

## **AN-2024 LMZ1420x / LMZ1200x Evaluation Board**

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### **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.

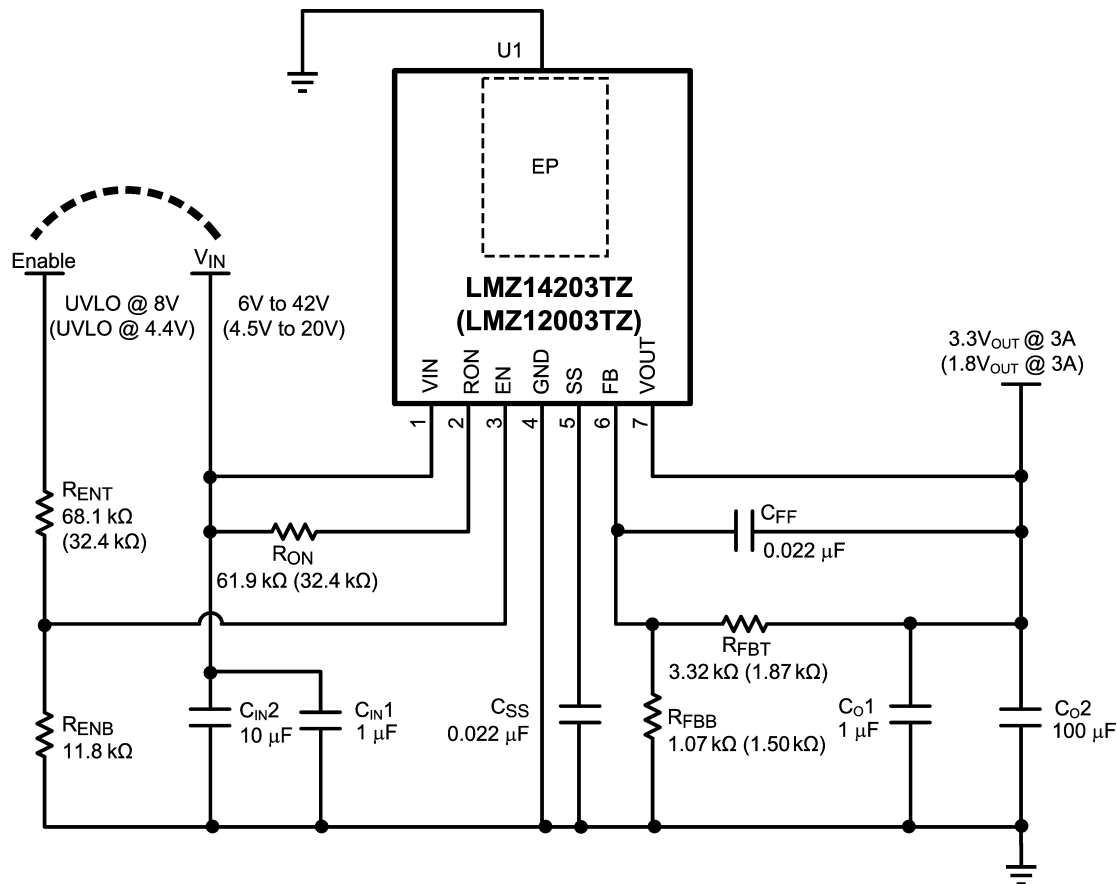
### **2 Board Specifications**

- 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
- $\theta_{JA}$  = 20°C / W,  $\theta_{JC}$  = 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  $C_{in}$  and  $C_{out}$  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)

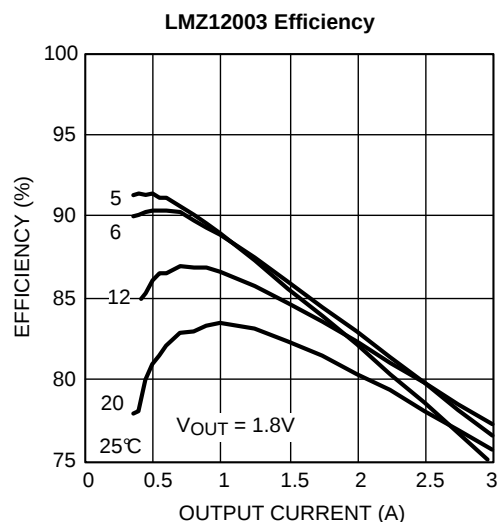
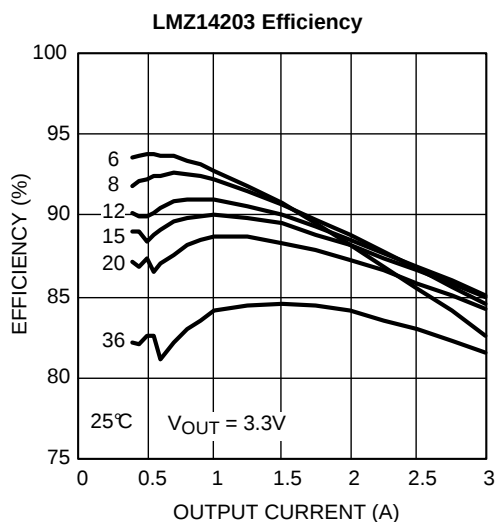
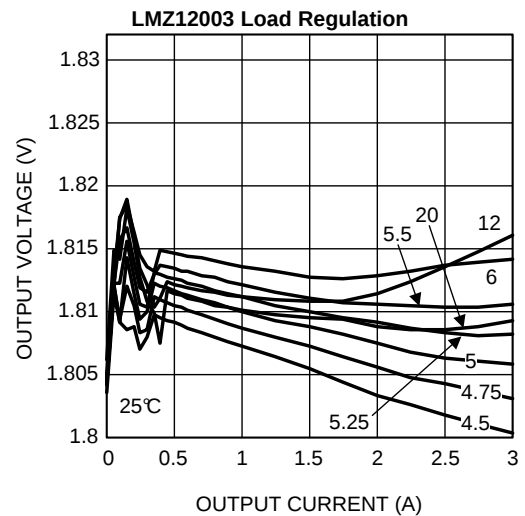
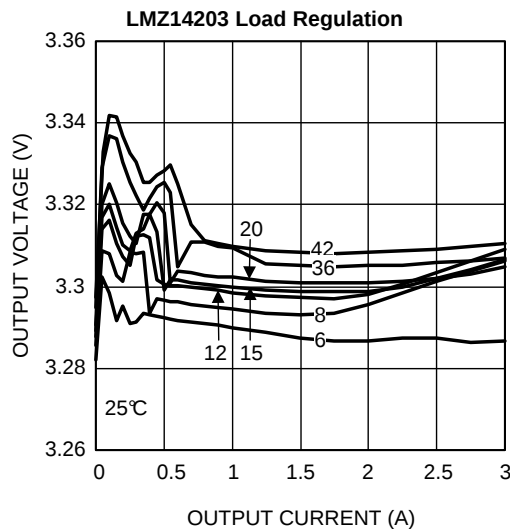
**Table 1. LMZ1420x Bill of Materials (BOM),  $V_{IN} = 8V$  to  $42V$ ,  $V_{OUT} = 3.3V$ ,  $I_{OUT (MAX)} = 3A / 2A / 1A$**

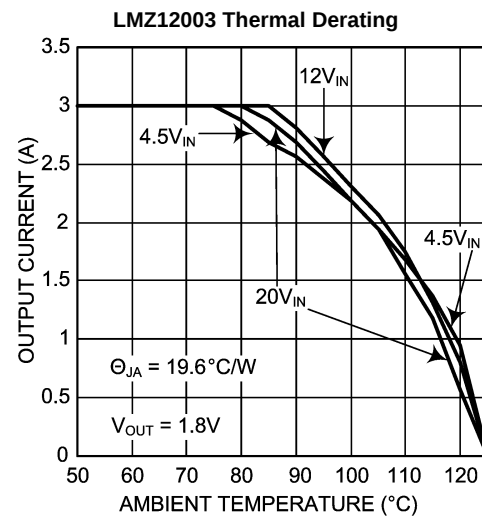
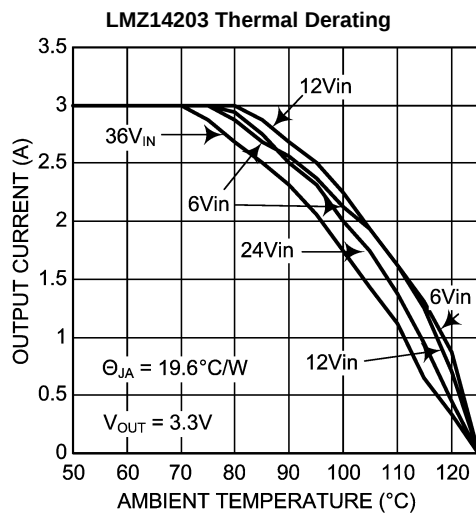
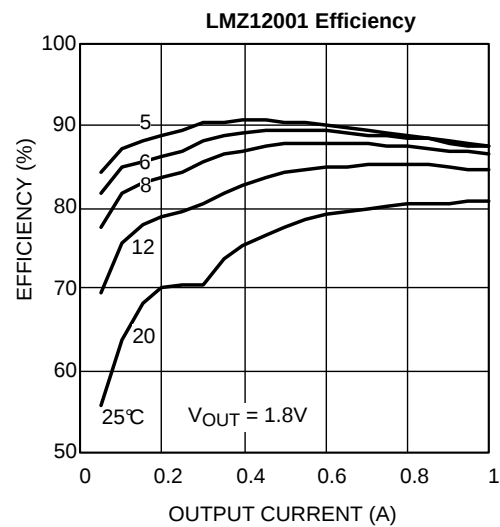
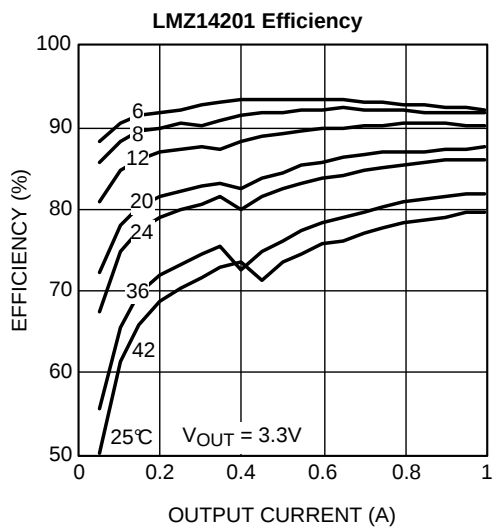
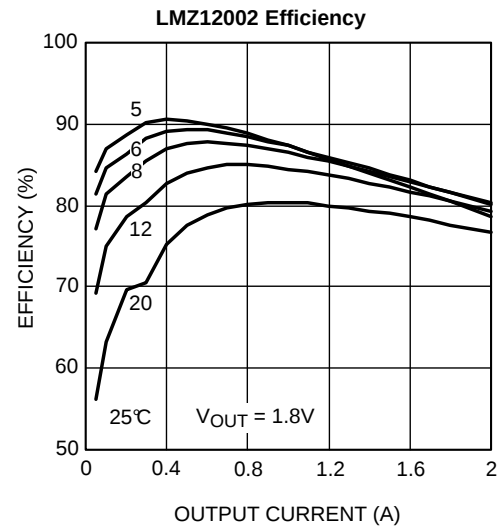
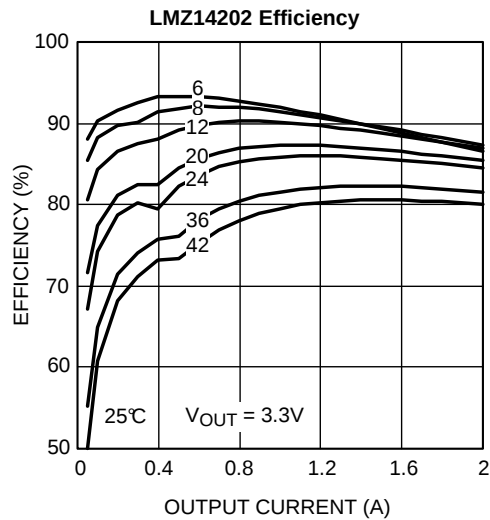
| Designator        | Description               | Case Size | Manufacturer      | Manufacturer P/N                       | Quantity |
|-------------------|---------------------------|-----------|-------------------|----------------------------------------|----------|
| U1                | SIMPLE SWITCHER®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

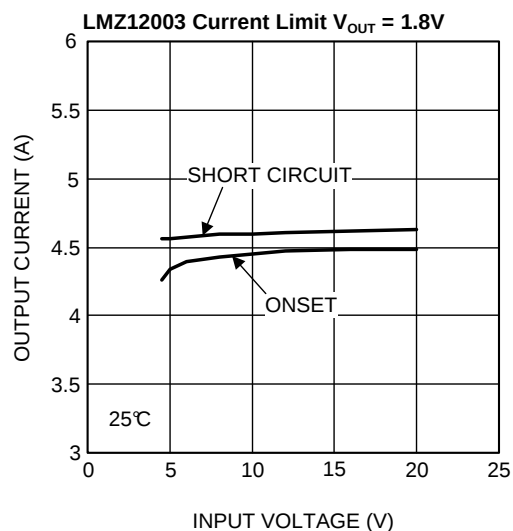
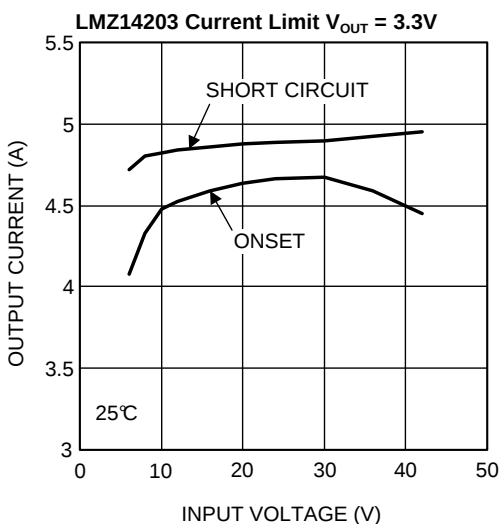
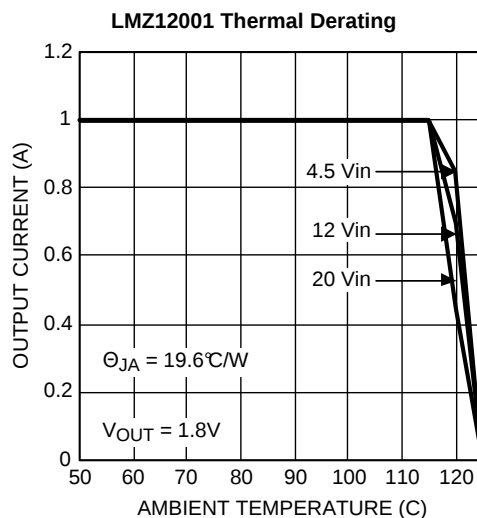
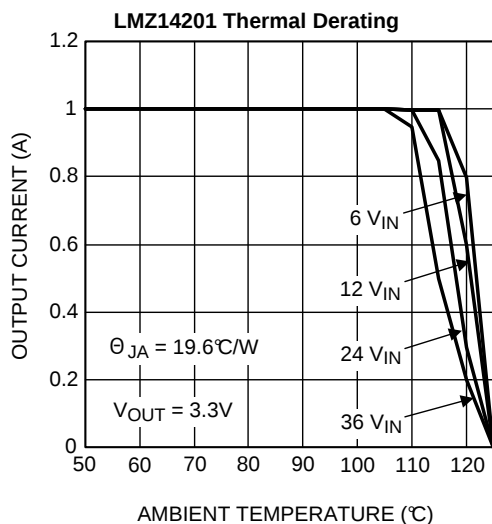
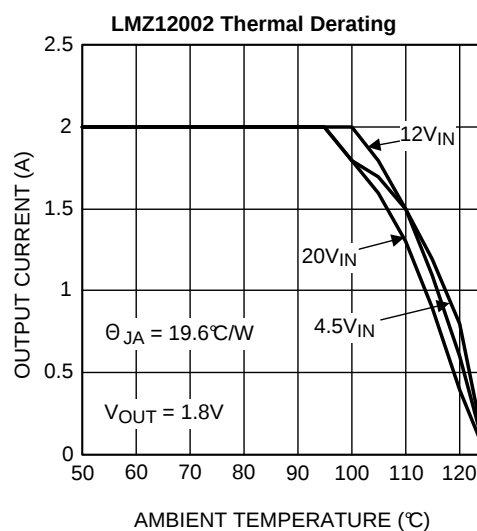
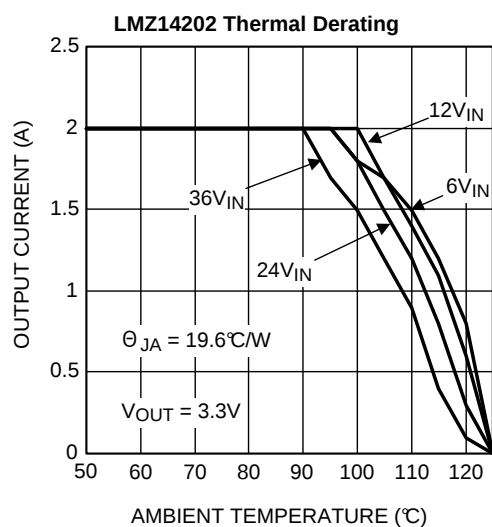
**Table 2. LMZ1200x Bill of Materials (BOM),  $V_{IN} = 4.5$  to  $20V$ ,  $V_{OUT} = 1.8V$ ,  $I_{OUT (MAX)} = 3A / 2A / 1A$** 

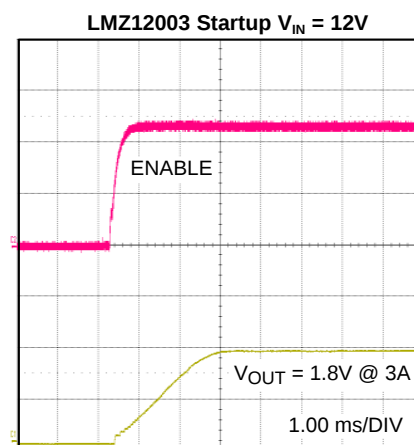
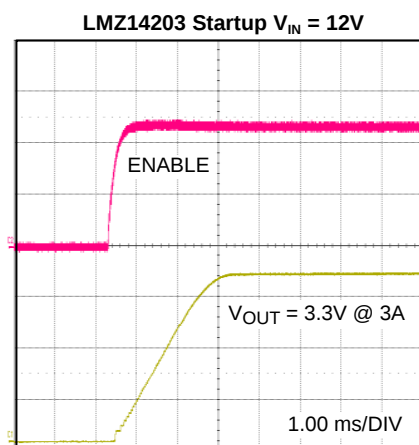
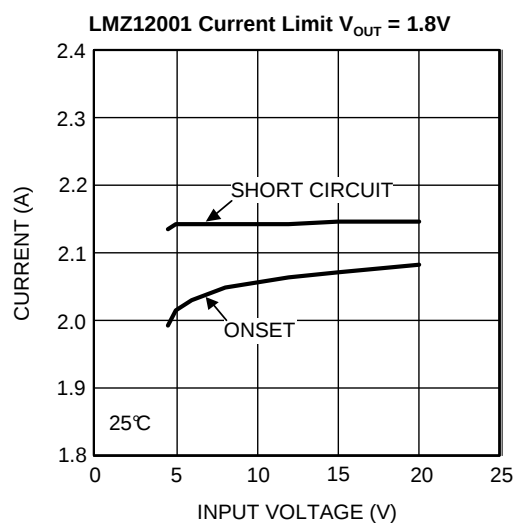
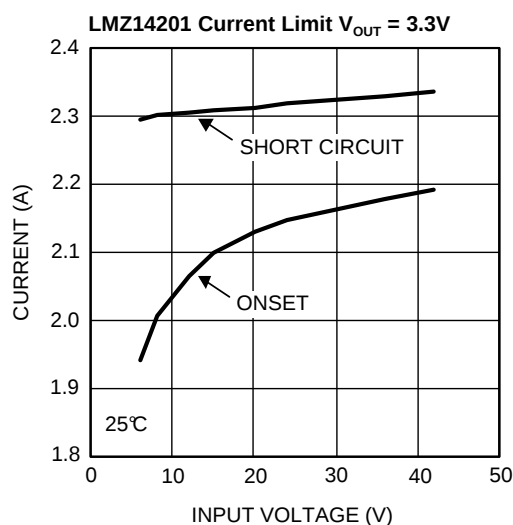
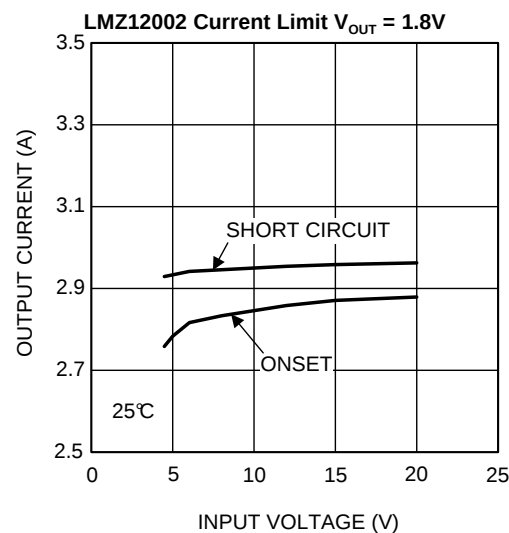
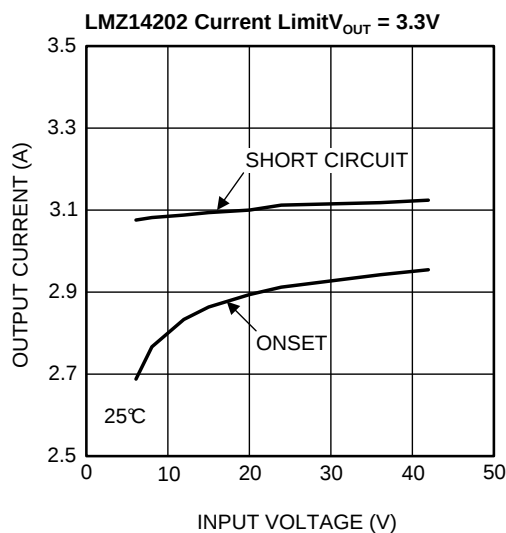
| Designator           | Description               | Case Size | Manufacturer      | Manufacturer P/N                       | Quantity |
|----------------------|---------------------------|-----------|-------------------|----------------------------------------|----------|
| U1                   | SIMPLE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

#### 4 Performance Characteristics

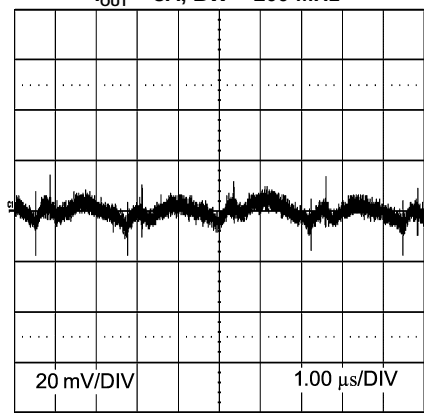




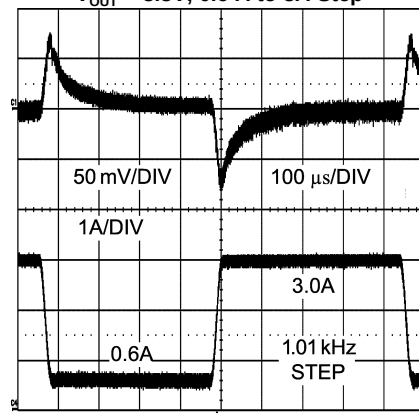




**LMZ14203 Output Ripple  $V_{OUT} = 3.3V$   
 $I_{OUT} = 3A$ , BW = 200 MHz**



**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.

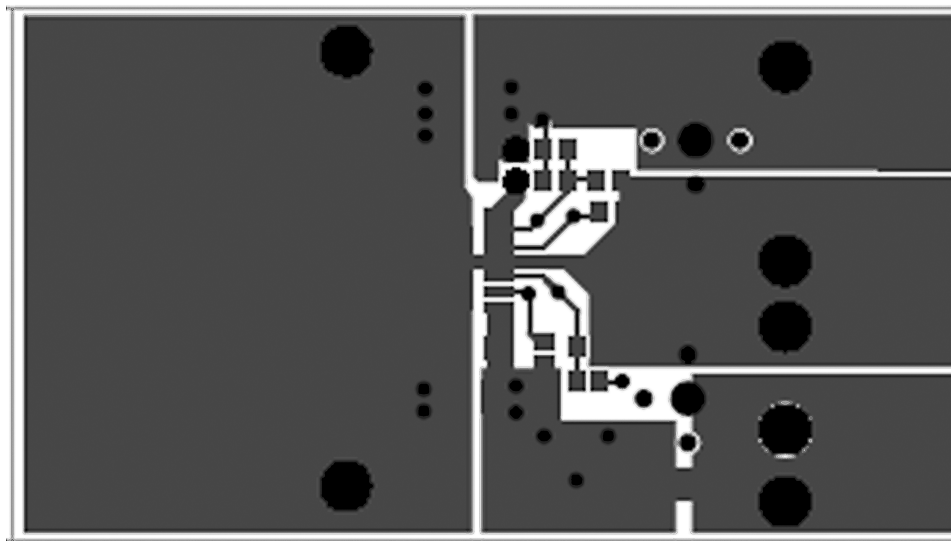


Figure 2. Top Layer

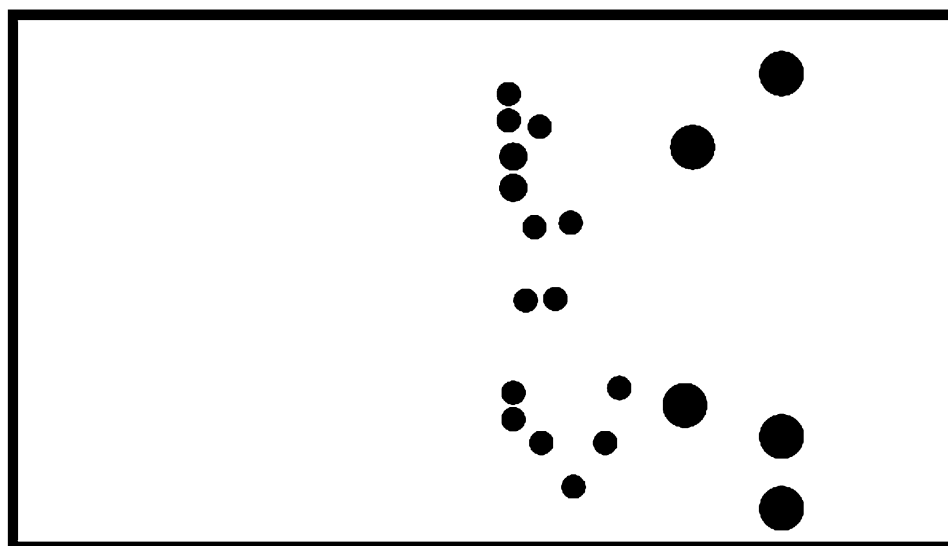
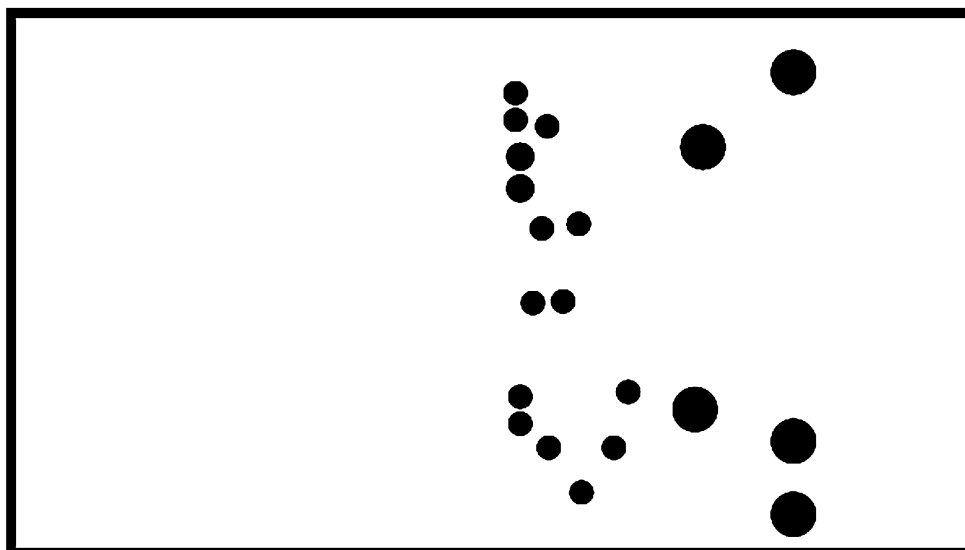
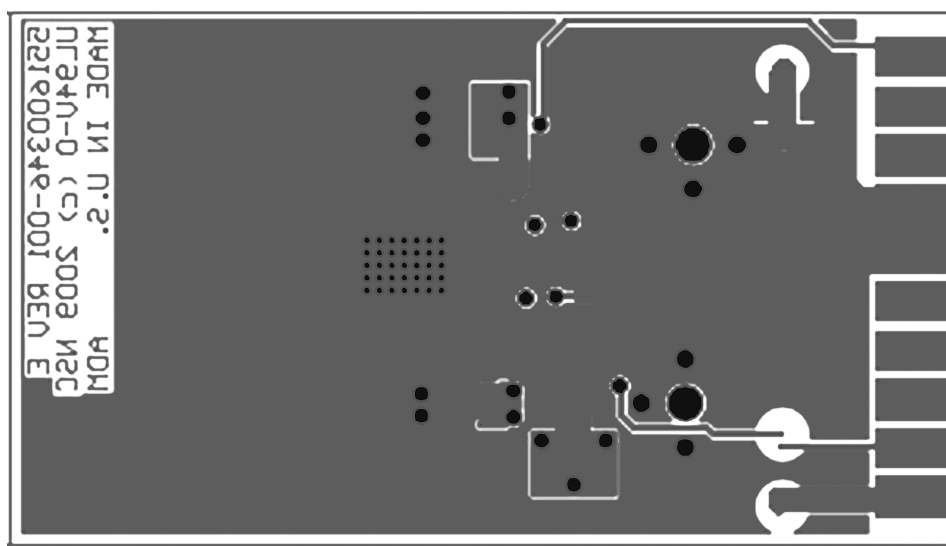


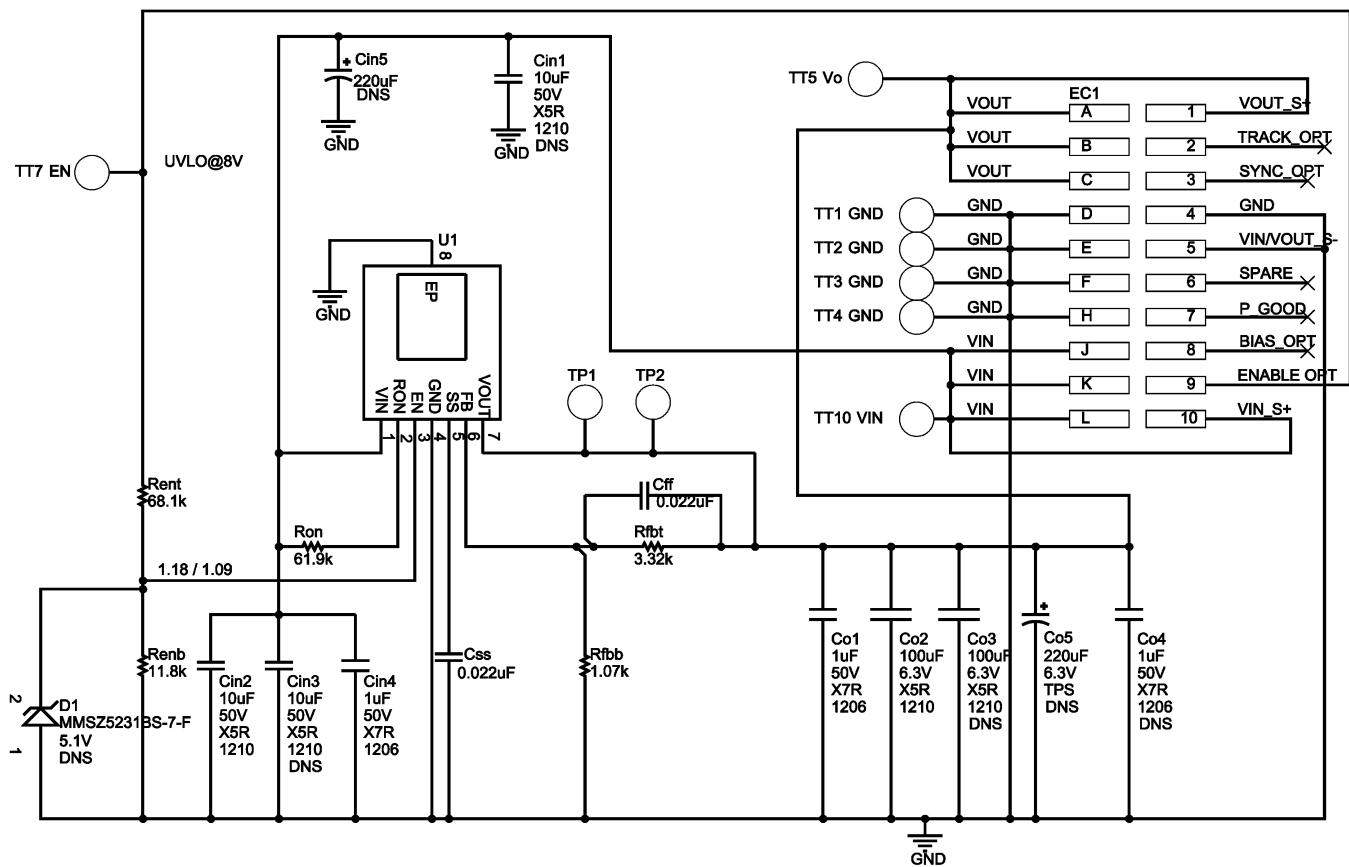
Figure 3. Internal Layer I (Ground)  
Heat Sinking Layer



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



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



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|                               |                                                                                          |
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| Computers and Peripherals     | <a href="http://www.ti.com/computers">www.ti.com/computers</a>                           |
| Consumer Electronics          | <a href="http://www.ti.com/consumer-apps">www.ti.com/consumer-apps</a>                   |
| Energy and Lighting           | <a href="http://www.ti.com/energy">www.ti.com/energy</a>                                 |
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