

Differences Between LM4600x/LM4360x A and Non-A Orderable Part Numbers

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ABSTRACT

This application note is written in order to provide our customers with a description of the differences between the A and non-A versions of the LM436xx device family as well as the LM460xx family.

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1 Introduction

The LM4360x and LM4600x regulators are capable of operating in PFM (Pulse Frequency Modulation) mode in order to increase efficiency at no load or light load conditions. The input current is reduced because the device reduces its switching frequency hence reducing the switching losses under light load conditions. During the ramping up of VIN, the device will transition from PWM (Pulse Width Modulation) to PFM mode if there is no load (or light load) at the output. In order to enter the PFM mode, the VIN has to be high enough such that there is enough energy delivered to the output capacitor. Once the output capacitor is charged, the extra energy will cause the FB node to slightly rise and trigger the converter to enter PFM mode.

2 "A" vs "non-A" Version

Yes, the difference between the A and non-A version of the part will be discussed in this section. This difference also applies to the whole family of parts (Automotive Q1 grade) which includes the LM43600, LM43601, LM43602, LM43603, LM46000, LM46001, and LM46002. During the ramping up of VIN test, in a non-A version of the device, there is more variation of the point where PFM mode is entered. In order to give a better picture of the statistics, [Figure 1](#) and [Figure 2](#) show the input voltage for PFM entry for a sample of 50 units.

Below is the statistical value of VIN PFM entry point for 50 units of LM43603-Q1 (non-A) operating in 200kHz and 400kHz

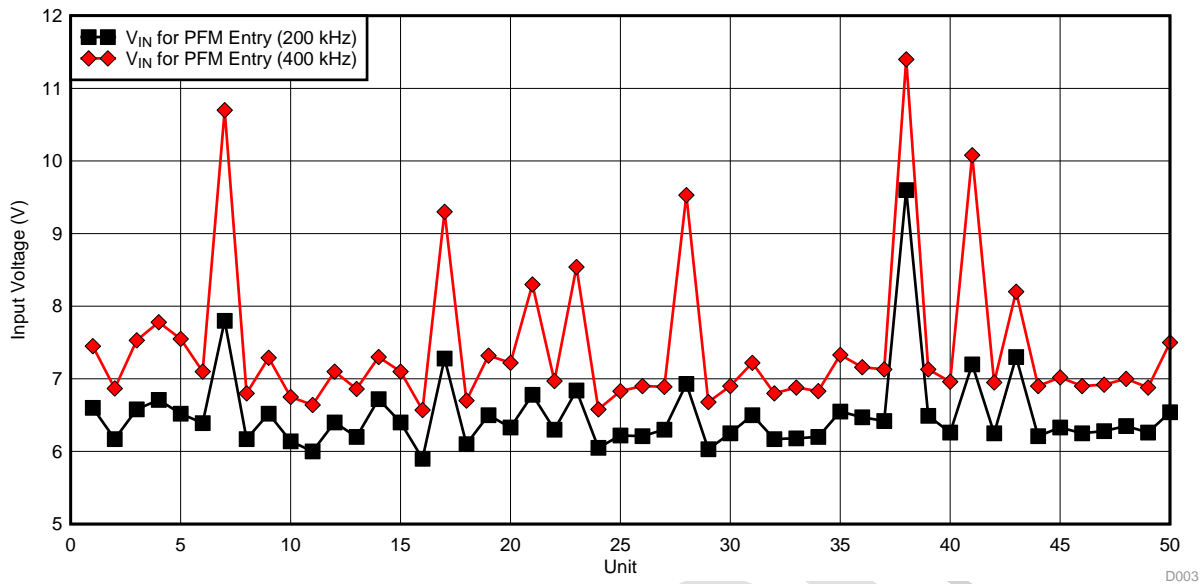


Figure 1. LM43603-Q1 PFM Entry Input Voltage for 5V Output with 12.2 μ H Inductor and 0.5mA Standby Load

As for comparison, below is the test result for 50 units of the LM43603A-Q1 version

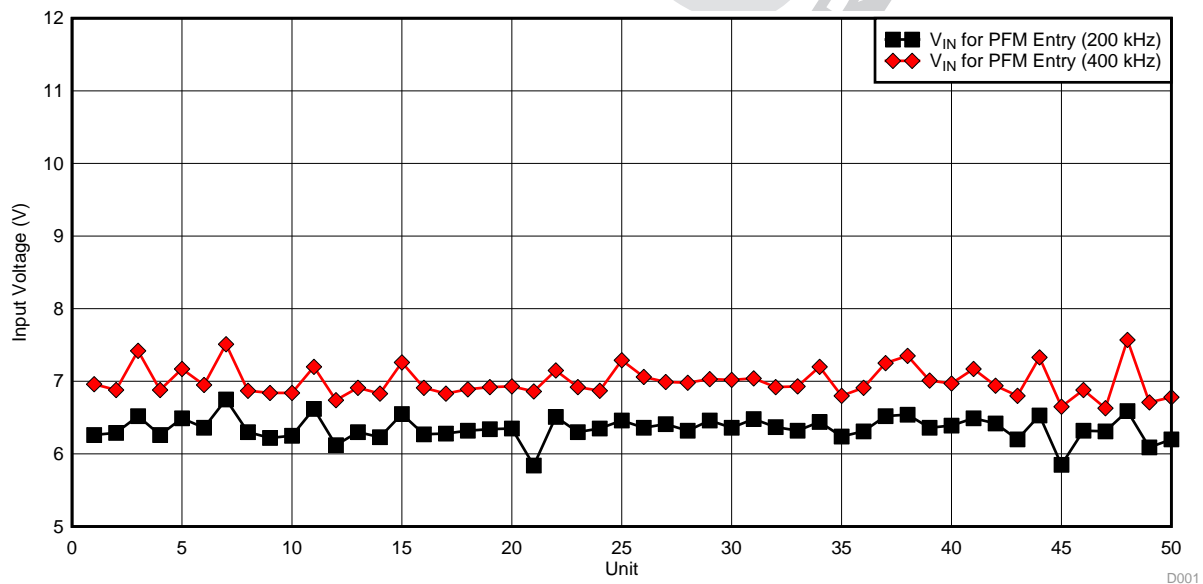


Figure 2. LM43603A-Q1 PFM Entry Input Voltage for 5V Output with 12.2 μ H Inductor and 0.5mA Standby Load

The tests above were done with 2 different RT resistor frequency settings (200kHz and 400kHz) with the same output voltage, inductor, and the same output capacitor. From Figure 1 and Figure 2 there are 2 important points to be noted. First, the device that operates at lower set switching frequency has a VIN PFM entry point lower compared with the same device that operates at a higher set frequency. Second, regardless of switching frequency, there are some units that have a VIN PFM entry point that is quite a bit higher compared to the rest of the other units.

The above points still hold true for the A version. However, the variation in the VIN PFM entry point is less with the A version than with the non-A version. All units in this case entered PFM at an input voltage below 8V. Therefore given the same BOM between the A and non-A version of the device, the A version has less variability of the VIN PFM entry point.

3 Application Information

For customers that require a low operating input current at light- or no-load, and low input voltages, the A version is the best choice. If these considerations are not a concern in a given application, then the non-A version is adequate.

Figure 3 and Figure 4 show a comparison of the input current for the A and non-A version of the device. The operating condition are as follows:

- Input Voltage = 8.5V
- Output Voltage = 5V
- Output standby load = 0.5mA
- Switching Frequency setting = 200kHz
- Same BOM for both versions

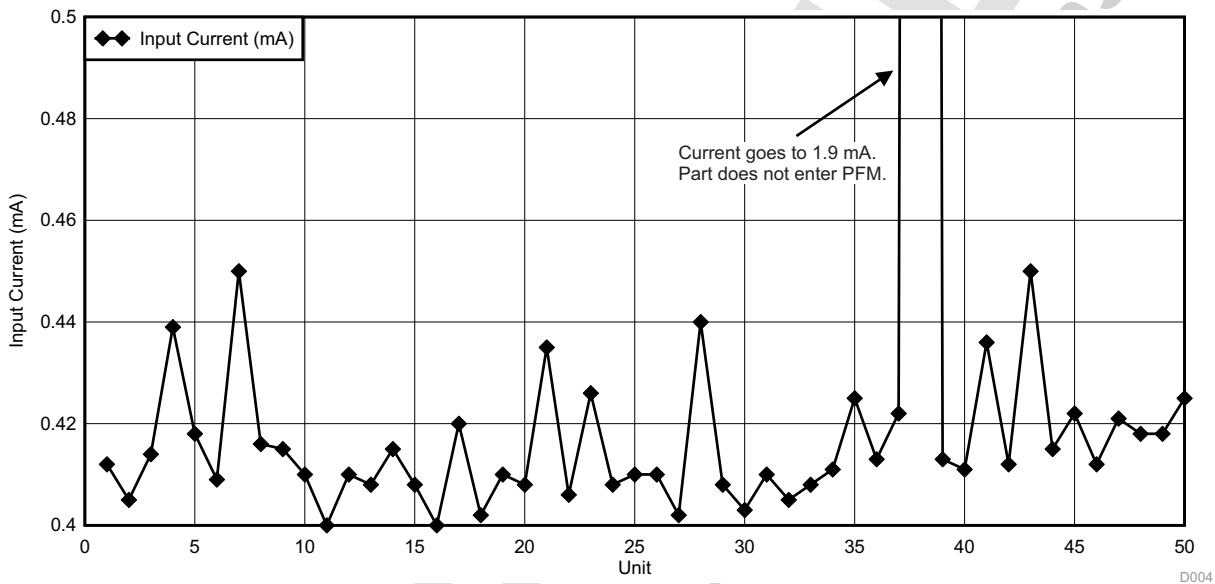


Figure 3. LM43603-Q1 Input current at 8.5VIN and 5VOUT with 0.5mA Standby load

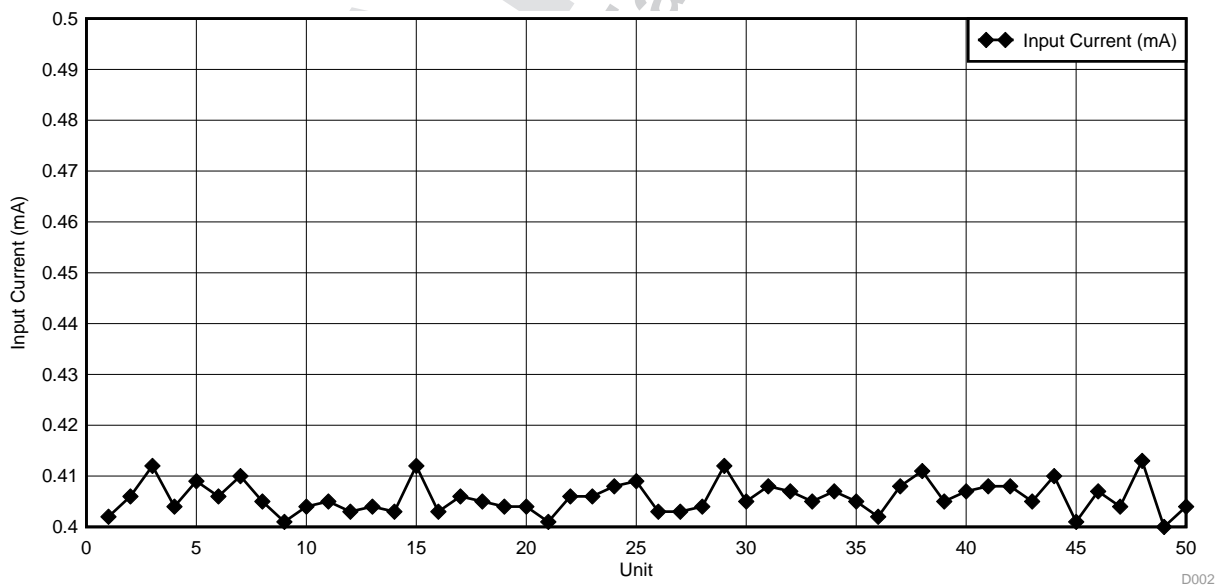


Figure 4. LM43603A-Q1 Input current at 8.5VIN and 5VOUT with 0.5mA Standby load

Therefore as seen from [Figure 4](#) the input current for the A version of the device stays below 0.5 mA and maintaining high efficiency at light load condition.

4 Summary

Based on the test results above, there are some conclusions that can be deduced:

- Whether it's an A or non A version, the VIN PFM entry point is lower when the part is set at lower switching frequency (200kHz compared to 400kHz).
- All the parts will eventually entered PFM mode at light load.
- The A version of the part minimizes the variation of PFM entry point compared to the non-A version

5 References

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