MBI5025 Application Note- Substituting for MBI5026

Foreword

The MBI5025 is designed for LED displays which need to operate at low current and match the luminous intensity of each channel. The digital part of the MBI5025 is the same as that of the MBI5026, and the output stage of the MBI5025 exploits PrecisionDrive^{TM} technology with further enhancement in accuracy at low current range. In addition, the MBI5025 applies the same pin configuration of the MBI5026. This article is, therefore, to guide the developers to substitute the MBI5025 for the MBI5026 under the specific conditions.

Application circuit

The MBI5025 application circuit is the same as the MBI5026. Please refer to Figure 1.

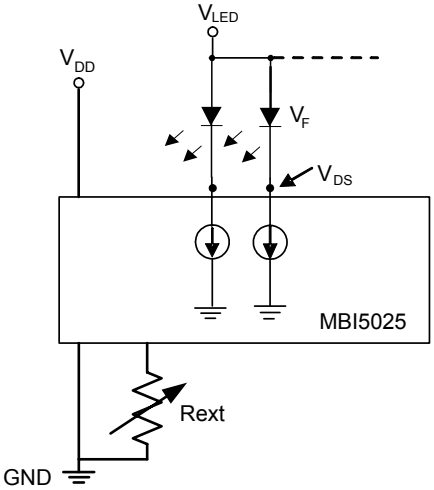

Figure 1. Application circuit diagram

Floor 3-5, No. 18, Pu-Ting Rd., Hsinchu, Taiwan 30077, ROC.
TEL: +886-3-579-0068, FAX: +886-3-579-8934 E-mail: info@mblock.com.tw

Characteristic comparison between the MBI5025 and MBI5026

The following table is the characteristic differences between the MBI5025 and MBI5026.

Characteristics	MBI5025	MBI5026
Supply voltage (V_{DD}) range	3.3V±0.3V and 5.0V±0.5V	5.0V±0.5V
Excellent output current accuracy between channels	±1% (typ.); ±3% (max.)	±3% (max.)
Constant output current (I_{OUT}) range that guarantees the current accuracy	3-30mA@ V_{DD}=3.3V	5-90mA@ V_{DD}=5.0V
	3-45mA@ V_{DD}=5.0V	
V_{DS} vs. I_{OUT} saturation point volt ($V_{DS,,sat}$)at I_{OUT}=25mA	0.7V@ V_{DD}=3.3V	0.5V@ V_{DD}=5.0V
	0.6V@ V_{DD}=5.0V	
Supply current (I_{DD}) at Rext open, $\overline{OUTn}$ off (V_{DD}=3.3V)	1.8mA	none
Supply current (I_{DD}) at Rext open, $\overline{OUTn}$ off (V_{DD}=5.0V)	2.4mA	6mA
Voltage of R-EXT (V_{R-EXT})	1.24V	1.26V
Output rise time of output ports	160ns (typ.)@ V_{DD}=3.3/5.0V	115ns (typ.)@ V_{DD}=5.0V
Output fall time of output ports	70ns (typ.)@ V_{DD}=3.3/5.0V	90ns (typ.)@ V_{DD}=5.0V
Built-in staggered output delay time*	35ns	none
Schmitt trigger (V_{IH}/V_{IL})	0.7xV_{DD}/0.3xV_{DD}	0.8xV_{DD}/0.3xV_{DD}
Package type	GD, GF, GP	GN, GNS, GD, GF, GP, GPA

Table 1. Characteristic comparison between the MBI5025 and MBI5026

*The delay time of output channels is 35ns between even channel $\overline{OUT2n}$ (e.g. $\overline{OUT0}$, $\overline{OUT2}$, $\overline{OUT4}$, etc.) and odd channel $\overline{OUT2n+1}$(e.g. $\overline{OUT1}$, $\overline{OUT3}$, $\overline{OUT5}$, etc.) The OUT of even channel has a time delay than odd channel. Stagger delay timing diagram shows in the Figure 2.

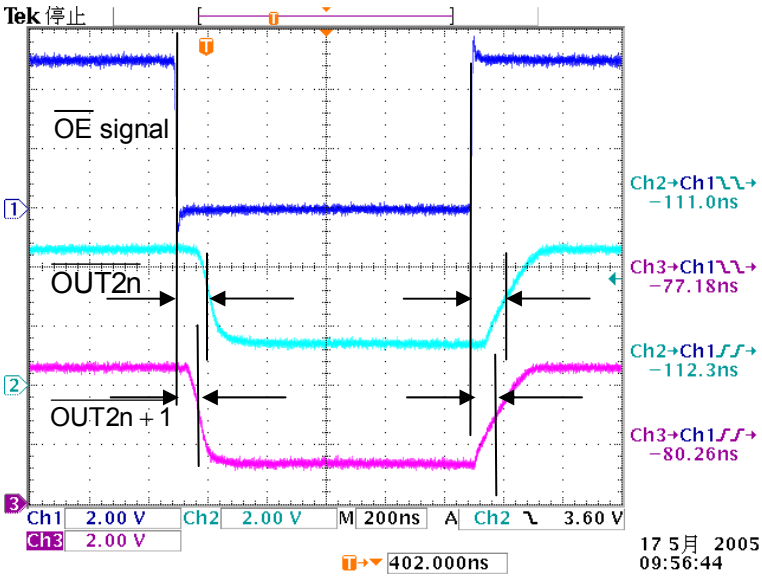

Figure 2. The relationship between the built-in staggered output delay and $\overline{OE}$ signal

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The notes of using the MBI5025

In specific conditions, the MBI5025 is equivalent to the MBI5026. Please pay attention to the following items for further instructions.

1. The MBI5025 can support V_{DD} at 3.3V±0.3V and 5.0V±0.5V, while the MBI5026 can only support V_{DD} at 5.0V±0.5V. When developers operate at 3.3V, please recheck the DC operating point.
2. At 5.0V supply voltage, the maximum output current that guarantees the accuracy of the MBI5025 (45mA) is much lower than that of the MBI5026 (90mA). If developers use the MBI5026 at I_{OUT} >45mA, developers cannot use the MBI5025. The MBI5025's current accuracy is ±3% between channels and ±6% between ICs, when :
   a. the output current application range is from 3mA~30mA and the V_{DD} is 3.3V.
   b. the output current application range is from 3mA~45mA and the V_{DD} is 5.0V.
3. If the developer applies the same Rext, I_{OUT} of the MBI5025 will be slightly lower than that of the MBI5026, since I_{OUT} and Rext satisfy the equation: I_{OUT} = ($V_{R\text{-}EXT}$/Rext) x 15, and $V_{R\text{-}EXT}$ of the MBI5025 is 1.24V, which is different from that of the MBI5026. (MBI5026's $V_{R\text{-}EXT}$=1.26V).
4. The developer has to double check the voltage level of V_{LED}, the supply voltage to LEDs. At the same constant output current, the saturation point voltage ($V_{DS,sat}$) of the MBI5025 (i.e. 0.6V at I_{OUT}=25mA) is a little higher than that of the MBI5026 (i.e. 0.5V at I_{OUT}=25mA). The developer should refer to the datasheet V_{DS} vs. I_{OUT} relationship to keep the operating point at the flat zone.
5. The MBI5025 has a built-in staggered circuit to perform delay mechanism. The delay time of output channels is 35ns between even number channel $\overline{OUT2n}$ (e.g. $\overline{OUT0}$, $\overline{OUT2}$, $\overline{OUT4}$, etc.) and odd number channel $\overline{OUT2n+1}$(e.g. $\overline{OUT1}$, $\overline{OUT3}$, $\overline{OUT5}$, etc.). This delay prevents large inrush current, which reduces spikes and noise when output ports are turned on.
6. The MBI5025's input signals including SDI/CLK/LE/$\overline{OE}$ are all with Schmitt trigger. Input "H" level voltage meets 0.7×V_{DD}, and input "L" level voltage meets 0.3×V_{DD}.
7. The output rising time of the MBI5025 is longer than that of the MBI5026, and the output falling time of the MBI5025 is shorter than that of the MBI5026. Therefore, the minimum $\overline{OE}$ pulse width is longer. Developers could decide the $\overline{OE}$ pulse width accordingly.
8. The MBI5025 provides only three package types including SOP (GD and GF) and SSOP (GP) for developers' selection.

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Summary

The MBI5025 can be easily used as an alternative to the MBI5026. With an input voltage ranging from 3.0V to 5.5V, the constant current characteristics down to 3mA, and the built-in staggered circuit, the MBI5025 is more flexible on low power consumption and well suited for operating at low constant current conditions. Developers should follow this application note and pay attention to those items which are different from the MBI5026. And please refer to MBI's "LED Driver IC- General Application Note.pdf" for detailed DC operating, digital signal and circuit layout information.

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