



Application Note

Astra™ Machina Foundation Series PMIC Solution and BOM Application Note

Abstract: This application note details the Power Management IC (PMIC) solution for the Astra Machina platform, ensuring efficient power distribution, precise power sequencing, and optimized Bill of Material (BOM) cost.

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1. Overview

The Power Management IC (PMIC) solution for the Astra Machina platform ensures efficient power distribution, precise power sequencing, optimized BOM cost, and improved thermal efficiency. This overview is tailored to the specific needs of the Astra Machina platform.

1.1. Scope Key PMIC requirements

1.1.1. Dynamic Voltage Frequency Scaling (DVFS)

DVFS integration aims to optimize power consumption across varying workloads, ensuring seamless transitions and platform stability during power state changes.

Refer to the FAQ for the DVFS table specific to Astra Machina platforms. <https://synacsm.atlassian.net/servicedesk/customer/kb/view/197066755>

Both I2C-controlled and PWM-controlled PMICs are accepted depending on the design requirements of the Astra Machina platforms.

1.1.2. Sequencing capabilities

Provides flexible and precise power-up and power-down sequencing for all components, with programmable options to adapt future platform requirements.

1.1.3. Maximum current requirements in Commercial application

Table 1. Maximum Current requirements for Astra Platforms

| Power Rail | SL1680(A) | SL1640(A) | SL1620(A) |
|-------------|-----------|-----------|-----------|
| VCPU | 4 | 2.5 | NA |
| VCORE | 4 | 2.5 | 2.5 |
| 3V3 | 1 | 1 | 1 |
| 1V8 | 1 | 1 | 1 |
| Vddm | 1.5 | 0.8 | 0.8 |
| 0.8V for SM | 0.3 | 0.3 | 0.3 |

1.1.4. Power ramp-up rate

Use PMIC registers to define these rates, ensuring they align with the SoC's requirements.

1.2. Suggested PMIC Solutions and BOM Cost

Table 2. SL1680 PMIC Solutions and BOM

| SL1680 Power Rail | Vender | PMIC Cost \$ | | Inductor Cost \$ | | Capacitor Cost \$ | | Total per Board \$ |
|------------------------------|---------|--------------------------------------|----------|------------------|----------|-------------------------------|----------|--------------------|
| VCORE/VCPU | TI | TPS62870Y1QWRXSRQ1 (6A, I2C control) | \$1.8839 | 220nH/16.8A | \$0.2380 | 22uF/6.3V x2 100uF/6.3V x2 | \$0.0825 | \$4.24 |
| | Silergy | SY8827N (6A, I2C control) | \$0.1550 | 330nH/9A | \$0.1081 | 22uF/6.3V x3 | \$0.0132 | \$0.53 |
| 3.3V/1.8V | Silergy | SY8832AIC(2A) | \$0.1309 | 1uH/3.6A x2 | \$0.0440 | 22uF/6.3V x3 10uF/6.3V x7 | \$0.0297 | \$0.17 |
| 3.3V/1.8V for M.2 and DDR | Silergy | SY8832AIC(2A) | \$0.1309 | 1uH/3.6A x2 | \$0.0440 | 22uF/6.3V x3 10uF/6.3V x7 | \$0.0297 | \$0.17 |
| 1.1V | Silergy | SY8859QWC(3A) | \$0.1400 | 1.5uH/3.9A | \$0.0448 | 22uF/6.3V x1 10uF/6.3V x1 | \$0.0068 | \$0.18 |
| 0.6V | Silergy | SY8859QWC(3A) | \$0.1400 | 1.5uH/3.9A | \$0.0448 | 22uF/6.3V x1 10uF/6.3V x1 | \$0.0068 | \$0.18 |
| 0.8V for SM | Richtek | RT9080N-08GJ5(0.6A) | \$0.0662 | | | 10uF/6.3V x3 | \$0.0047 | \$0.07 |

Table 3. SL1640 PMIC Solutions and BOM

| SL1640 Power Rail | Vender | PMIC Cost \$ | | Inductor Cost \$ | | Capacitor Cost \$ | | Total per Board \$ |
|-------------------|------------------|--------------------------------------|----------|------------------|----------|-------------------------------|----------|--------------------|
| VCORE/VCPU | TI | TPS62870Y1QWRXSRQ1 (6A, I2C control) | \$1.8839 | 220nH/16.8A | \$0.2380 | 22uF/6.3V x2 100uF/6.3V x2 | \$0.0825 | \$4.41 |
| | Silergy | SY8827N (6A, I2C control) | \$0.1550 | 330nH/9A | \$0.1081 | 22uF/6.3V x3 10uF/6.3V x2 | \$0.0132 | \$0.55 |
| | Halo | HL7593WL06 (3A, I2C control) | \$0.1350 | 470nH/5A | \$0.0187 | 22uF/6.3V x1 | \$0.0088 | \$0.33 |
| 3.3V/1.8V | Silergy | SY8832AIC(2A) | \$0.1309 | 1uH/3.6A x2 | \$0.0440 | 22uF/6.3V x3 10uF/6.3V x7 | \$0.0297 | \$0.20 |
| 2.5V | ON Semiconductor | NCP114ASN250T1G(0.3A) | \$0.0467 | | | 1uF/10V x2 | \$0.0015 | \$0.05 |
| 1.2V | Silergy | SY8088IAAC(1A) | \$0.0301 | 2.2uH/2.2A | \$0.0700 | 1uF/10V x2 | \$0.0015 | \$0.10 |
| 0.6V VTT | TI | TPS51206DSQR(2A) | \$0.0818 | | | 22uF/6.3V x1 10uF/6.3V x1 | \$0.0068 | \$0.09 |
| 0.8V for SM | Richtek | RT9080N-08GJ5(0.6A) | \$0.0662 | | | 10uF/6.3V x3 | \$0.0047 | \$0.07 |

Table 4. SL1620 PMIC Solutions and BOM

| SL1620 Power Rail | Vender | PMIC Cost \$ | | Inductor Cost \$ | | Capacitor Cost \$ | | Total per Board \$ |
|-------------------|-----------|---------------------------|----------|------------------|----------|------------------------------|----------|--------------------|
| VCORE | Silergy | SY8113C1(3A, PWM control) | \$0.0977 | 1uH/3.1A | \$0.0938 | 10uF/6.3V x3 | \$0.0066 | \$0.20 |
| | Fitepower | FP6359S6(3A, PWM control) | \$0.1019 | 1.2uH/4A | \$0.0941 | 22uF/6.3V x3 | \$0.0132 | \$0.21 |
| | ETA | ETA3519(4A, PWM control) | \$0.0630 | 470nH/5A | \$0.0187 | 22uF/6.3V x4 | \$0.0176 | \$0.10 |
| | Silergy | SY8827N (6A, I2C control) | \$0.1550 | 330nH/9A | \$0.1081 | 22uF/6.3V x3 | \$0.0132 | \$0.28 |
| 3.3V/1.8V | Silergy | SY8832AIC(2A) | \$0.1309 | 1uH/3.6A x2 | \$0.0440 | 22uF/6.3V x3 10uF/6.3V x1 | \$0.0156 | \$0.19 |
| 2.5V | TI | TLV73325PDBVR(0.3A) | \$0.0397 | | | 10uF/6.3V x3 | \$0.0066 | \$0.05 |
| 1.2V | Silergy | SY8088IAAC(1A) | \$0.0301 | 2.2uH/2.2A | \$0.0700 | 10uF/6.3V x3 | \$0.0066 | \$0.11 |

Notes:

All BOM costs are evaluated based on a reference quantity of 10K units.

The purpose of using the TI solution (TPS62870, 6A) on the SL1680/1640 and the SY8827N (6A) on the SL1620 RDK reference design is to support industrial applications, which requires higher current than regular commercial applications. TI also offers another PMIC, the TPS62871 (9A), which is pin-to-pin compatible with the TPS62870.

1.3. Software and Register Configurations (If Applicable)

- Software needs to configure the slew rate to ensure stability during transitions.
- I2C-controlled PMICs is to configure register; PWM-controlled PMICs is to configure the PWM duty-cycle.

2. References

- *Astra Machina Foundation Series Quick Start Guide* (PN: 511-001404-01)
- *Astra Machina SL1620 Developer Kit User Guide* (PN: 511-001407-01)
- *Astra Machina SL1640 Developer Kit User Guide* (PN: 511-001405-01)
- *Astra Machina SL1680 Developer Kit User Guide* (PN: 511-001403-01)
- TI TPS62870 datasheet
https://www.ti.com/lit/ds/symlink/tps62870.pdf?ts=1736494605802&ref_url=https%253A%252F%252Fwww.ti.com%252Fproduct%252FTPS62870
- Silergy SY8832AIC Datasheet
https://uploadcdn.oneyac.com/upload/document/1726727059666_7395.pdf
- Silergy SY8859QWC Datasheet
<https://www.silergy.com/download/downloadFile?id=3773&type=product&ftype=datasheet>
- Richtek RT9080N Datasheet
https://www.mouser.com/datasheet/2/1458/DS9080_08-3104923.pdf?srsId=AfmBOoq_hD2JEK5A_mHvjOWGplaywNcYob2U2Uz4u42xeSSoiwHRNaOc
- Halo HL7593WLO6 Datasheet
https://www.mouser.com/datasheet/2/1059/20190722141914_27878-1854212.pdf?srsId=AfmBOook4q_lxnvwjDNMwOBLrLmVljcsCtqEOXyld2-kOJpec6yMCL6
- On Semiconductor NCP114 Datasheet
https://www.mouser.com/datasheet/2/308/NCP114_D-1114414.pdf
- Silergy SY8088IAAC Datasheet
https://www.lcsc.com/datasheet/lcsc_datasheet_2001171834_Silergy-Corp-SY8088IAAC_C479072.pdf
- TI TPS51206 Datasheet
https://www.ti.com/lit/ds/symlink/tps51206.pdf?ts=1736495877879&ref_url=https%253A%252F%252Fwww.google.com%252F
- Silergy SY8113C1 Datasheet
<https://us1.silergy.com/download/downloadFile?id=3842&type=product&ftype=note>
- Fitipower FP6359S6 Datasheet
https://www.lcsc.com/datasheet/lcsc_datasheet_2211081730_Fitipower-Integrated-Tech-FP6359S6_C5162509.pdf
- TI TLV73325PDBVR Datasheet
https://www.ti.com/lit/ds/symlink/tlv733p.pdf?ts=1736496143572&ref_url=https%253A%252F%252Fwww.mouser.com%252F

3. Revision History

| Revision | Description |
|----------|------------------------------------|
| A | Initial release. |
| B | Minor update to trademarked items. |

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