LMZ14203H/02H/01H Evaluation Board

National Semiconductor
Application Note 2089
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Introduction

The LMZ14203H/02H/01H SIMPLE SWITCHER® power modules for high output voltage are easy-to-use DC-DC solutions 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 LMZ14203H/02H/01H Evaluation Board is configured for 12V output voltage from 15V to 42V input. The precision enable input allows for programmable UVLO of the input supply. The resistor voltage divider R_{ENT} and R_{ENB} set the input UVLO threshold. Connect the V_{IN} turret terminal to the EN turret on the board to enable operation.

The external soft-start capacitor C_{SS} facilitates controlled startup output rise time. The resistors R_{FBT} and R_{FBB} set the output voltage. An output feed-forward capacitor C_{FF} across the upper feedback resistor trims for optimum transient response. The control loop operates well with low ESR output capacitors such as ceramic and polymer electrolytic capacitors. The resistor R_{ON} sets the operating frequency. See datasheet for component selection details.

The LMZ14203H/02H/01H PCB layout offers excellent thermal performance, achieving junction-to-ambient thermal resistance θ_{JA} of 14.9°C/W. The evaluation board with its default Bill of Materials offers great EMI performance, complying with the EN 55022 Class B radiated emissions standard. The solution also complies with the CISPR22 conducted emissions standard with the addition of a small input filter.

Board Specifications

- V_{IN} = 15V to 42V
- V_{OUT} = 12V
- 3A max load at 24V_{IN} and 65°C T_{AMB}
- Low radiated EMI (EN 55022 Class B compliant)
- 400kHz switching frequency
- Enable UVLO set at 13.5V
- θ_{JA} = 14.9°C/W
- 4 copper layers
- 2 oz copper on top and bottom layer
- 1 oz copper on internal layers
- 6.985 cm x 7.620 cm (2.75 in x 3 in) with 1.575 cm (.062 in) thickness of FR4 laminate material

Additional Footprints

Additional component mounting pads are available to experiment with alternative input and output capacitor combinations or a zener clamp on the enable input. See Figure 6 for corresponding schematic locations.

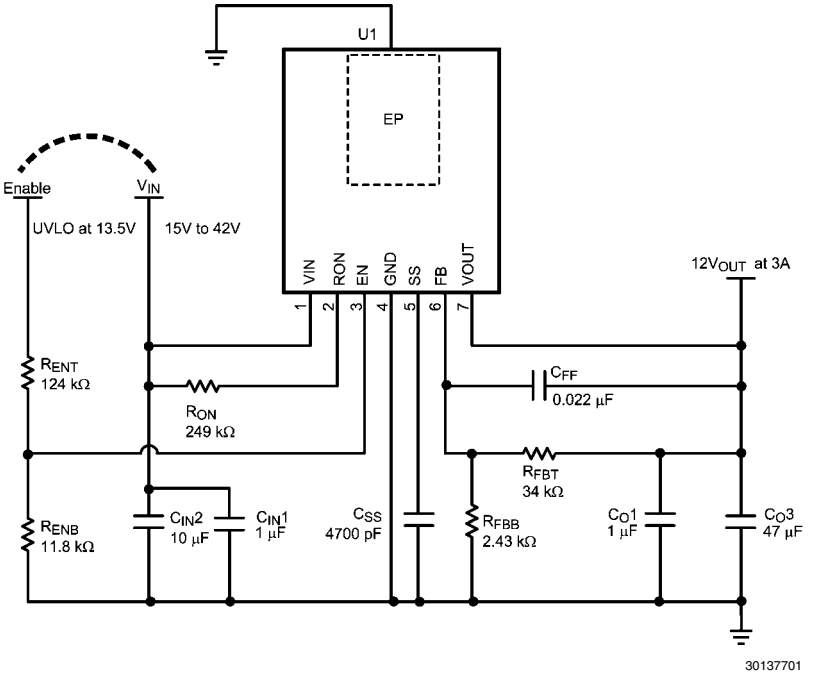


FIGURE 1. Evaluation Board Schematic

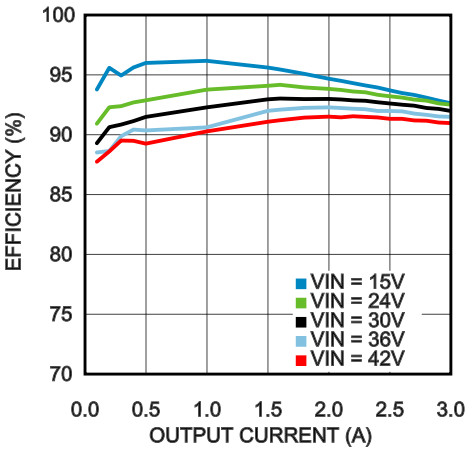
TABLE 1. LMZ1420xH Bill of Materials, V_{IN} = 15V to 42V, V_{OUT} = 12V, $I_{OUT\ (MAX)}$ = 3A / 2A / 1A

Designator	Description	Case Size	Manufacturer	Manufacturer P/N	Quantity
U1	SIMPLE SWITCHER®	TO-PMOD-7	National Semiconductor	LMZ14203HTZ or LMZ14202HTZ or LMZ14201HTZ	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_{O3}	47 µF, 35 mΩ, 16V, Polymer	7343-43	KEMET	T525D476M016ATE035	1
C_{FF}	0.022 µF, X7R, 100V	0805	AVX	08051C223JAT2A	1
C_{SS}	4700 pF, X7R, 25V	0805	AVX	08053A472JAT2A	1
R_{ENB}	11.8 kΩ	0805	Panasonic	ERJ-6ENF1182V	1
R_{ENT}	124 kΩ	0805	Panasonic	ERJ-6ENF1243V	1
R_{FBT}	34 kΩ	0805	Vishay-Dale	CRCW080534K0FKEA	1
R_{FBB}	2.43 kΩ	0805	Panasonic	ERJ-6ENF2431V	1
R_{ON}	249 kΩ	0805	Vishay-Dale	CRCW0805249KFKEA	1

Performance Characteristics

Unless otherwise specified the following conditions apply: V_{IN} = 24V, V_{OUT} = 12V, T_{AMB} = 25°C

LMZ14203H Efficiency



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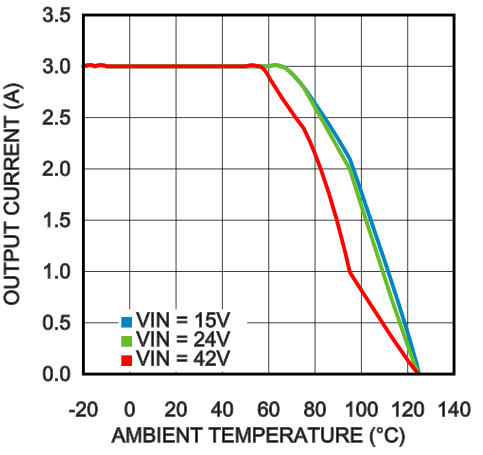
LMZ14203H Thermal Derating



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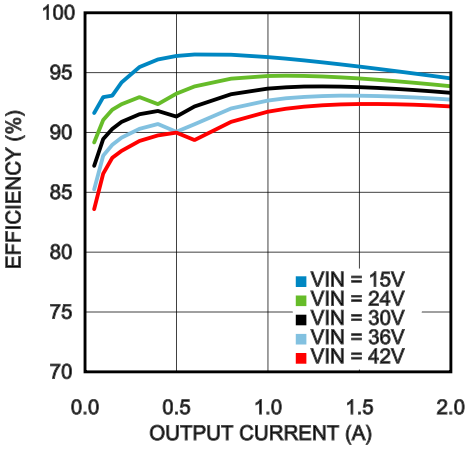
LMZ14202H Efficiency



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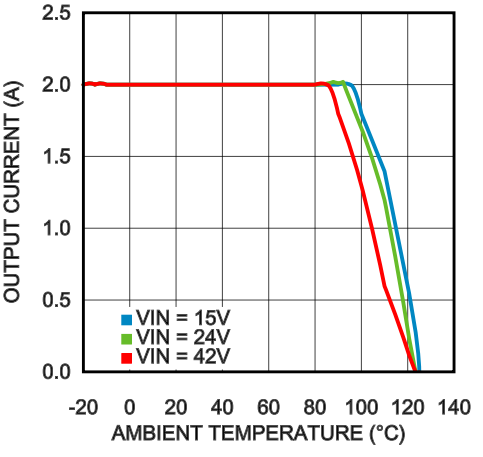
LMZ14202H Thermal Derating



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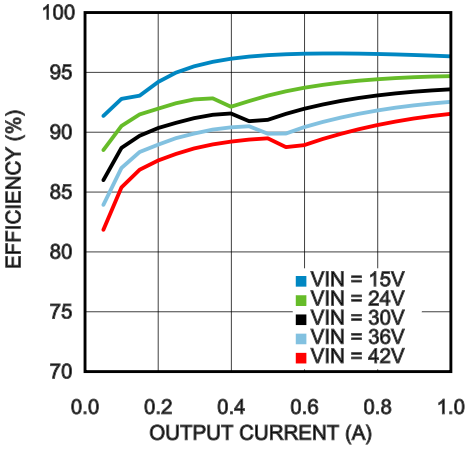
LMZ14201H Efficiency



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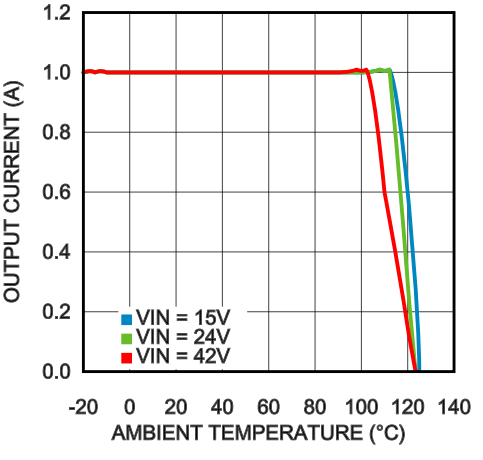
LMZ14201H Thermal Derating



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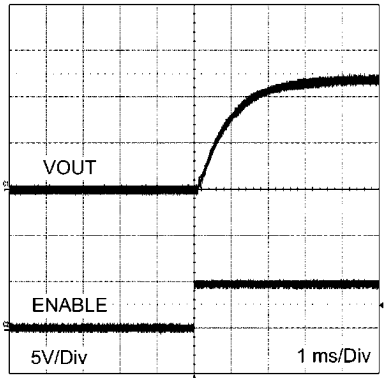
LMZ14203H Startup



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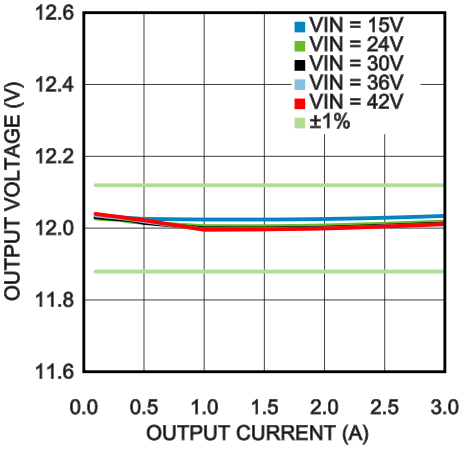
LMZ14203H Line and Load Regulation



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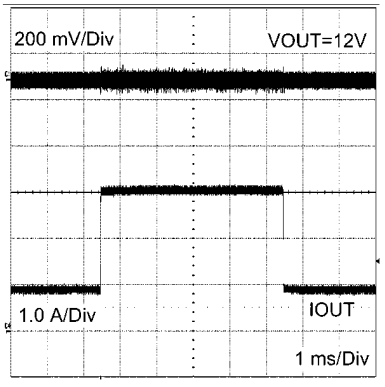
LMZ14203H Transient Response
30% to 100% Load Step



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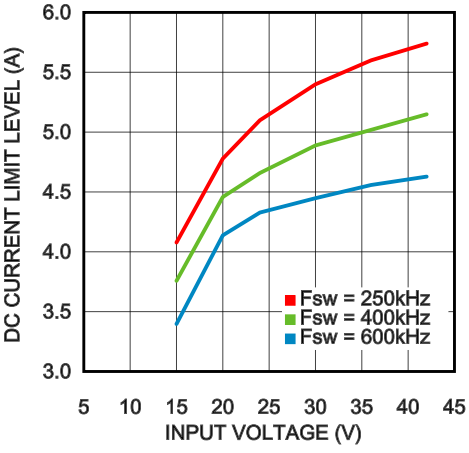
LMZ14203H Current Limit



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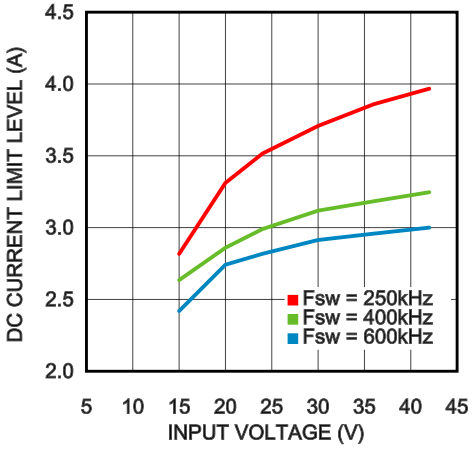
LMZ14202H Current Limit



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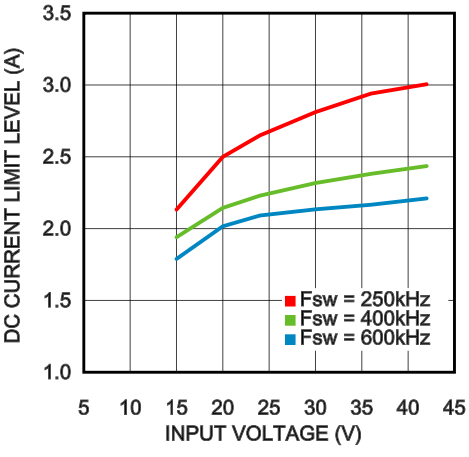
LMZ14201H Current Limit



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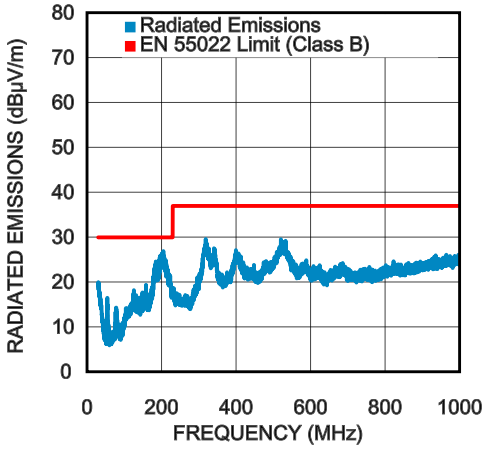
LMZ14203H Radiated EMI, I_{OUT} = 3A



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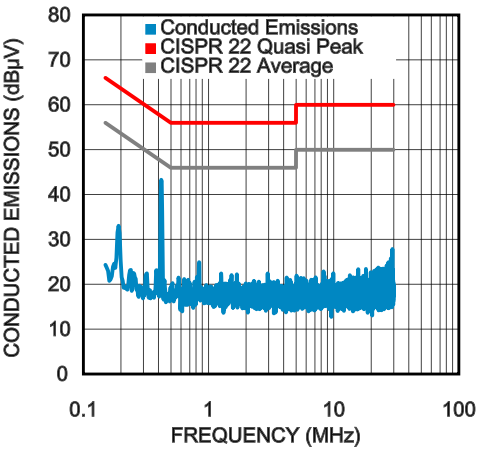
LMZ14203H Conducted EMI, I_{OUT} = 3A with 3.3µH 2x10µF LC line filter added



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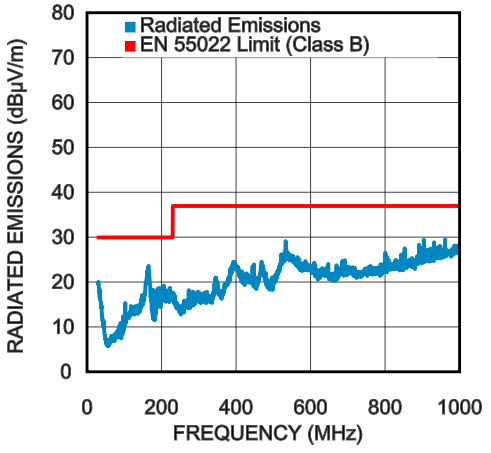
LMZ14202H Radiated EMI, I_{OUT} = 2A



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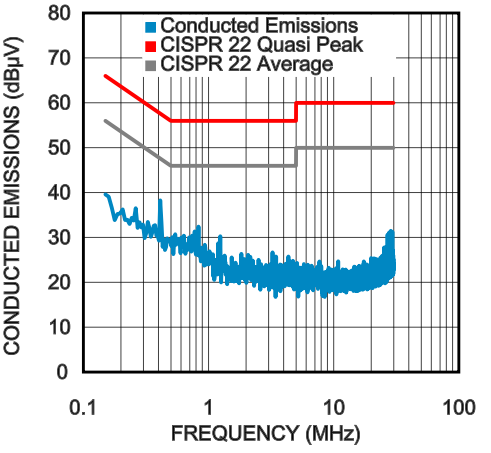
LMZ14202H Conducted EMI, I_{OUT} = 2A with 3.3µH 2x10µF LC line filter added



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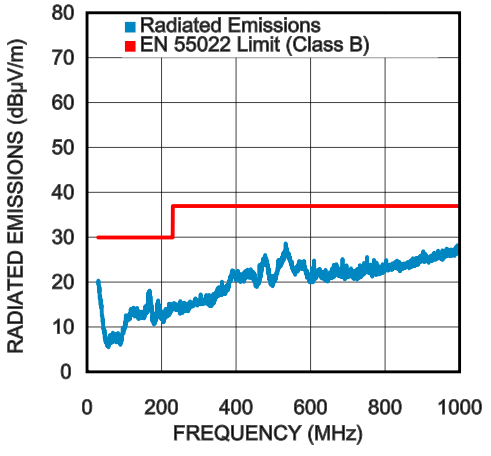
LMZ14201H Radiated EMI, I_{OUT} = 1A



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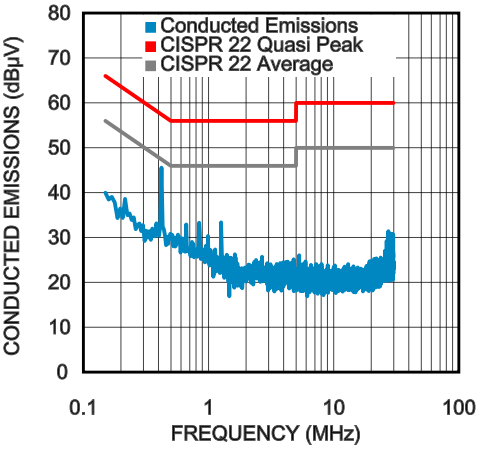
LMZ14201H Conducted EMI, I_{OUT} = 1A with 3.3µH 1µF LC line filter added



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PCB Layout Diagrams

Gerber and CAD files can be download from the LMZ14203H product folder.

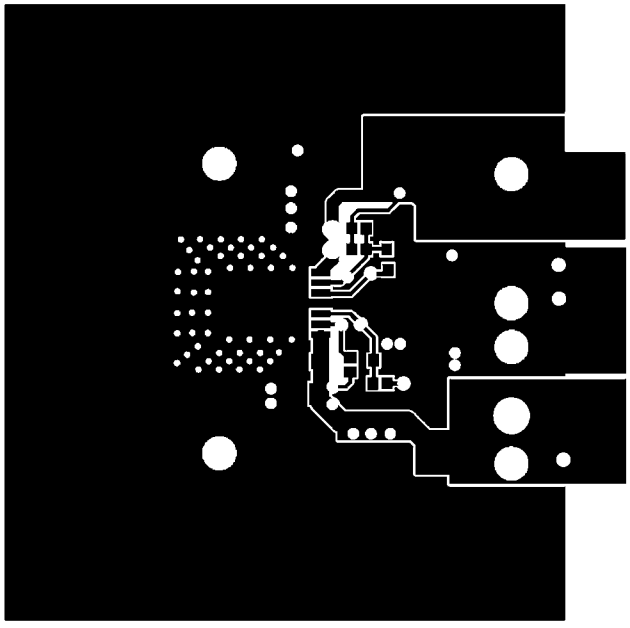

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FIGURE 2. Top Layer

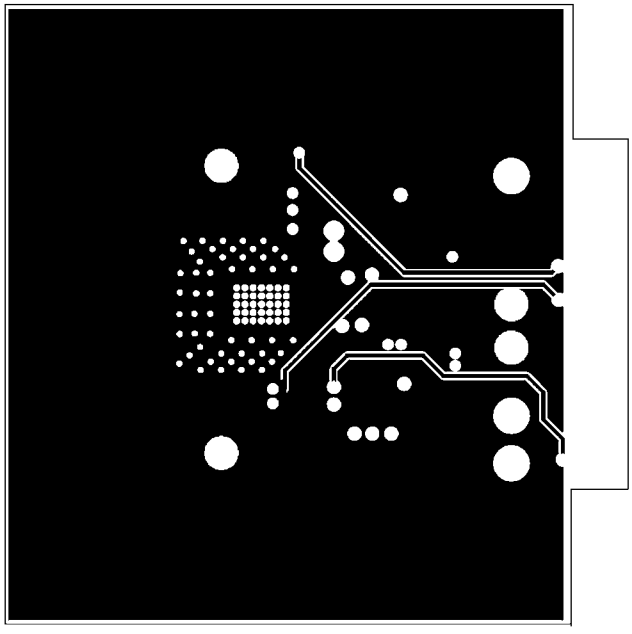

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FIGURE 3. Internal Layer I (Ground)
Heat Sinking Layer

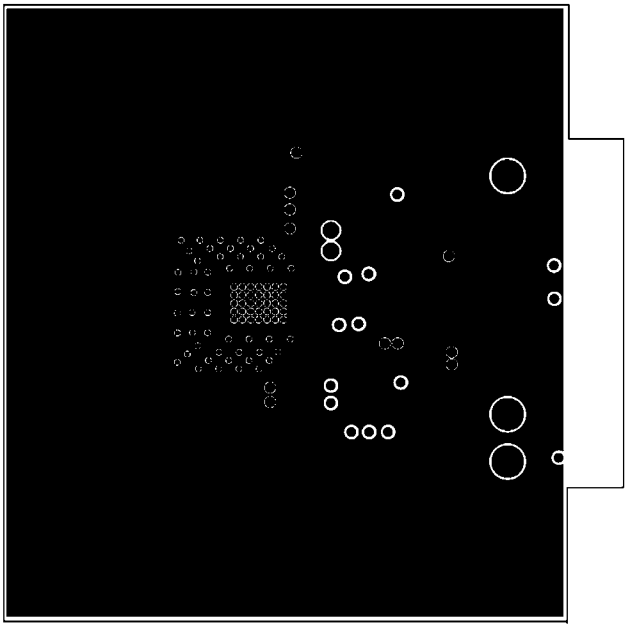

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FIGURE 4. Internal Layer II (Ground)
Heat Sinking Layer

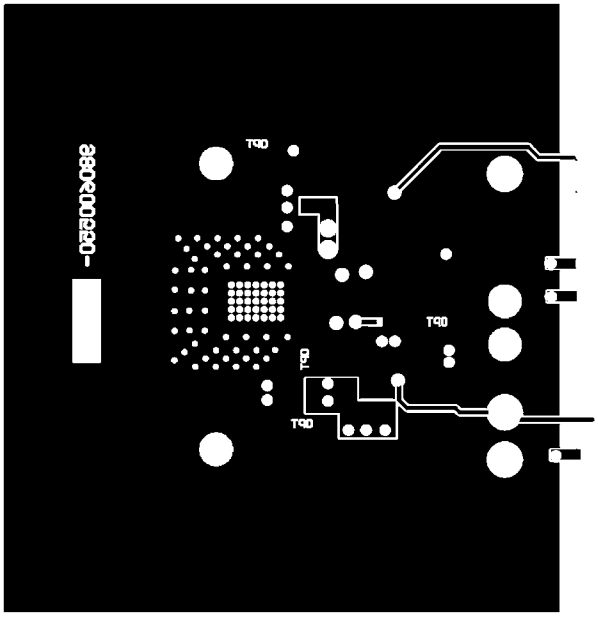

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FIGURE 5. Bottom Layer (Ground and Routing)
Heat Sinking Layer

PCB Schematic

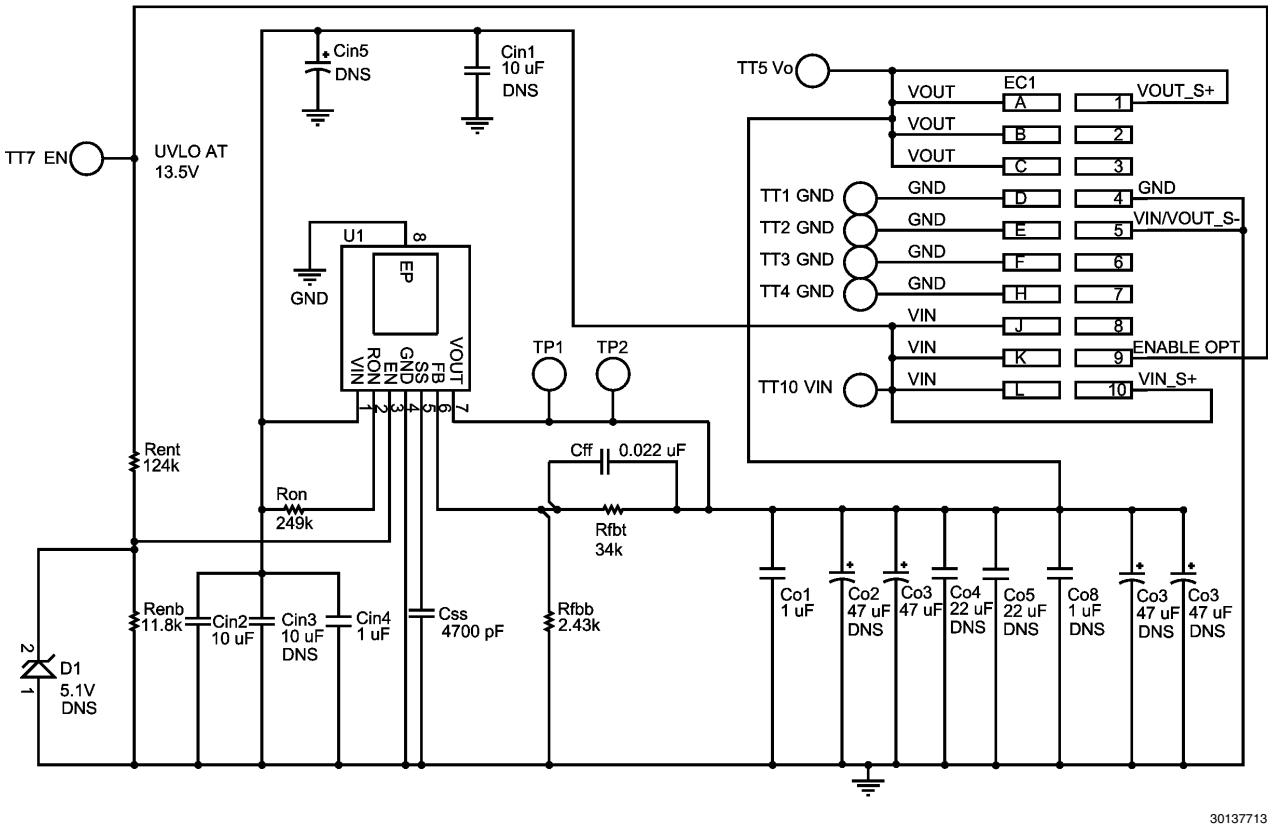

FIGURE 6. Detailed Schematic
DNS = Component not installed

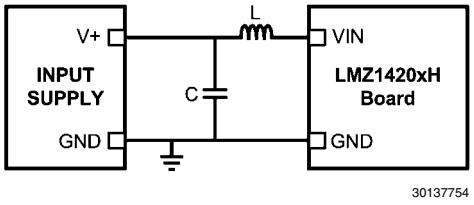

FIGURE 7. Conducted EMI LC Filter Configuration

Notes

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