AN-2024 LMZ1420x / LMZ1200x Evaluation Board

1 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 shutdown, input under-voltage lock-out, and will start up into a pre-biased output.

2 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 see the *Design Consideration* section in the device-specific data sheet. For negative output voltage connections, see *AN-2027 Inverting Application for the LMZ14203 SIMPLE SWITCHER® Power Module* (SNVA425).

3 Additional Footprints

Additional component mounting pads are available to experiment with alternative Cin and Cout combinations or a zener clamp on the enable input. for corresponding schematic locations, see Figure 6.

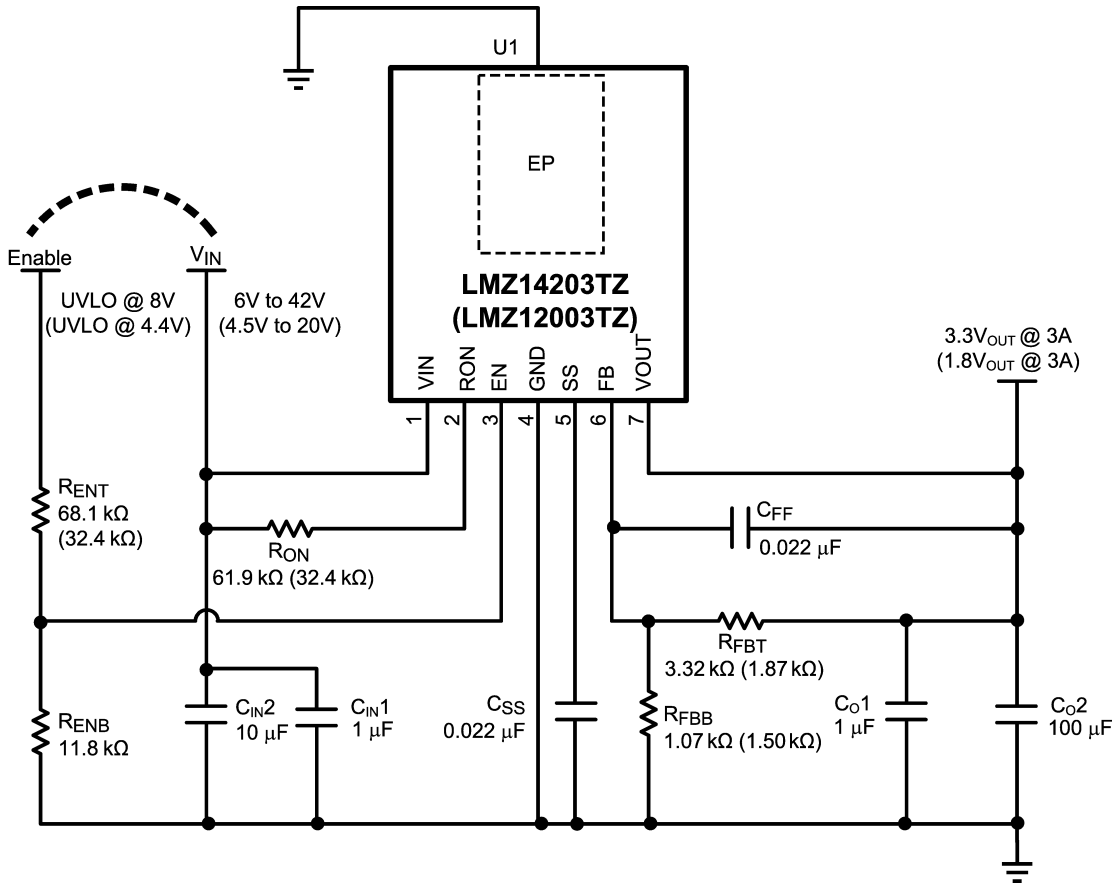


Figure 1. Evaluation Board Schematic
(LMZ12003 1.8V application values shown in parentheses)

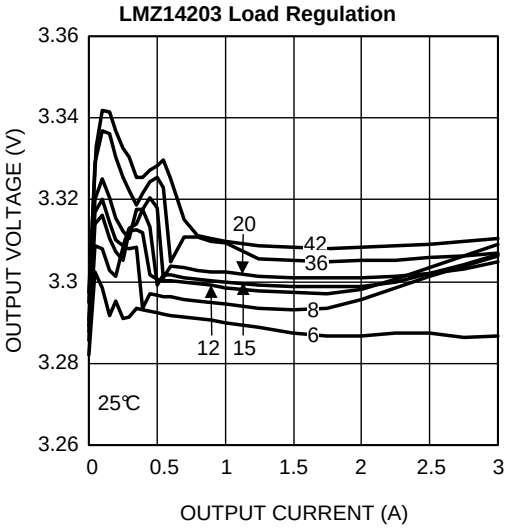
Table 1. LMZ1420x Bill of Materials (BOM), V_{IN} = 8V to 42V, V_{OUT} = 3.3V, $I_{OUT\ (MAX)}$ = 3A / 2A / 1A

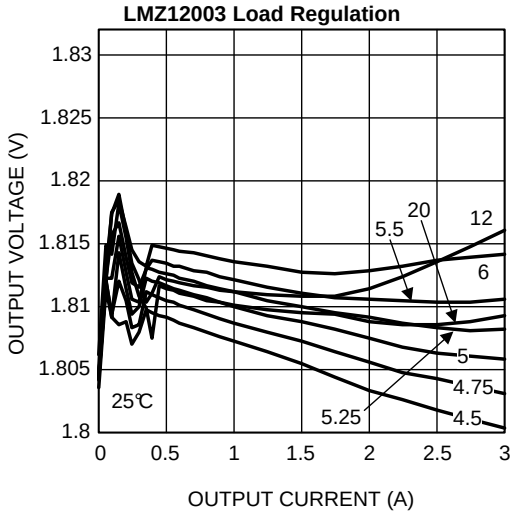
Designator	Description	Case Size	Manufacturer	Manufacturer P/N	Quantity
U1	SIMPLE SWITCHER®	PFM-7	Texas Instruments	LMZ14203 or LMZ14202 or LMZ14201	1
C_{IN4}, C_{O1}	1 µF, X7R, 50V	1206	Taiyo Yuden	UMK316B7105KL-T	2
C_{IN2}	10 µF, X5R, 50V	1210	Taiyo Yuden	UMK325BJ106MM-T	1
C_{O2}	100 µF, X5R, 6.3V	1210	Taiyo Yuden	JMK325BJ107MM-T	1
C_{SS}, C_{FF}	0.022 µF, X7R, 100V	0805	AVX	08051C223JAT2A	2
R_{ENB}	11.8k	0805	Panasonic	ERJ-6ENF1182V	1
R_{ENT}	68.1 kΩ	0805	Panasonic	ERJ-6ENF6812V	1
R_{FBT}	3.32 kΩ	0805	Vishay-Dale	CRCW08053K32FKEA	1
R_{FBB}	1.07 kΩ	0805	Panasonic	CRCW080534K8FKEA	1
R_{ON}	61.9 kΩ	0805	Panasonic	ERJ-6ENF6192V	1

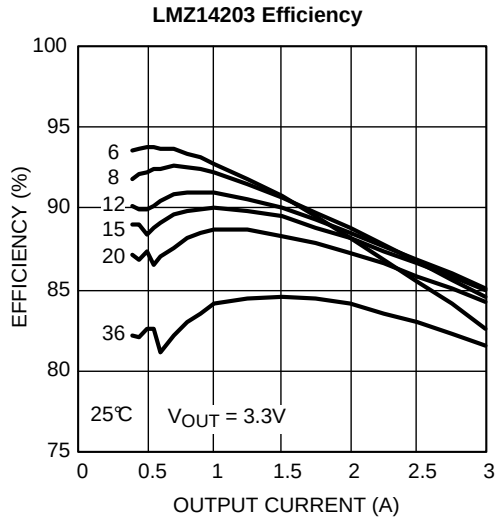
Table 2. LMZ1200x Bill of Materials (BOM), V_{IN} = 4.5 to 20V, V_{OUT} = 1.8V, $I_{OUT\ (MAX)}$ = 3A / 2A / 1A

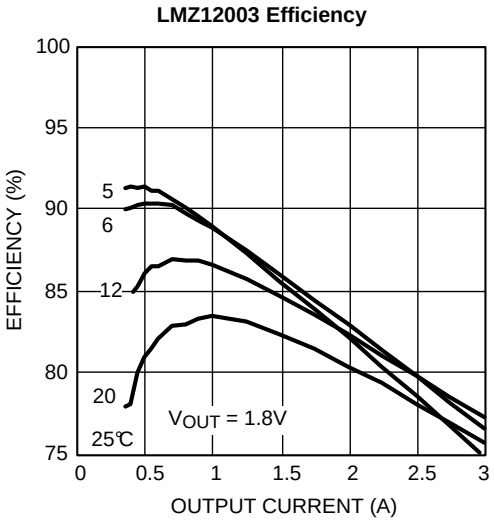
Designator	Description	Case Size	Manufacturer	Manufacturer P/N	Quantity
U1	SIMPLE SWITCHER®	PFM-7	Texas Instruments	LMZ12003 or LMZ12002 or LMZ12001	1
C_{IN4}, C_{O1}	1 µF, X7R, 50V	1206	Taiyo Yuden	UMK316B7105KL-T	2
C_{IN2}	10 µF, X5R, 50V	1210	Taiyo Yuden	UMK325BJ106MM-T	1
C_{O2}	100 µF, X5R, 6.3V	1210	Taiyo Yuden	JMK325BJ107MM-T	1
C_{SS}, C_{FF}	0.022 µF, X7R, 100V	0805	AVX	08051C223JAT2A	2
R_{ENB}	11.8k	0805	Panasonic	ERJ-6ENF1182V	1
R_{ENT}	32.4KΩ	0805	Panasonic	ERJ-6ENF3242V	1
R_{FBT}	1.87 kΩ	0805	Vishay-Dale	CRCW08051K87FKEA`	1
R_{FBB}	1.50 kΩ	0805	Panasonic	CRCW08051K50FKEA	1
R_{ON}	32.4KΩ	0805	Panasonic	ERJ-6ENF3242V	1

4 Performance Characteristics

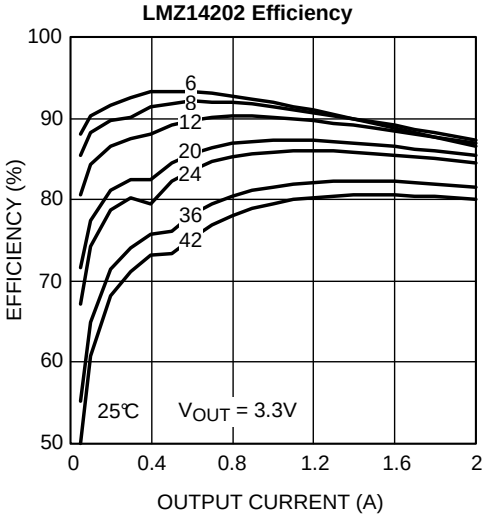




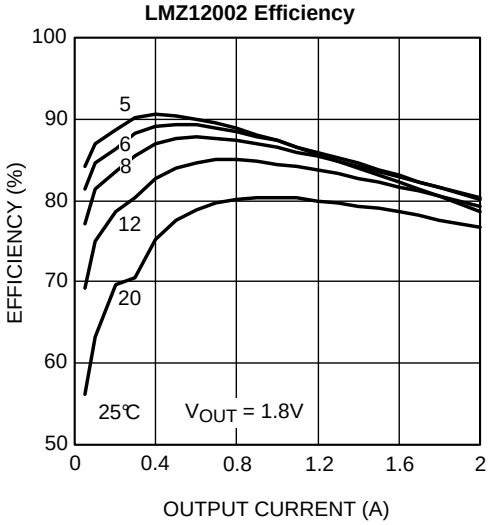




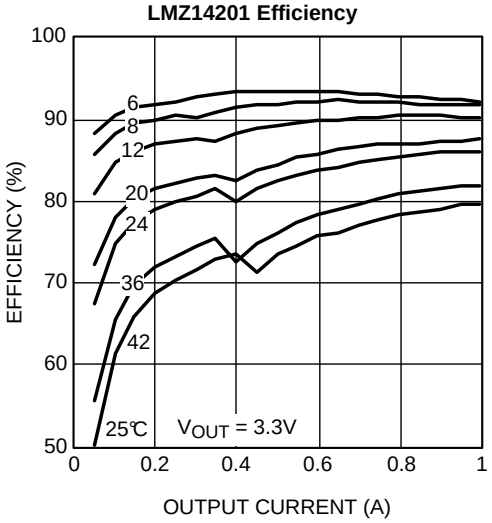
LMZ14202 Efficiency



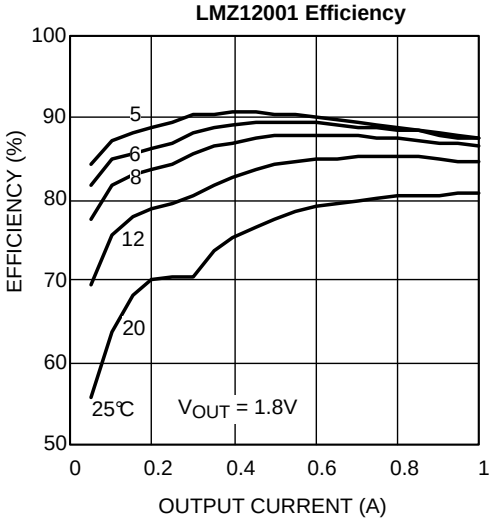
LMZ12002 Efficiency



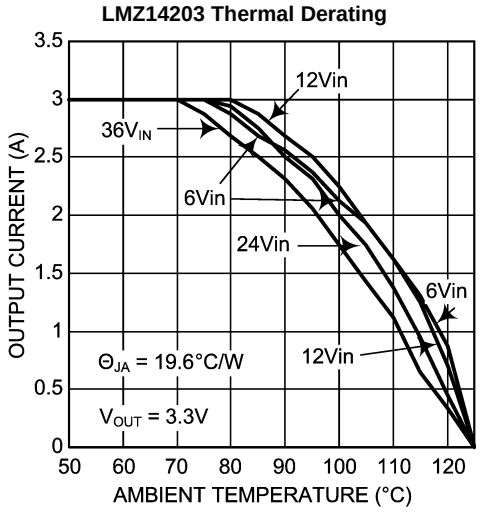
LMZ14201 Efficiency



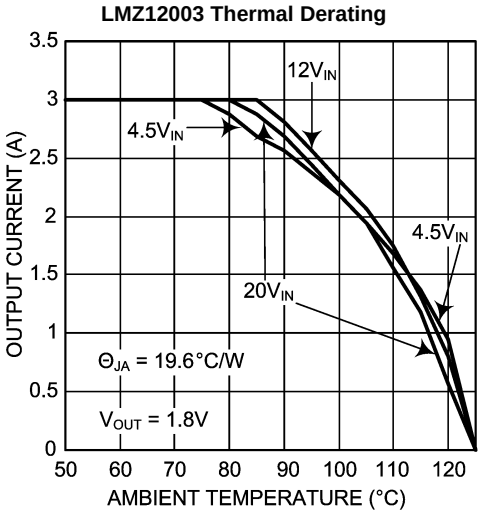
LMZ12001 Efficiency



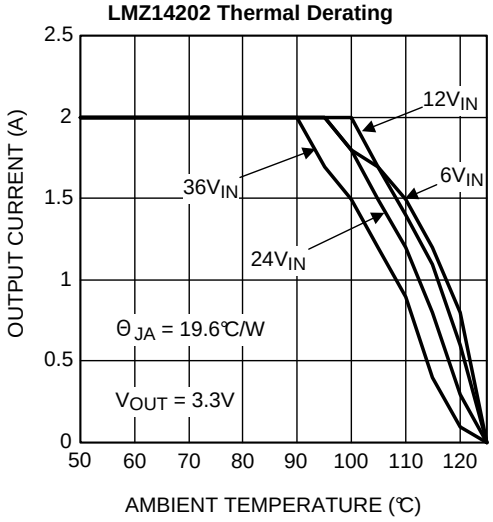
LMZ14203 Thermal Derating



LMZ12003 Thermal Derating



LMZ14202 Thermal Derating



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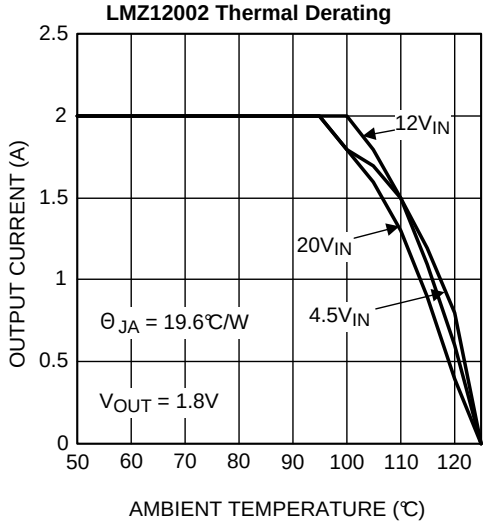
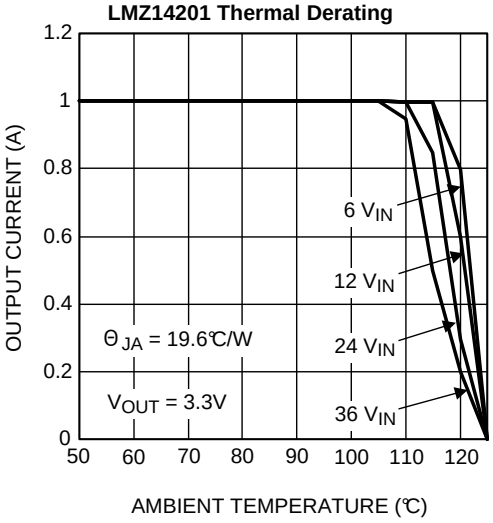
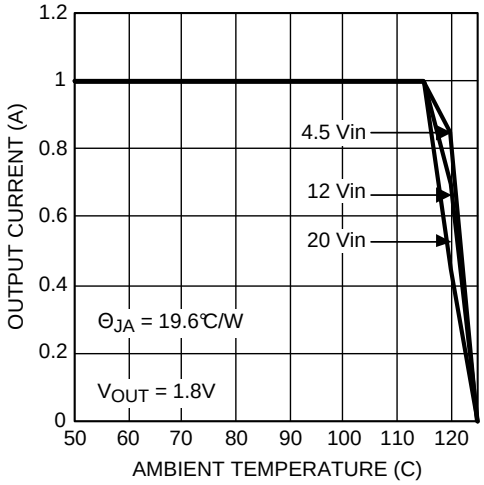


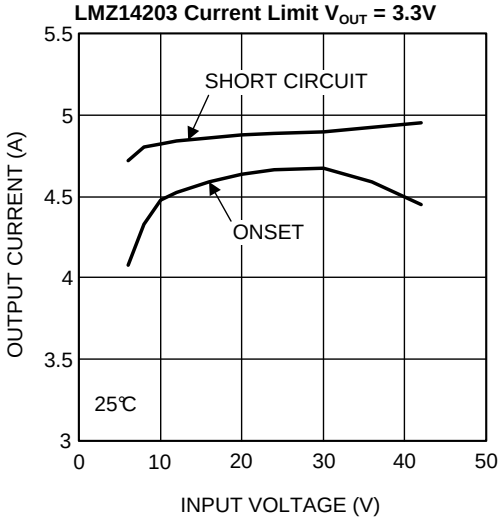
LMZ14201 Thermal Derating



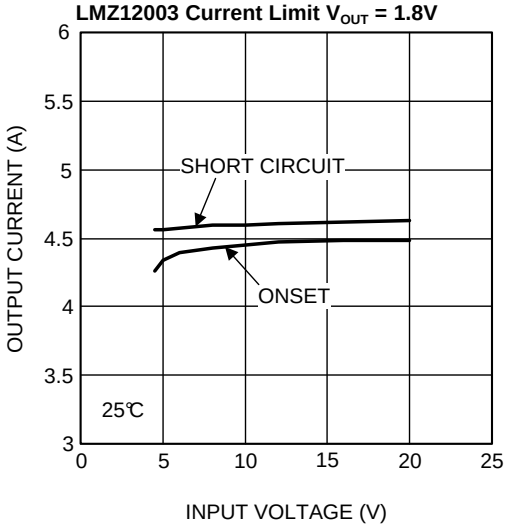
LMZ12001 Thermal Derating



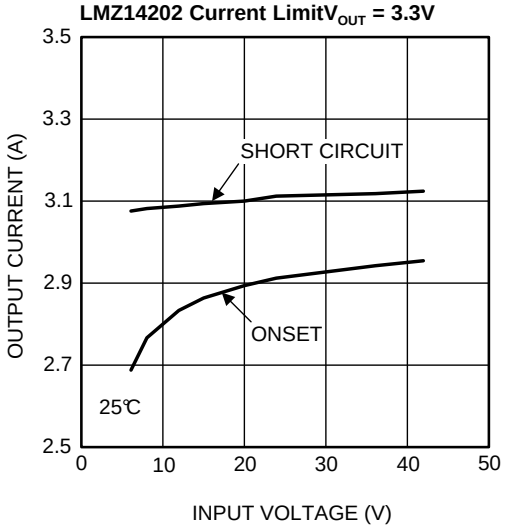
LMZ14203 Current Limit V_{OUT} = 3.3V



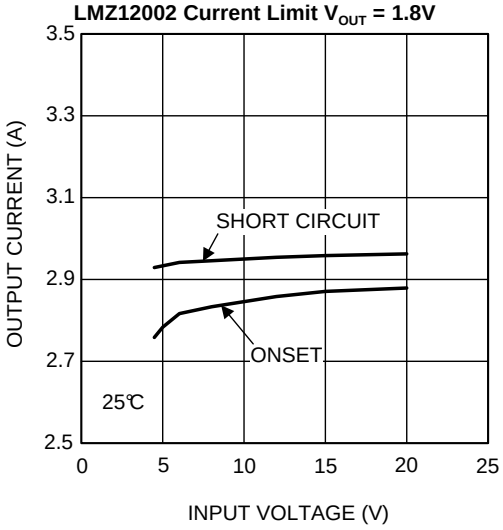
LMZ12003 Current Limit V_{OUT} = 1.8V



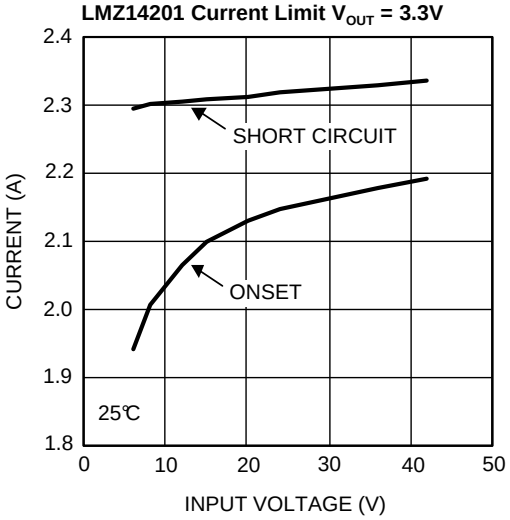
LMZ14202 Current LimitV_{OUT} = 3.3V



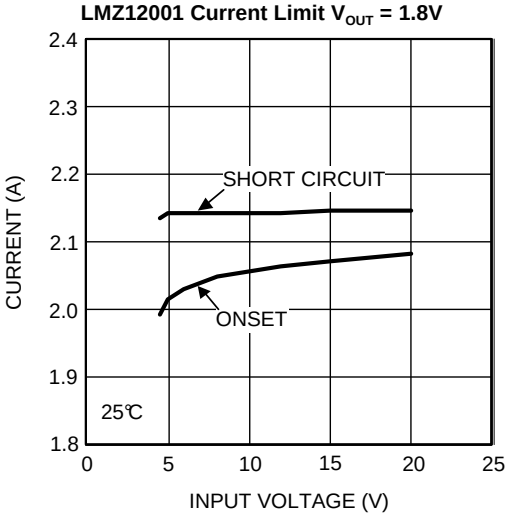
LMZ12002 Current Limit V_{OUT} = 1.8V



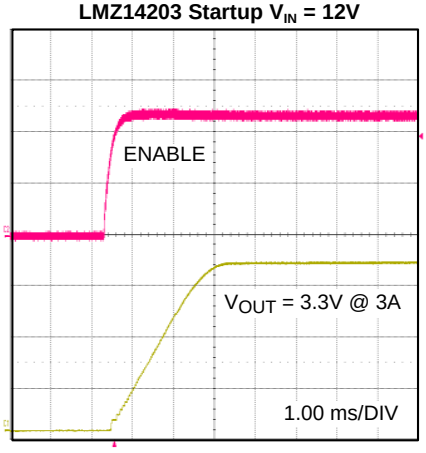
LMZ14201 Current Limit V_{OUT} = 3.3V



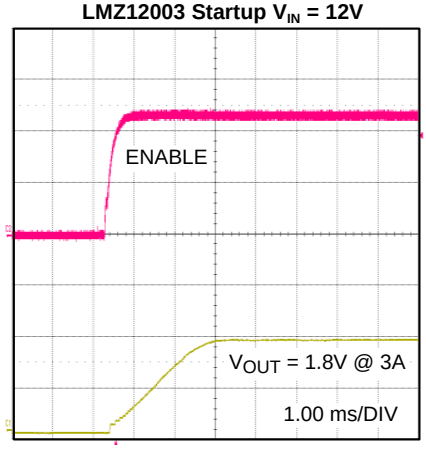
LMZ12001 Current Limit V_{OUT} = 1.8V



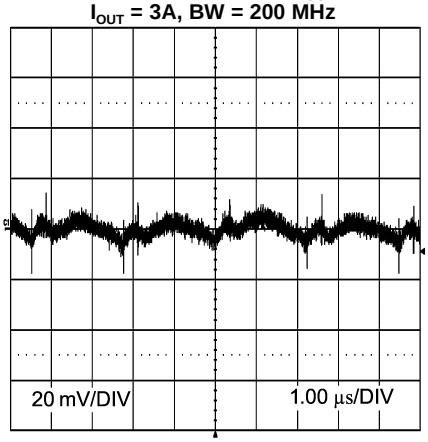
LMZ14203 Startup V_{IN} = 12V



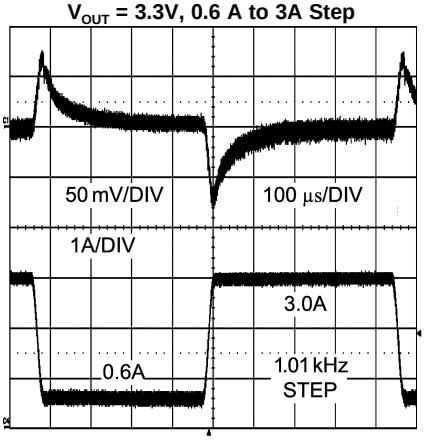
LMZ12003 Startup V_{IN} = 12V



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



LMZ14203 Transient Response V_{IN} = 24V
V_{OUT} = 3.3V, 0.6 A to 3A Step



5 PCB Layout Diagrams

Gerber and CAD files can be download from the LMZ14203 product folder.

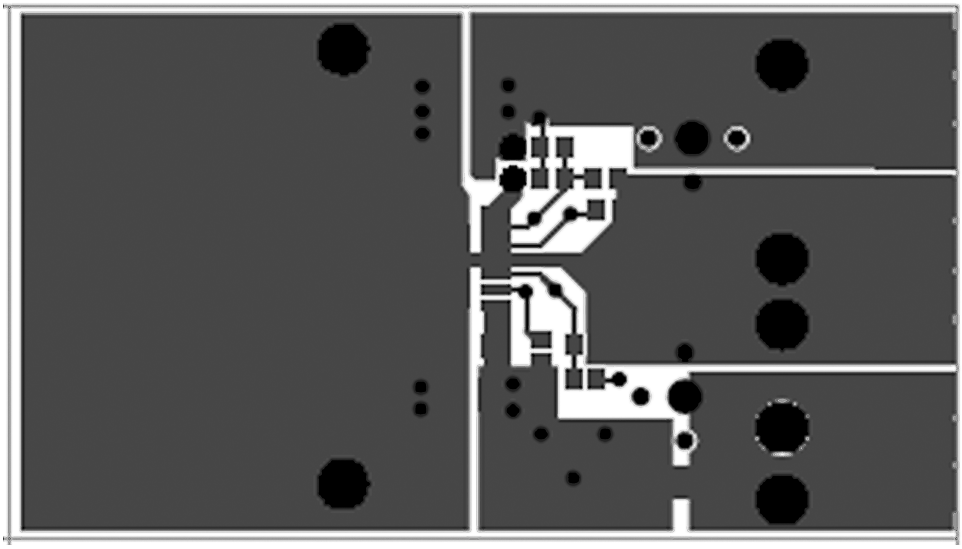


Figure 2. Top Layer

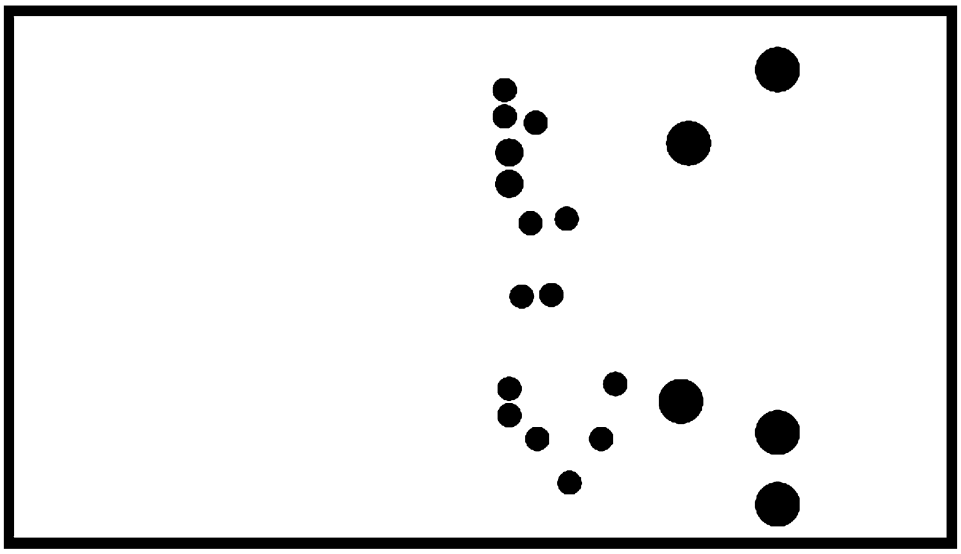


Figure 3. Internal Layer I (Ground)
Heat Sinking Layer

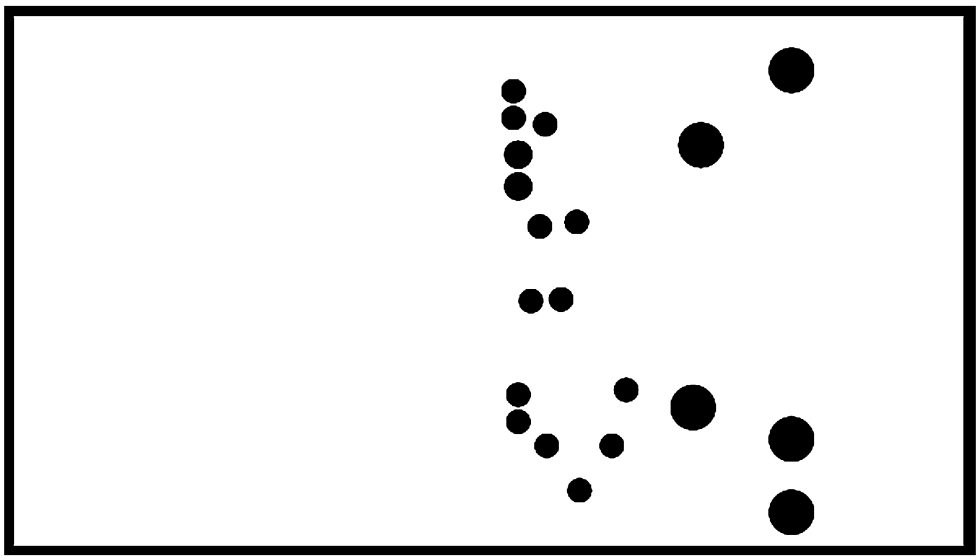


Figure 4. Internal Layer II (Ground)
Heat Sinking Layer

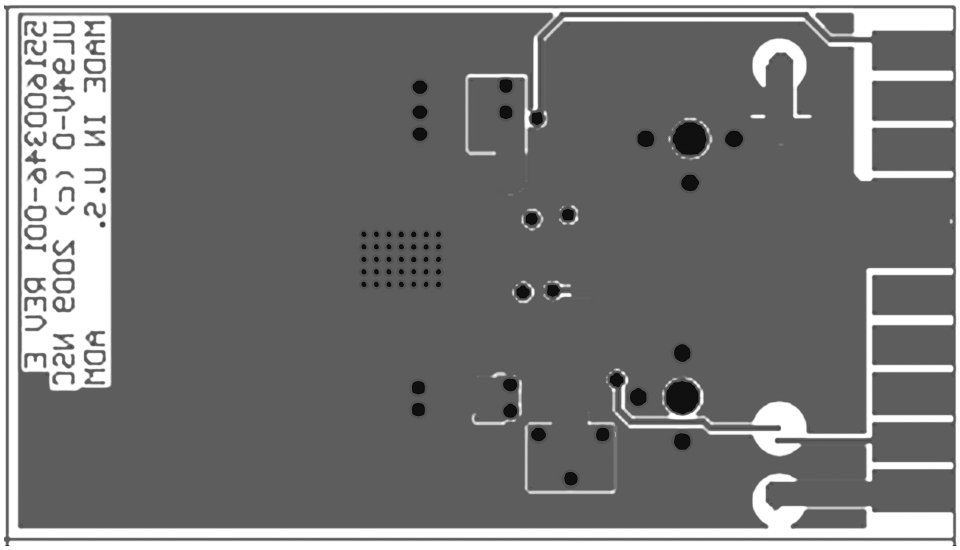


Figure 5. Bottom Layer (Ground and Routing)
Heat Sinking Layer

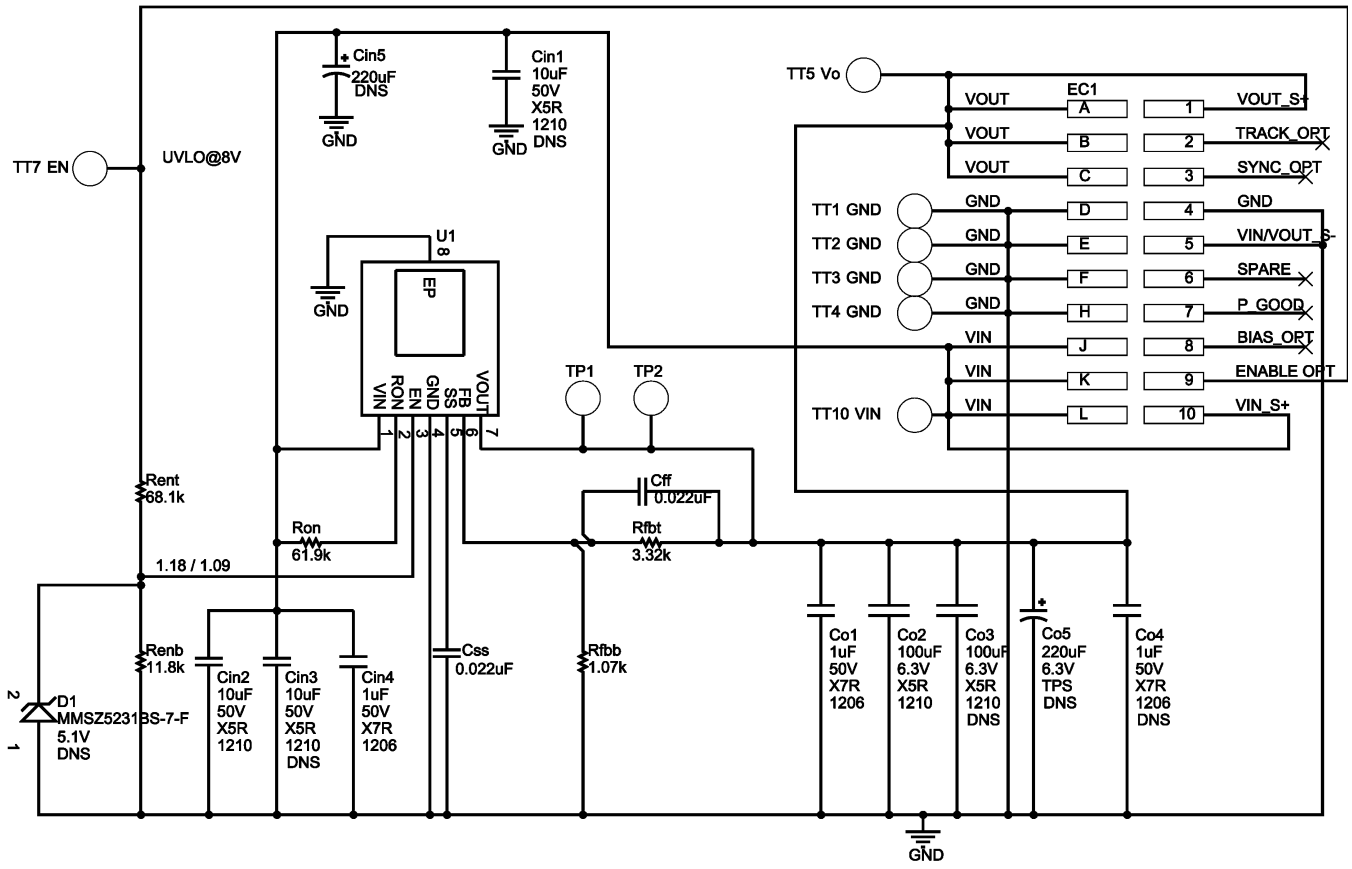


Figure 6. LMZ14203 PCB CAD Package Schematic DNS = Component Not Installed

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