FRONTGRADE

APPLICATION NOTE
UT32M0R500

Board Design Recommendations

12/7/2023
Version #:1.0.1

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Product Name	Manufacturer Part Number	SMD #	Device Type
Arm Cortex M0+	UT32M0R500	5962-17212	01, 02

Table 1: Cross Reference of Applicable Products

1.0 Introduction

This document provides board design recommendations for the UT32M0R500 Arm® M0+ Microcontroller. The UT32M0R500 is a mixed signal microcontroller, meaning it contains both digital and analog functionality. The recommendations in this document are specific to the UT32M0R500, and users should still work with experienced board designers to incorporate these recommendations into the rest of their design.

2.0 Power and Ground Planes

The UT32M0R500 requires 3.3V for both the digital and analog supplies, making it tempting for users to combine the power delivery into a single power rail and ground plane. However, FRONTGRADE recommends users provide separate power rails and ground planes for the UT32M0R500's digital and analog supplies (VDD/VSS and VDDA/VSSA). This will ensure the noise from the digital domain caused by high frequency switching will not impact the performance of the analog domain. To ensure there isn't a difference between the voltage potential of the analog and digital grounds, place a ferrite bead or similar current-limiting component between the two grounds.

> **WARNING:**
>
> **The UT32M0R500 Arm Microcontroller has a reported sensitivity in its startup circuitry as documented in GIDEP GB4-P-23-02.**
>
> **This issue has been reported only on systems that do not separate analog/digital power and ground domains per the guidance above. The sensitivity may manifest in the part not exiting the reset state.**
>
> **As an alternative work-around way of addressing the internal power-on-reset (POR) circuitry's sensitivity, that circuitry may be disabled by setting input pin B11 (POR_SHUTDOWN) to a logic high condition.**
>
> **In that case, the internal power-on-reset (POR) circuitry and its output are bypassed and the external input reset pin K10 (RSTN) will directly control the reset to the microcontroller digital core instead.**
>
> **It is therefore recommended that when designing and implementing a board based on the UT32M0R500 Arm Microcontroller, input pin B11 not be connected directly to ground (ie., it is normally intended to be "Reserved" and set to NUIL= not used input low), but that it be configured to allow it to be able to be pulled up or down (ie., through pull resistors), depending on whether the described workaround is needed or not.**

3.0 Decoupling

Decoupling capacitors between the power and ground pins of a component ensure the supply voltage is kept steady by providing a localized charge source. Place multiple surface-mount decoupling capacitors in a variety of values in parallel directly on the other side of the board from the UT32M0R500. The shortest possible distance is crucial to reduce the size of the current loop created.

4.0 Referencing the UT32M0R500 Evaluation Board

The UT32M0R500 evaluation board can be used as an initial reference for power and ground planes, and for decoupling capacitor values. However, as previously pointed out, this information is specific to the UT32M0R500, and there may need to be adjustments depending on the rest of the board being designed. The evaluation board schematics can be found on the FRONTGRADE website in the UT32M0R500-EVB Users Guide document:

https://frontgrade.com/sites/default/files/documents/App-Note-UT32M0R500-EVB-Users-Guide.pdf

5.0 Conclusion

The recommendations in this document are intended to provide customers with information on the preferred way to power and ground the UT32M0R500. There is a lot of research and differing opinions on board and system level grounding philosophies, and there isn't any one right answer on how to approach every design. Users should reference this recommendation to achieve a better understanding of how to design their overall board and system.

Revision History

Date	Revision #	Author	Change Description	Page #
05/09/2022	1.0.0	OW	Initial Release	
12/7/2023	1.0.1	JB	Added WARNING about risk of not following recommendation for ".. users provide separate power rails and ground planes for the UT32M0R500's digital and analog supplies (VDD/VSS and VDDA/VSSA)."	