

LMZ10501 and LMZ10500 SIMPLE SWITCHER® Nano Module Evaluation Board

National Semiconductor
Application Note 2166
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Introduction

The LMZ10501 and LMZ10500 SIMPLE SWITCHER® nano modules are easy-to-use DC-DC solutions optimized for space-constrained applications. The LMZ10501 is capable of driving up to 1A load with excellent power conversion efficiency, line and load regulation, and EMI performance. The LMZ10500 is a 650mA version module and is pin-to-pin compatible with the LMZ10501.

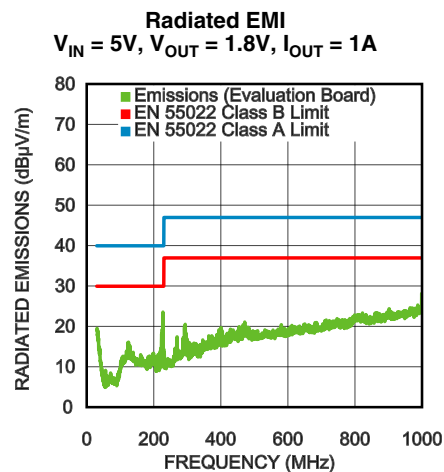
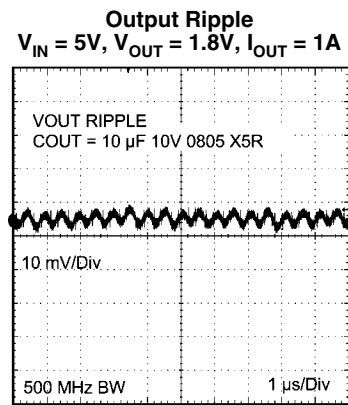
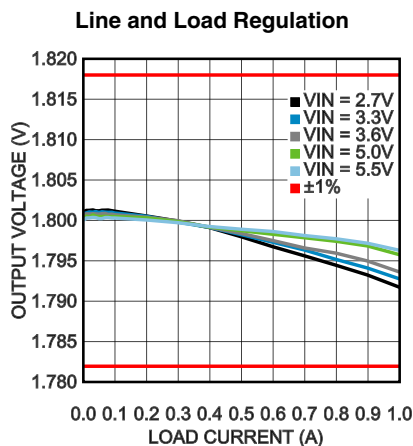
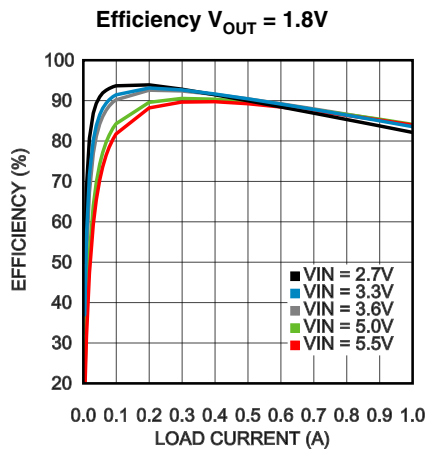
The LMZ10501 and LMZ10500 Evaluation Board is configured for 1.8V output voltage from 2.7V to 5.5V input. The resistor voltage divider R_T and R_B set the output voltage. The external capacitor C_{VC} bypasses the V_{CON} pin and provides additional soft start time. See datasheet for component selection and device information details. The board features additional component footprints for various device enabling schemes and AC signal injection terminals for feedback loop measurements.

The evaluation board with its default Bill of Materials offers great EMI performance, complying with the EN 55022 Class B radiated emissions standard.

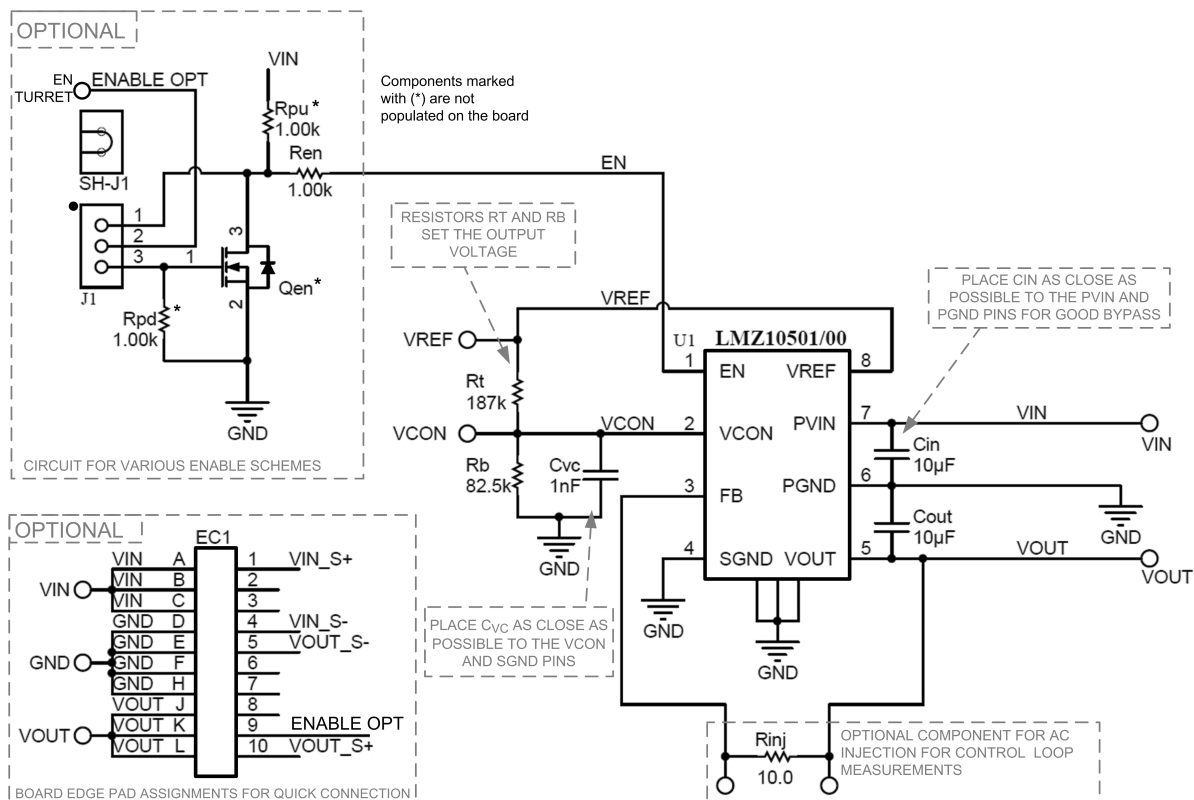
Board Specifications

- V_{IN} = 2.7V to 5.5V
- V_{OUT} = 1.8V (default setting)
- 1A max load (LMZ10501)
- 650mA max load (LMZ10500)
- 2MHz switching frequency
- 4 layers PCB with 1oz copper
- 4.3 x 4.3 cm (1700 x 1700 mil) PCB size
- Low radiated EMI (EN 55022 Class B compliant)

Typical Performance Characteristics



Evaluation Board Schematic and Bill of Materials



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FIGURE 1. Evaluation Board Schematic

TABLE 1. LMZ10501 and LMZ10500 Bill of Materials, $V_{IN} = 2.7V$ to $5.5V$, $V_{OUT} = 1.8V$, $I_{OUT(MAX)} = 1000mA / 650mA$

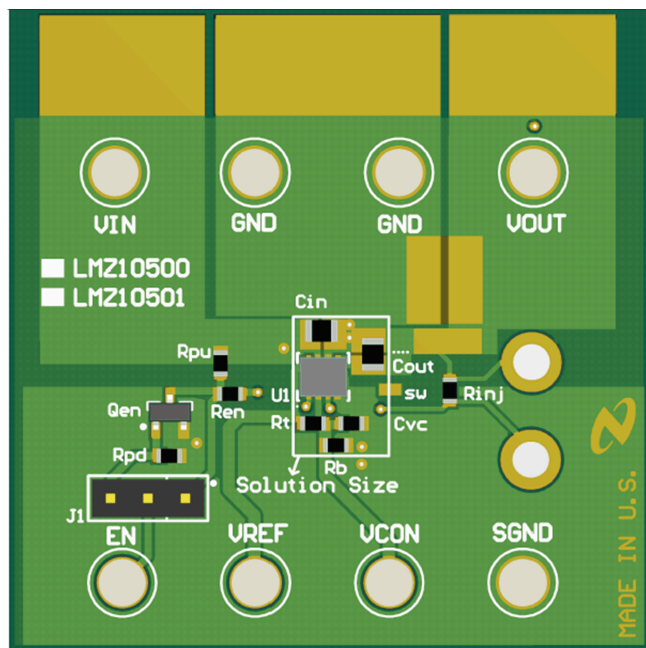
Designator	Description	Case Size	Manufacturer	Manufacturer P/N	Quantity
U1	SIMPLE SWITCHER® Nano Module	SE08A	National Semiconductor	LMZ10501SE or LMZ10500SE	1
C_{IN} , C_{OUT}	10 μF , X5R, 10V	0805	KEMET	C0805C106K8PACTU	2
C_{VC}	1000 pF	0603	TDK	C1608C0G2A102J	1
R_B	82.5 k Ω	0603	Vishay-Dale	CRCW060382K5FKEA	1
R_T	187 k Ω	0603	Vishay-Dale	CRCW0603187KFKEA	1
R_{EN} (optional)	1 k Ω	0603	Vishay-Dale	CRCW06031K00FKEA	1
R_{INJ} (optional)	10 Ω	0603	Vishay-Dale	CRCW060310R0FKEA	1

Optional Components and Footprints

- R_{INJ} resistor – allows for a network analyzer connection to measure the control loop response. Replace this resistor with a short in a final design if control loop measurements are not needed.
- R_{PU} resistor – an optional footprint to pull EN up to V_{IN} with an external resistor. EN is internally pulled up to V_{IN} by a 790 k Ω resistor.
- R_{EN} – an optional resistor in series with the EN pin.
- R_{PD} – an optional pull-down resistor for the Q_{EN} gate.

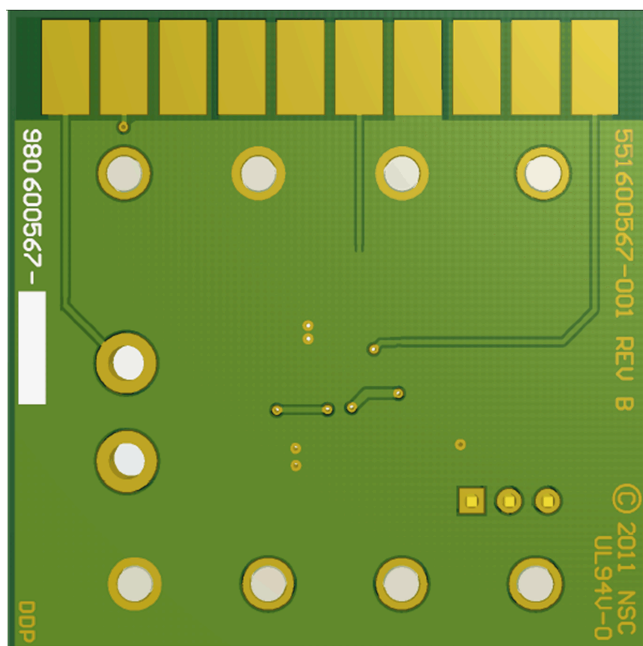
- Q_{EN} – an optional footprint to use an N-ch MOSFET as a pull-down device for EN.
- J1 – jumper to select how to drive EN. Connecting the jumper pins 1 and 2 allows for driving EN directly from the EN turret at the edge of the board. Connecting the jumper pins 2 and 3 allows for driving the gate of the pull-down device Q_{EN} .
- EC1 – board edge connector for quick testing.
- C_{OUT} footprints – the solder mask on the V_{OUT} side of the board is removed to allow for different output capacitor configurations.

Evaluation Board Layout



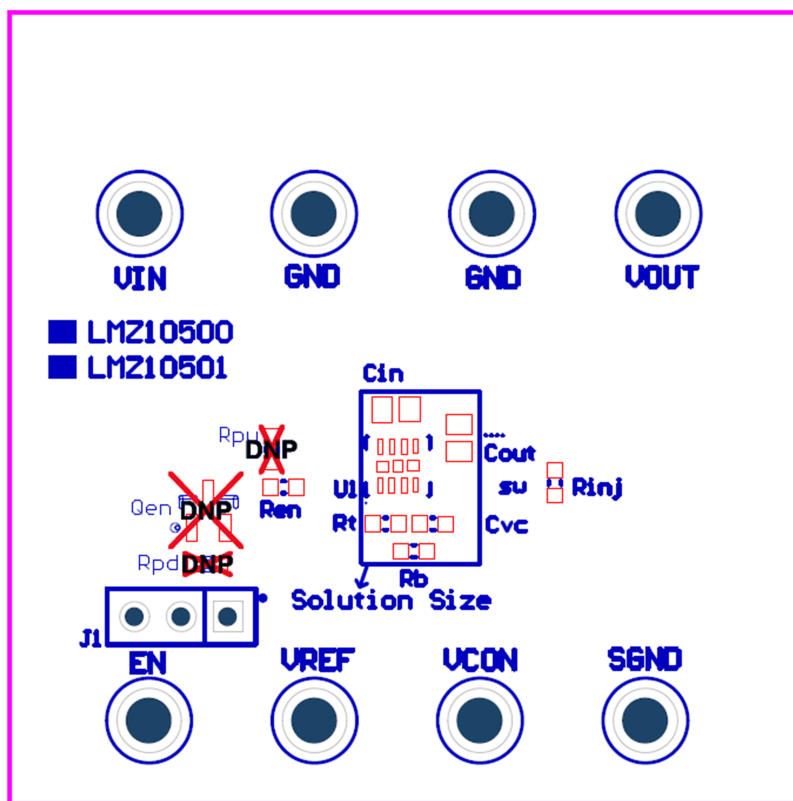
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FIGURE 2. Evaluation Board Top View



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FIGURE 3. Evaluation Board Bottom View



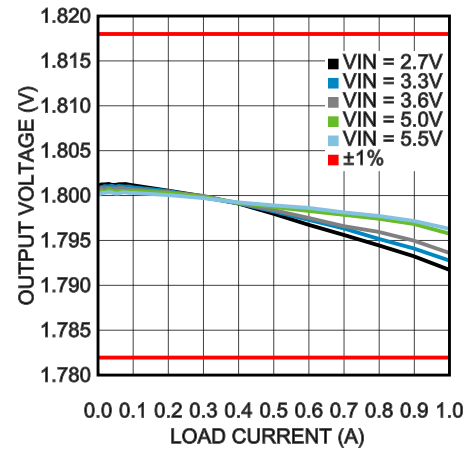
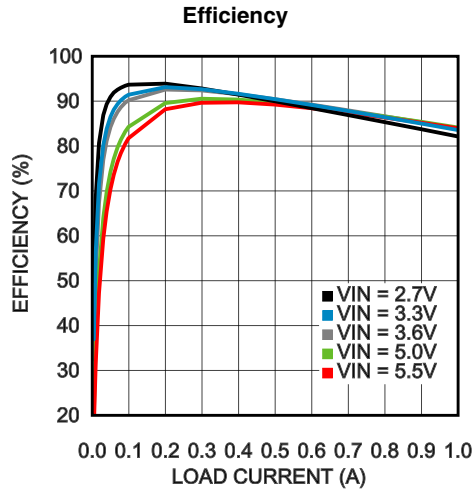
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FIGURE 4. Evaluation Board Assembly (DNP = not populated components)

Typical Performance for $V_{OUT} = 1.8V$

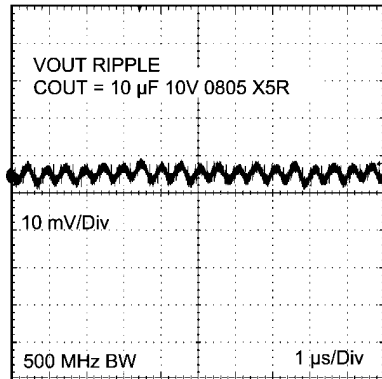
Unless otherwise specified the following conditions apply: $V_{IN} = 5V$, $I_{OUT} = 1A$, $T_A = 25^\circ C$

Line and load regulation



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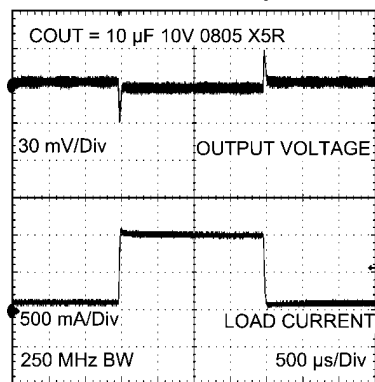
Output Voltage Ripple



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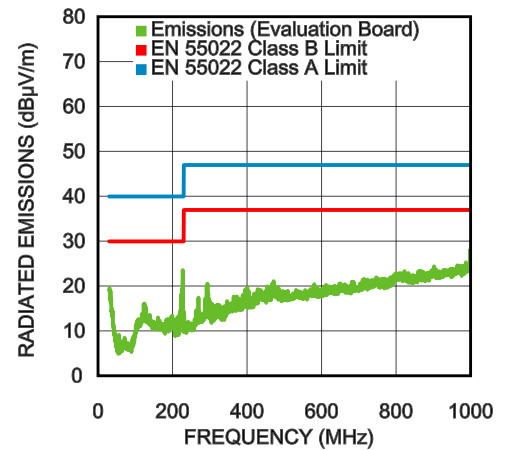
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Load Transient Response



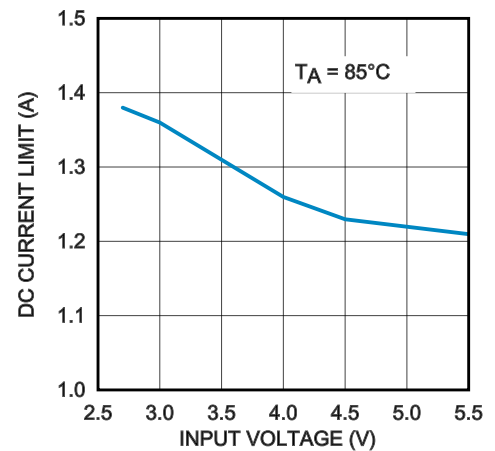
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Radiated EMI



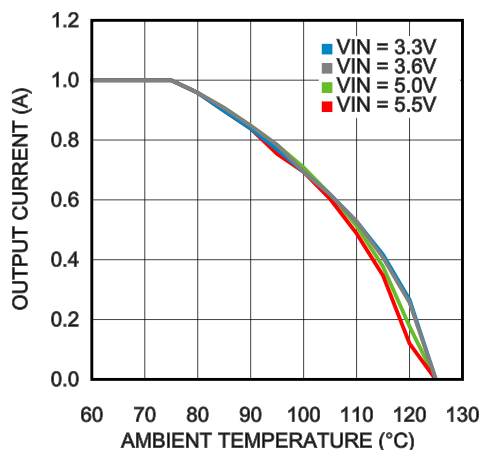
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DC Current Limit



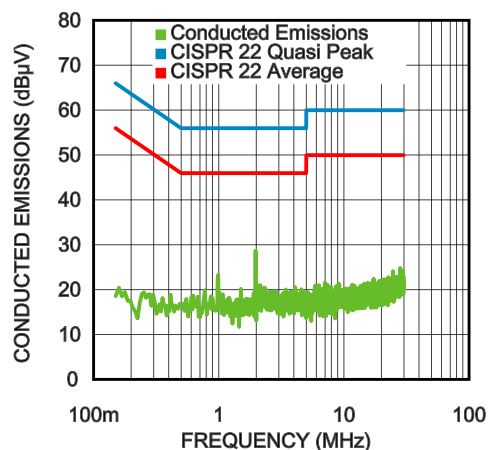
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Thermal Derating



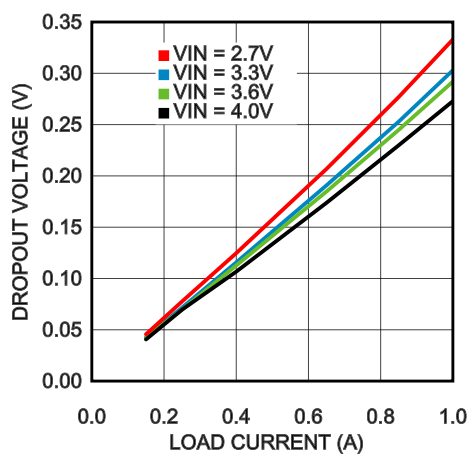
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Conducted EMI with the Input LC Filter



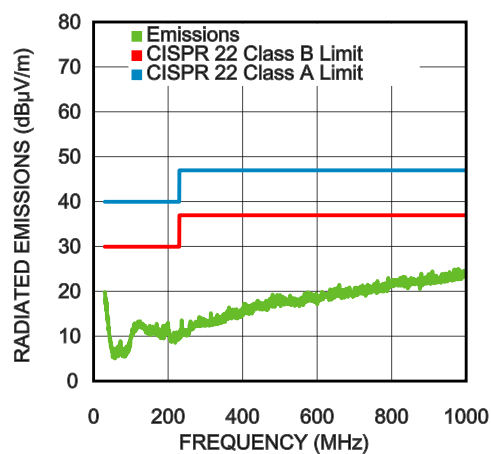
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Dropout Voltage



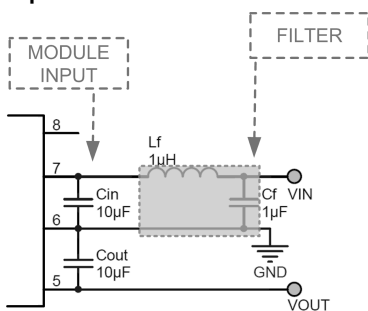
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Radiated EMI with the Input LC Filter



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Input LC Filter for Conducted EMI



Cf = 0603YD105MAT AVX
Lf = VLS252015T-1R0N1R7 TDK

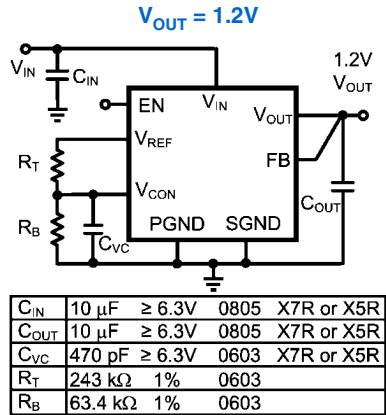
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Other Output Voltage Settings

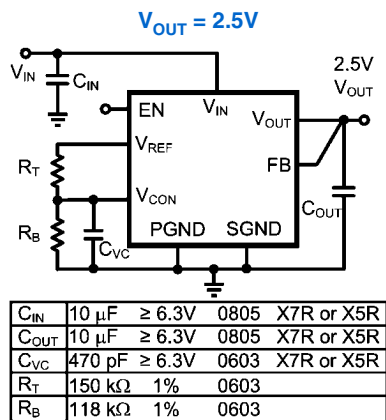
For other output voltages, choose $R_T = 80\text{k}\Omega$ to $300\text{k}\Omega$

Then calculate R_B using

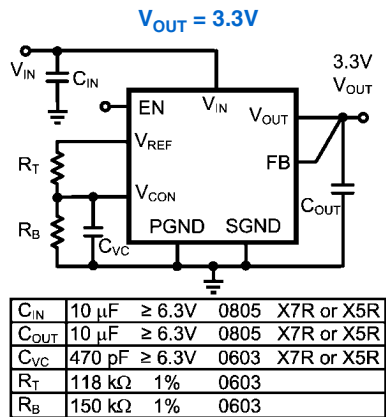
$$R_B = V_{OUT} \times R_T / (5.875V - V_{OUT})$$



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Notes

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