

LMZ1420x / LMZ1200x Evaluation Board

National Semiconductor
Application Note 2024
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Introduction

The LMZ1420x and LMZ1200x SIMPLE SWITCHER® power modules are easy-to-use DC-DC solution capable of driving up to a 3A load with exceptional power conversion efficiency, output voltage accuracy, line and load regulation. They are available in an innovative package that enhances thermal performance and allows for hand or machine soldering.

The LMZ14203/2/1 can accept an input voltage rail between 6V and 42V and the LMZ12003/2/1 can accept an input voltage rail between 4.5V and 20V. The devices can deliver an adjustable and highly accurate output voltage as low as 0.8V and as high as 6V. The control structure is constant on-time with input voltage feed forward. This creates a nearly constant switching frequency across the input voltage range. The control loop operates well with low ESR output capacitors such as ceramics. An output feed-forward capacitor across the upper feedback resistor trims for optimum transient response. The precision enable input allows for programmable UVLO of the input supply. The external soft-start capacitor facilitates controlled startup output rise time. The LMZ1420x and LMZ1200x family is a reliable and robust solution with the following features: lossless cycle-by-cycle valley current limit to protect for over current or short-circuit fault, thermal shut-down, input under-voltage lock-out, and will start up into a pre-biased output.

Board Specifications

- LMZ1420x V_{IN} = 6V to 42V
- LMZ1420x enable UVLO = 8V
- LMZ1420x V_{OUT} = 3.3V
- LMZ1200x V_{IN} = 4.5V to 20V
- LMZ1200x enable UVLO = 4.5V
- LMZ1200x V_{OUT} = 1.8V
- Operates at full load up to 80°C ambient at 12V input
- θ_{JA} = 20°C / W, θ_{JC} = 1.9°C / W
- Designed on four layers, all four layers are 1 oz. copper weight
- The two internal ground planes are identical
- Measures 1.705 in. x 3.03 in. (4.33 cm x 7.7cm) and is 62mil (.062") thick of FR4 laminate material

For additional circuit modifications refer to the Design Consideration section of the LMZ1420x or LMZ1200x data sheet.

Additional Footprints

Additional component mounting pads are available to experiment with alternative C_{in} and C_{out} combinations or a zener clamp on the enable input.

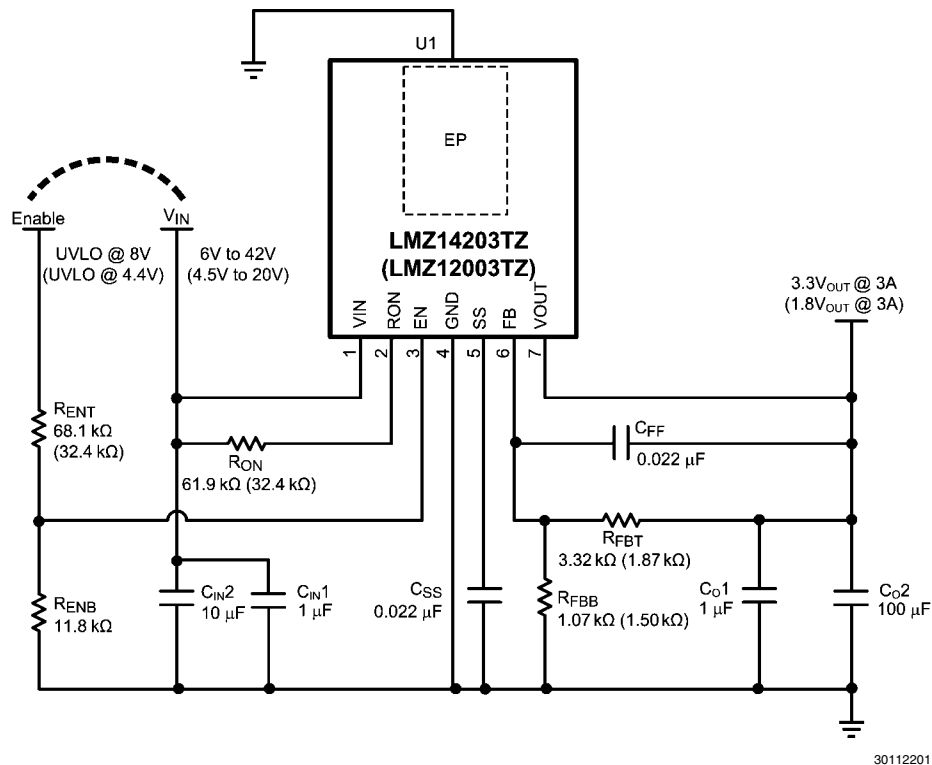


FIGURE 1. Evaluation Board Schematic
(LMZ12003 1.8V application values shown in parentheses)

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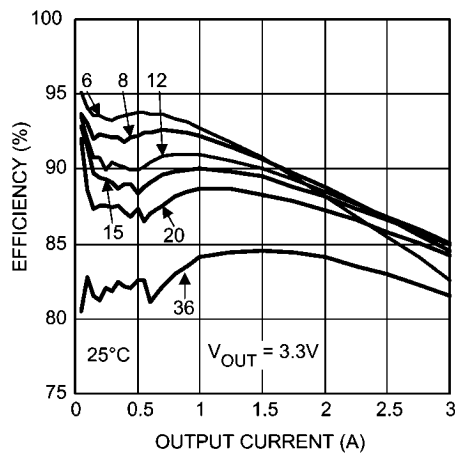
TABLE 1. LMZ14203 Bill of Materials, $V_{IN} = 8V$ to $42V$, $V_{OUT} = 3.3V$, $I_{OUT(MAX)} = 3A$

Designator	Description	Case Size	Manufacturer	Manufacturer P/N	Quantity
U1	SIMPLE SWITCHER®	TO-PMOD-7	National Semiconductor	LMZ14203TZ-ADJ	1
C_{IN4}, C_{O1}	1 μF , X7R, 50V	1206	Taiyo Yuden	UMK316B7105KL-T	2
C_{IN2}	10 μF , X5R, 50V	1210	Taiyo Yuden	UMK325BJ106MM-T	1
C_{O2}	100 μF , X5R, 6.3V	1210	Taiyo Yuden	JMK325BJ107MM-T	1
C_{SS}, C_{FF}	.022 μF , X7R, 100V	0805	AVX	08051C223JAT2A	2
R_{ENB}	11.8k	0805	Panasonic	ERJ-6ENF1182V	1
R_{ENT}	68.1 k Ω	0805	Panasonic	ERJ-6ENF6812V	1
R_{FBT}	3.32 k Ω	0805	Vishay-Dale	CRCW08053K32FKEA	1
R_{FBB}	1.07 k Ω	0805	Panasonic	CRCW080534K8FKEA	1
R_{ON}	61.9 k Ω	0805	Panasonic	ERJ-6ENF6192V	1

TABLE 2. LMZ12003 Bill of Materials, $V_{IN} = 4.5$ to $20V$, $V_{OUT} = 1.8V$, $I_{OUT(MAX)} = 3A$

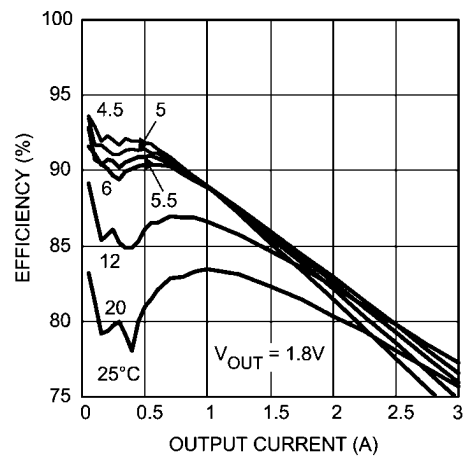
Designator	Description	Case Size	Manufacturer	Manufacturer P/N	Quantity
U1	SIMPLE SWITCHER®	TO-PMOD-7	National Semiconductor	LMZ12003TZ-ADJ	1
C_{IN4}, C_{O1}	1 μF , X7R, 50V	1206	Taiyo Yuden	UMK316B7105KL-T	2
C_{IN2}	10 μF , X5R, 50V	1210	Taiyo Yuden	UMK325BJ106MM-T	1
C_{O2}	100 μF , X5R, 6.3V	1210	Taiyo Yuden	JMK325BJ107MM-T	1
C_{SS}, C_{FF}	.022 μF , X7R, 100V	0805	AVX	08051C223JAT2A	2
R_{ENB}	11.8k	0805	Panasonic	ERJ-6ENF1182V	1
R_{ENT}	32.4K Ω	0805	Panasonic	ERJ-6ENF3242V	1
R_{FBT}	1.87 k Ω	0805	Vishay-Dale	CRCW08051K87FKEA	1
R_{FBB}	1.50 k Ω	0805	Panasonic	CRCW08051K50FKEA	1
R_{ON}	32.4K Ω	0805	Panasonic	ERJ-6ENF3242V	1

Performance Characteristics



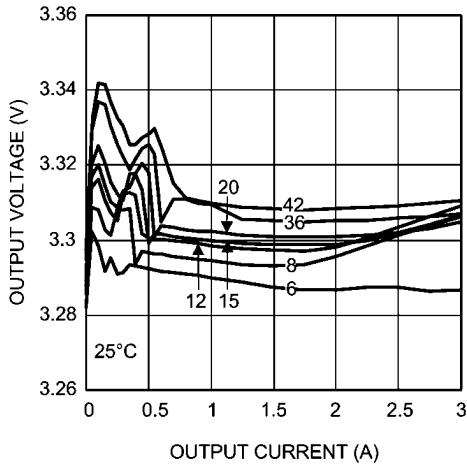
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FIGURE 2. LMZ14203 Efficiency vs. Load Current



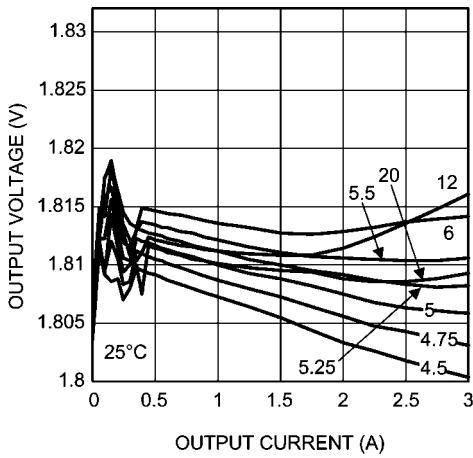
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FIGURE 3. LMZ12003 Efficiency vs. Load Current



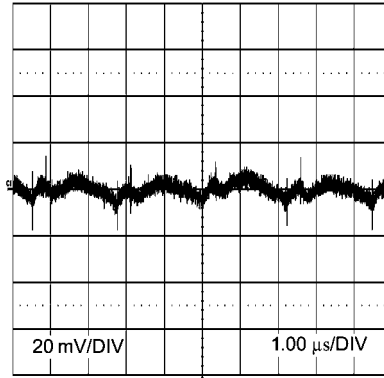
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FIGURE 4. LMZ14203 Load Regulation



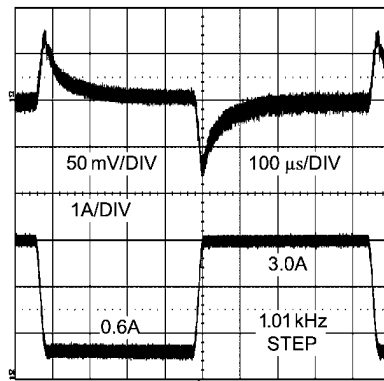
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FIGURE 5. LMZ12003 Load Regulation



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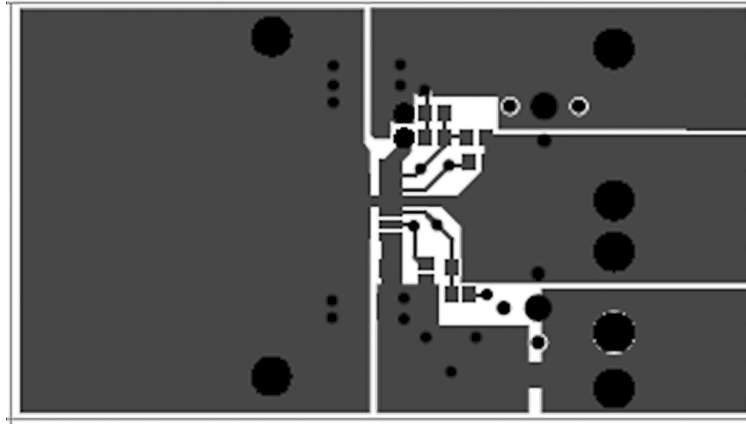
FIGURE 6. LMZ14203 Output Ripple $V_{OUT} = 3.3V$
 $I_{OUT} = 3A$, $BW = 200MHz$



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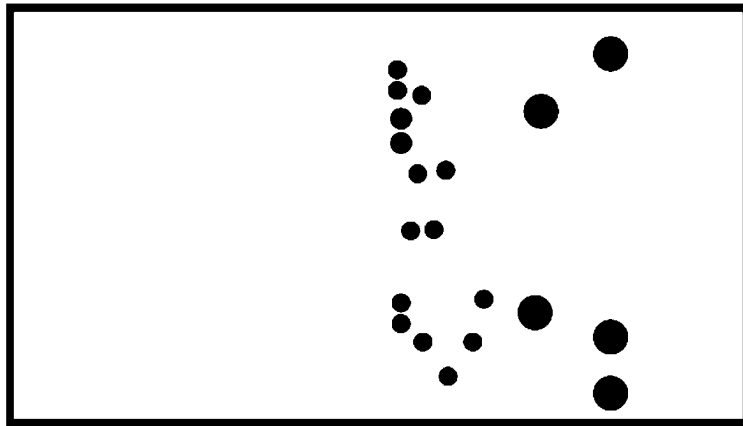
FIGURE 7. LMZ14203 Transient Response
 $24V_{IN}$, $3.3V_{OUT}$, $0.6A$ to $3A$ Step

PCB Layout Diagram(s)



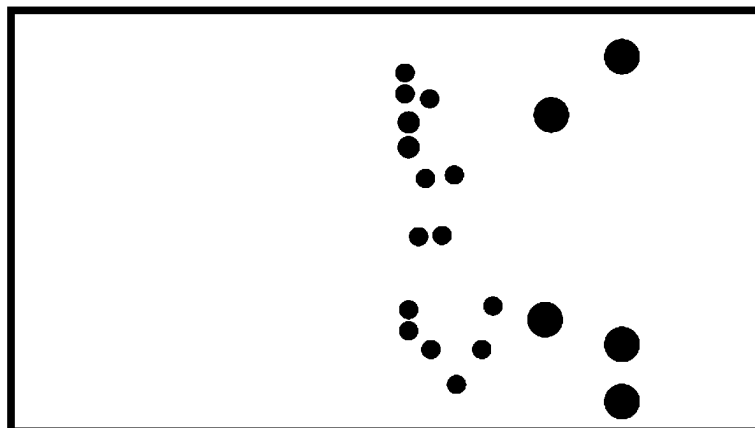
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FIGURE 8. Top Layer



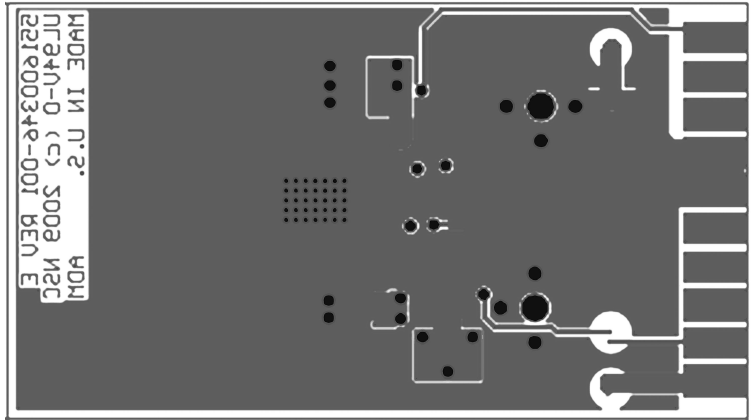
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FIGURE 9. Internal Layer I (Ground)



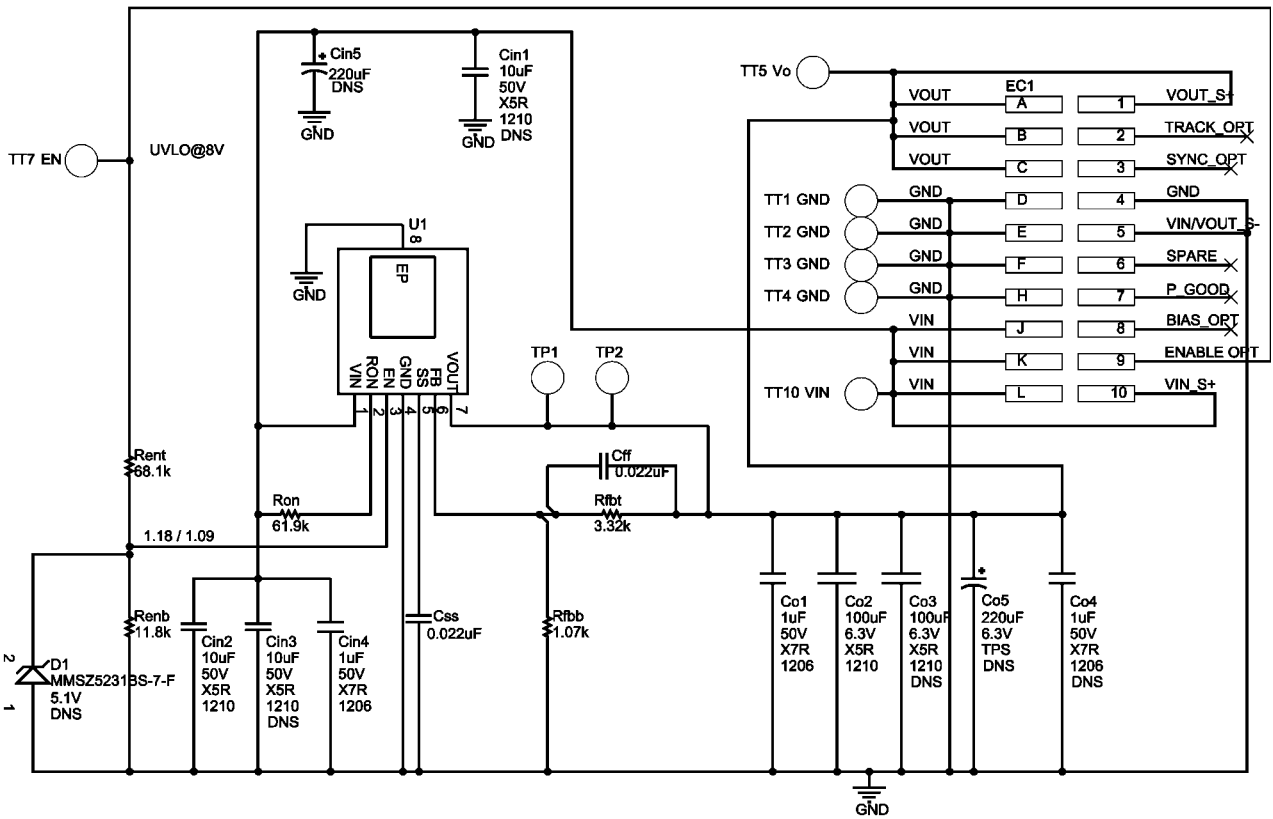
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FIGURE 10. Internal Layer II (Ground)
Heat Sinking Layer



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FIGURE 11. Bottom Layer Heat Sinking Layer



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FIGURE 12. LMZ14203 PCB CAD package schematic
DNS = Component not installed

Notes

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