightness.

[0033] The preset correlation between the duty ratio and the brightness may be a one-to-one correspondence in an array.

TABLE 1

	brightness (unit: nits)	duty ratio
first rank, Gamma curve A	600	100%
	580	80%
	520	60%
	450	40%
second rank, Gamma curve B	400	100%
	370	80%
	320	60%
	240	40%
third rank, Gamma curve C	150	100%
	130	80%
	100	60%
	50	40%

[0034] For example, as shown in Table 1, which shows the correlation between the brightness and the duty ratio corresponding to the Gamma curve in each rank.

[0035] The correlation between the brightness and the duty ratio can be illustrated in other manners in addition to the abovementioned manner. For example, in each rank, a simulation curve of the brightness and the duty ratio is drawn, and an equation of the brightness and the duty ratio can be obtained based on the curve, and then the correlation between the brightness and the duty ratio can be illustrated by the equation.

[0036] In an embodiment, the first brightness range H**1** of each rank is divided into a plurality of second brightness ranges H**2**, and different second brightness ranges H**2** in a same first brightness range H**1** have no overlapping. For example, in the first rank, the first brightness range H**1** (**400**, **600**] is divided into four second brightness intervals H**2**: (**400**, **450**], (**450**, **520**], (**520**, **580**], and (**580**, **600**]. In the second rank, the first brightness range H**1** (**150**,**400**] is divided into four second brightness ranges H**2**: (**150**, **240**], (**240**, **320**], (**320**, **370**], and (**370**, **400**]. In the third rank, the first brightness range H**1** (**0**,**150**] is divided into four second brightness ranges H**2**: (**0**, **50**], (**50**, **100**], (**100**, **130**], and (**130**, **150**]. As shown in FIG. **5**, which is a flowchart of another driving method for an organic light-emitting display panel according to an embodiment of the present disclosure, the step **103** of determining, according to the preset correlation between the duty ratio and the brightness, a duty ratio corresponding to the target brightness in the rank corresponding to the target brightness includes following steps.

[0037] Step **1031**: a second brightness range corresponding to the target brightness is determined in a rank corresponding to the target brightness.

[0038] In one embodiment, for example, the target brightness is 500 nits, and it corresponds to the second brightness range (450, 520] in the first rank.

[0039] Step **1032**: a correlation between a brightness and a duty ratio in the second brightness range corresponding to the target brightness is determined.

[0040] In one embodiment, for example, a correlation between a brightness and a duty ratio in each second brightness range H**2** is set in advance, and the correlation between the brightness and the duty ratio in the second brightness range H**2** (450, 520] is determined.

[0041] Step **1033**: in the second brightness range corresponding to the target brightness, a duty ratio corresponding to the target brightness is determined based on the correlation between the brightness and the duty ratio in the second brightness range corresponding to the target brightness.

[0042] The process of step **1031** to step **1033** can further determine a corresponding duty ratio according to the target brightness in the second brightness range H**2**, so that when the target brightness is between different nodes, the duty ratio can be more accurately determined, and thus the transition effect of brightness adjustment between different nodes can be improved.

[0043] In an embodiment, the correlation between the brightness and the duty ratio in the second brightness range corresponding to the target brightness satisfies the following formula:

$$\frac{D-D2}{L-L2}=\frac{D1-D2}{L1-L2}$$

[0044] In the above formula, D is the duty ratio corresponding to the target brightness, L is the target brightness, D**1** is the duty ratio corresponding to the maximum brightness of the second brightness range corresponding to the target brightness, D**2** is the duty ratio corresponding to the minimum brightness of the second brightness range corresponding to the target brightness, L**1** is the maximum brightness of the second brightness range corresponding to the target brightness, and L**2** is the minimum brightness of the second brightness range corresponding to the target brightness.

[0045] For example, the brightness and the duty ratio corresponding to the maximum brightness of each second brightness range H**2** are set in advance, and the brightness and the duty ratio corresponding to the minimum brightness of each second brightness range H**2** are set in advance, that is, a correlation between each brightness and duty ratio shown in Table 1 is set in advance. If the target brightness is the brightness in Table 1, the corresponding duty ratio can be directly selected. If the target brightness is a brightness other than that in Table 1, the duty ratio corresponding to the target brightness can be obtained according to the above formula. For example, the target brightness L=500 nits, which is within a range from 520 nits to 450 nits, then D**1**=60%, D**2**=40%, L**1**=520 nits, L**2**=450 nits, and the duty ratio corresponding to the target brightness can be obtained according to the above formula:

$$\frac{D-40\%}{500-450}=\frac{60\%-40\%}{520-450},\ d\approx 54\%.$$

[0046] In an embodiment, for all second brightness ranges H**2** of each rank, the difference between the maximum duty ratio and the minimum duty ratio has a same value. For example, as shown in Table 1, in each rank, for each second brightness range H**2**, the difference between the maximum duty ratio and the minimum duty ratio is 20%. The duty ratio corresponding to the maximum brightness and the duty ratio corresponding to the minimum brightness in each second brightness range H**2** are obtained by pre-testing and the adjustment effect is the best, and the duty ratio corresponding to other brightness is obtained by the above formula and thus only a duty ratio that is close to the duty ratio corresponding to the target brightness can be obtained. Therefore, with the above setting manner in which the difference between the maximum duty ratio and the minimum duty ratio has a same value for all second brightness ranges H2, i.e., the second brightness ranges H2 are arranged more uniformly, the adjustment of the duty ratio is closer to the actual testing result in a same rank.

[0047] In an embodiment, the maximum brightness of the first brightness range H1 in each rank corresponds to a duty ratio of 100%. With this arrangement, the characteristic of the display panel itself can be more fully utilized, so that the display panel works within a larger brightness range.

[0048] FIG. **6** is a structural block diagram of a driving chip for an organic light-emitting display panel according to an embodiment of the present disclosure. As shown in FIG. **6**, an embodiment of the present disclosure further provides a driving chip for an organic light-emitting display panel. The driving chip includes: a target brightness acquiring device **1**, a rank determining device **2**, a duty ratio determining device **3**, and a driving device. The target brightness acquiring device **1** is configured to acquire a target brightness. The rank determining device **2** is configured to determine a rank corresponding to the target brightness from a plurality of ranks, and each rank includes a first brightness range. Different ranks have different first brightness ranges and have no overlapping. The first brightness range in the rank corresponding to the target brightness includes the target brightness. Each rank has a Gamma curve corresponding to the maximum brightness of the first brightness range in this rank. The duty ratio determining device **3** is configured to determine a duty ratio corresponding to the target brightness in the rank corresponding to the target brightness, where the duty ratio is an effective pulse duty ratio of a light-emitting control signal, and the maximum brightness of the first brightness range in each rank corresponds to a same duty ratio. The driving device **4** is configured to drive an organic light-emitting display panel based on the Gamma curve in the rank corresponding to the target brightness and the duty ratio corresponding to the target brightness in the rank corresponding to the target brightness.

[0049] The driving method and principle of the driving chip are the same as those described in the above embodiments, and the details are not further described herein.

[0050] The driving chip for the organic light-emitting display panel in this embodiment of the present disclosure is driven based on the Gamma curve in the rank corresponding to the target brightness. That is, based on the target brightness, different Gamma curves are selected during a wide range of brightness adjustment, and the brightness is adjusted by adjusting a corresponding data voltage value, and then the brightness is finely adjusted by adjusting the duty ratio within a small range of variation based on the selected Gamma curve. On the one hand, the image can be closer to the Gamma curve when the brightness is adjusted within a large range of variation; and on the other hand, the brightness is finely adjusted by adjusting the duty ratio based on the selected Gamma curve, so that the transition effect of brightness adjustment between different Gamma curves can be improved

[0051] In an embodiment, the duty ratio determining device **3** is configured to determine, according to a preset correlation between the duty ratio and the brightness, a duty ratio corresponding to the target brightness in the rank corresponding to the target brightness

[0052] In an embodiment, the first brightness range in each rank is divided into a plurality of second brightness ranges, and different second brightness ranges in a same first brightness range have no overlapping. FIG. **7** is a structural block diagram of another driving chip for an organic light-emitting display panel according to an embodiment of the present disclosure. As shown in FIG. **7**, the duty ratio determining device **3** includes: a brightness range determining device **31**, a correlation determining device **32**, and a duty ratio determining device **33**. The brightness range determining device **31** is configured to determine, in the rank corresponding to the target brightness, a second brightness range corresponding to the target brightness. The correlation determining device **32** is configured to determine a correlation between the brightness and the duty ratio in the second brightness range corresponding to the target brightness. The duty ratio determining device **33** is configured to determine, in the second brightness range corresponding to the target brightness, a duty ratio corresponding to the target brightness according to the correlation between the brightness and the duty ratio in the second brightness range corresponding to the target brightness.

[0053] In an embodiment, the correlation between the brightness and the duty ratio in the second brightness range corresponding to the target brightness satisfies the following formula:

$$D = L \times \frac{D1 - D2}{L1 - L2}$$

[0054] In the above formula, D is the duty ratio corresponding to the target brightness, L is the target brightness, D**1** is the duty ratio corresponding to the maximum brightness of the second brightness range corresponding to the target brightness, D**2** is the duty ratio corresponding to the minimum brightness of the second brightness range corresponding to the target brightness, L**1** is the maximum brightness of the second brightness range corresponding to the target brightness, and L**2** is the minimum brightness of the second brightness range corresponding to the target brightness.

[0055] In an embodiment, for all second brightness ranges H**2** of each rank, the difference between the maximum duty ratio and the minimum duty ratio has a same value.

[0056] In an embodiment, the maximum brightness of the first brightness range in each rank corresponds to a duty ratio of 100%.

[0057] FIG. **8** is a schematic structural diagram of a display device according to an embodiment of the present disclosure. As shown in FIG. **8**, the display device includes an organic light-emitting display panel **100** and the above-mentioned driving chip.

[0058] The structure and principle of the organic light-emitting display panel **100** are the same as those described in the above embodiments, and the details are not further described herein. The display device may be any electronic device having a display function, such as a touch display screen, a cellphone, a tablet computer, a laptop computer, an electronic paper book, or a television.

[0059] The driving chip for the organic light-emitting display panel in this embodiment of the present disclosure is driven based on the Gamma curve in the rank corresponding to the target brightness. That is, based on the target brightness, different Gamma curves are selected during a wide range of brightness adjustment, and the brightness is adjusted by adjusting a corresponding data voltage value, and then the brightness is finely adjusted by adjusting the duty ratio within a small range of variation based on the selected Gamma curve. On the one hand, the image can be closer to the Gamma curve when the brightness is adjusted within a large range of variation; and on the other hand, the brightness is finely adjusted by adjusting the duty ratio based on the selected Gamma curve, so that the transition effect of brightness adjustment between different Gamma curves can be improved

What is claimed is:

1. A driving method for an organic light-emitting display panel, comprising:

acquiring a target brightness;

determining a rank, from a plurality of ranks, corresponding to the target brightness, wherein each of the plurality of ranks comprises a first brightness range, and the first brightness ranges of any two ranks of the plurality of ranks are different from each other and have no overlapping, the first brightness range of the rank corresponding to the target brightness comprises the target brightness, and each of the plurality of ranks has a Gamma curve corresponding to a maximum brightness of the first brightness range of the rank,

determining, in the rank corresponding to the target brightness, a duty ratio corresponding to the target brightness, wherein the duty ratio is an effective pulse duty ratio of a light-emitting control signal, and the maximum brightness of the first brightness range of each of the plurality of ranks corresponds to a same duty ratio; and

driving the organic light-emitting display panel based on the Gamma curve of the rank corresponding to the target brightness and the duty ratio corresponding to the target brightness in the rank corresponding to the target brightness.

2. The driving method for the organic light-emitting display panel according to claim **1**, wherein said determining, in the rank corresponding to the target brightness, a duty ratio corresponding to the target brightness comprises: determining, in the rank corresponding to the target brightness, a duty ratio corresponding to the target brightness according to a preset correlation between a duty ratio and a brightness.

3. The driving method for the organic light-emitting display panel according to claim **2**, wherein

the first brightness range of each of the plurality of ranks is divided into a plurality of second brightness ranges, any two second brightness ranges of the plurality of second brightness ranges in a same first brightness range having no overlapping;

wherein said determining, in the rank corresponding to the target brightness, a duty ratio corresponding to the target brightness according to a preset correlation between a duty ratio and a brightness comprises:

determining, in the rank corresponding to the target brightness, a second brightness range corresponding to the target brightness from the plurality of second brightness ranges;

determining a correlation between a brightness and a duty ratio in the second brightness range corresponding to the target brightness; and

determining, in the second brightness range corresponding to the target brightness, a duty ratio corresponding to the target brightness based on the correlation between the brightness and the duty ratio in the second brightness range corresponding to the target brightness.

4. The driving method for the organic light-emitting display panel according to claim **3**, wherein

the correlation between the brightness and the duty ratio in the second brightness range corresponding to the target brightness satisfies a formula of:

$$\frac{D-D2}{L-L2}=\frac{D1-D2}{L1-L2},$$

wherein D is the duty ratio corresponding to the target brightness, L is the target brightness, D**1** is a duty ratio corresponding to a maximum brightness of the second brightness range corresponding to the target brightness, D**2** is a duty ratio corresponding to a minimum brightness of the second brightness range corresponding to the target brightness, L**1** is the maximum brightness of the second brightness range corresponding to the target brightness, and L**2** is the minimum brightness of the second brightness range corresponding to the target brightness.

5. The driving method for the organic light-emitting display panel according to claim **4**, wherein

for the plurality of second brightness ranges of each of the plurality of ranks, a difference between a maximum duty ratio and a minimum duty ratio has a same value.

6. The driving method for the organic light-emitting display panel according to claim **1**, wherein the maximum brightness of the first brightness range of each of the plurality of ranks corresponds to a duty ratio of 100%.

7. A driving chip for an organic light-emitting display panel, comprising:

a target brightness acquiring device configured to acquire a target brightness;

a rank determining device configured to determine a rank corresponding to the target brightness from a plurality of ranks, wherein each of the plurality of ranks comprises a first brightness range, the first brightness ranges of any two ranks of the plurality of ranks are different from each other and have no overlapping, the first brightness range of the rank corresponding to the target brightness comprises the target brightness, each of the plurality of ranks has a Gamma curve corresponding to a maximum brightness of the first brightness range of the rank;

a duty ratio determining device configured to determine a duty ratio corresponding to the target brightness in the rank corresponding to the target brightness, wherein the duty ratio is an effective pulse duty ratio of a light-emitting control signal, and the maximum brightness of the first brightness range in each of the plurality of ranks corresponds to a same duty ratio; and

a driving device configured to drive the organic light-emitting display panel based on the Gamma curve of the rank corresponding to the target brightness and the duty ratio corresponding to the target brightness in the rank corresponding to the target brightness.

8. The driving chip for the organic light-emitting display panel according to claim **7**, wherein the duty ratio determining device is configured to determine, in the rank corresponding to the target brightness, a duty ratio corresponding to the target brightness according to a preset correlation between a duty ratio and a brightness.

9. The driving chip for the organic light-emitting display panel according to claim **8**, wherein the first brightness range of each of the plurality of ranks is divided into a plurality of second brightness ranges, and any two second brightness ranges of the plurality of second brightness ranges in a same first brightness range have no overlapping;

the duty ratio determining device comprises:

a brightness range determining device configured to determine, in the rank corresponding to the target brightness, a second brightness range corresponding to the target brightness;

a correlation determining device configured to determine a correlation between a brightness and a duty ratio in the second brightness range corresponding to the target brightness; and

a duty ratio determining device determine, in the second brightness range corresponding to the target brightness, a duty ratio corresponding to the target brightness according to the correlation between the brightness and the duty ratio in the second brightness range corresponding to the target brightness.

10. The driving chip for the organic light-emitting display panel according to claim **9**, wherein

the correlation between the brightness and the duty ratio in the second brightness range corresponding to the target brightness satisfies a formula of:

$$\frac{D-D2}{L-L2}=\frac{D1-D2}{L1-L2},$$

wherein D is the duty ratio corresponding to the target brightness, L is the target brightness, D**1** is a duty ratio corresponding to a maximum brightness of the second brightness range corresponding to the target brightness, D**2** is a duty ratio corresponding to a minimum brightness of the second brightness range corresponding to the target brightness, L**1** is the maximum brightness of the second brightness range corresponding to the target brightness, and L**2** is the minimum brightness of the second brightness range corresponding to the target brightness.

11. The driving chip for the organic light-emitting display panel according to claim **10**, wherein

for the plurality of second brightness ranges of each of the plurality of ranks, a difference between a maximum duty ratio and a minimum duty ratio has a same value.

12. The driving chip for the organic light-emitting display panel according to claim **7**, wherein the maximum brightness of the first brightness range of each of the plurality of ranks corresponds to a duty ratio of 100%.

13. A display device, comprising:

an organic light-emitting display panel; and

a driving chip for an organic light-emitting display panel, comprising:

a target brightness acquiring device configured to acquire a target brightness;

a rank determining device configured to determine a rank corresponding to the target brightness from a plurality of ranks, wherein each of the plurality of ranks comprises a first brightness range, the first brightness ranges of any two ranks of the plurality of ranks are different from each other and have no overlapping, the first brightness range of the rank corresponding to the target brightness comprises the target brightness, each of the plurality of ranks has a Gamma curve corresponding to a maximum brightness of the first brightness range of the rank;

a duty ratio determining device configured to determine a duty ratio corresponding to the target brightness in the rank corresponding to the target brightness, wherein the duty ratio is an effective pulse duty ratio of a light-emitting control signal, and the maximum brightness of the first brightness range in each of the plurality of ranks corresponds to a same duty ratio; and

a driving device configured to drive the organic light-emitting display panel based on the Gamma curve of the rank corresponding to the target brightness and the duty ratio corresponding to the target brightness in the rank corresponding to the target brightness.

* * * * *

专利名称(译)	用于有机发光显示面板的驱动方法和驱动芯片，以及显示装置		
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摘要(译)

提供一种用于有机发光显示面板的驱动方法和驱动芯片，以及显示装置。该方法包括：获取目标亮度;确定与目标亮度对应的等级，每个等级包括第一亮度范围，第一亮度范围不同且不重叠，第一亮度范围包括目标亮度，每个等级具有对应于最大亮度的Gamma曲线在等级中的第一亮度范围中，在等级中确定对应于目标亮度的占空比，占空比是发光控制信号的有效脉冲占空比，以及第一亮度范围的最大亮度在每个等级中对应于相同的占空比;基于Gamma曲线和与等级中的目标亮度对应的占空比来驱动有机发光显示面板。