

LMZ10501SIL and LMZ10500SIL SIMPLE SWITCHER® Nano Module Evaluation Board

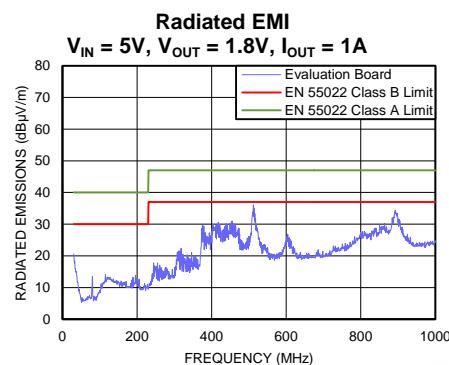
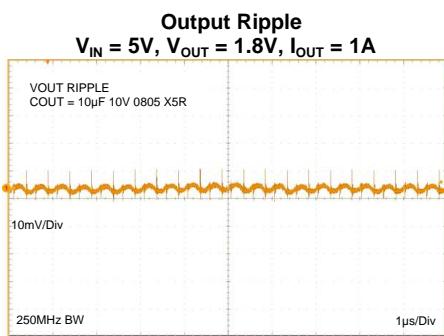
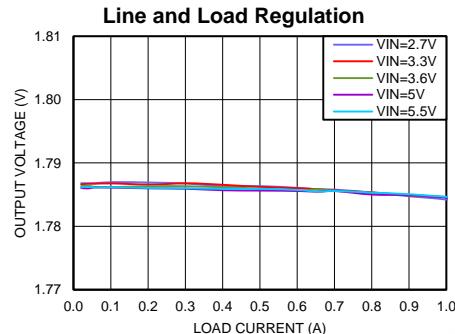
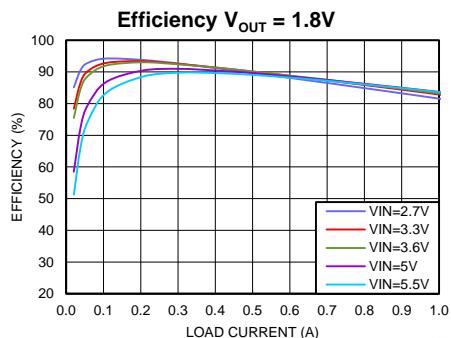
1 Introduction

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. For component selection and device information details, see the device-specific data sheet. 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.

2 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, Low radiated EMI (EN 55022 Class B compliant)
- 4.3 x 4.3 cm (1700 x 1700 mil) PCB size, 4 layers PCB with 1oz copper

3 Typical Performance Characteristics



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4 Evaluation Board Schematic and Bill of Materials

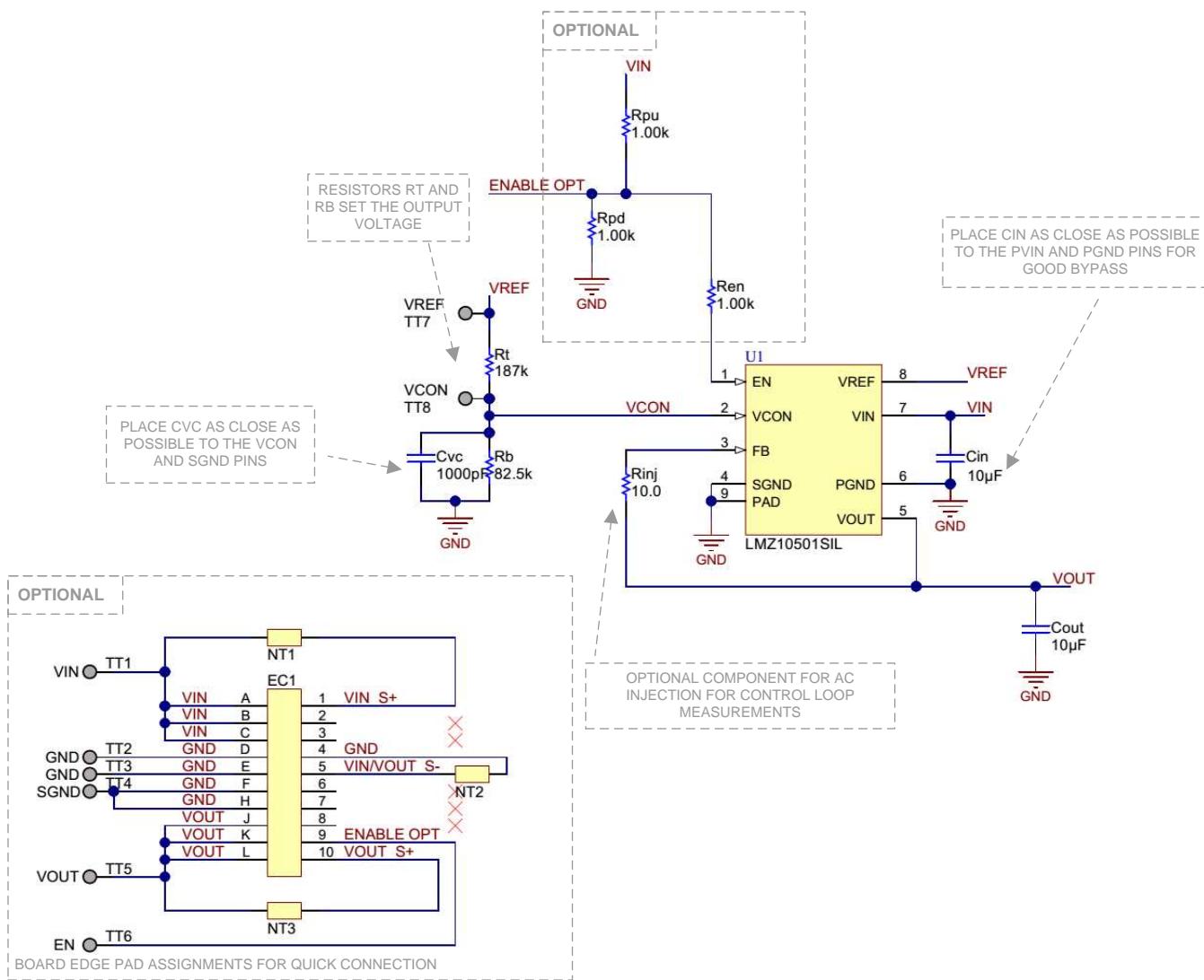


Figure 1. Evaluation Board Schematic

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	SIL0008A	Texas Instruments	LMZ10501SIL or LMZ10500SIL	1
C_{IN}, C_{OUT}	10 μ F, 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

4.1 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 $790\text{ k}\Omega$ resistor.
- R_{EN} – an optional resistor in series with the EN pin.
- R_{PD} – an optional pull-down resistor for the EN pin.
- 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.

5 Evaluation Board Layout

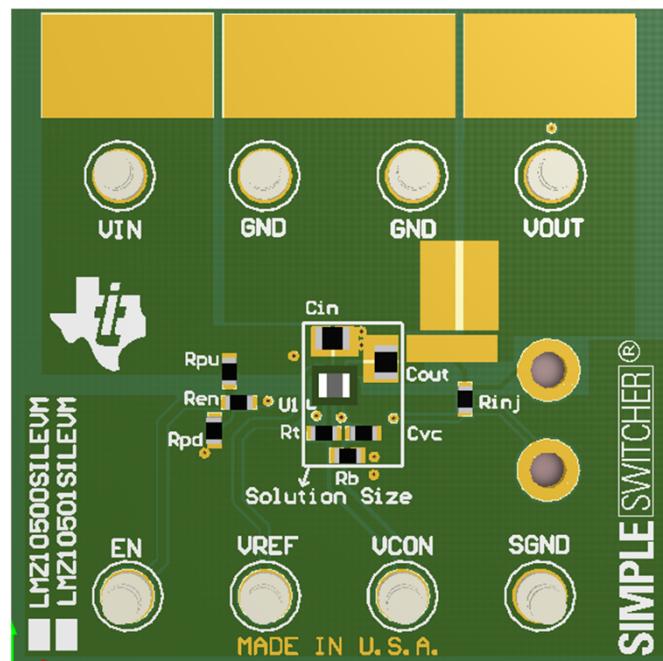


Figure 2. Evaluation Board Top View

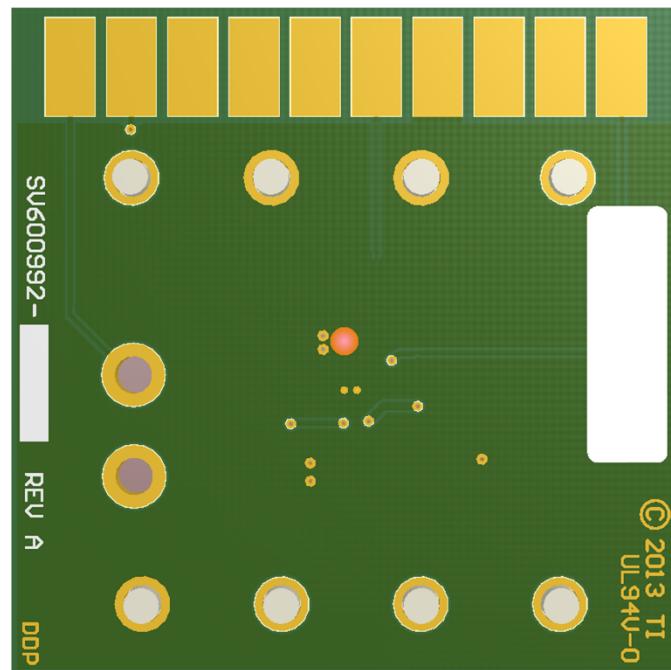


Figure 3. Evaluation Board Bottom View

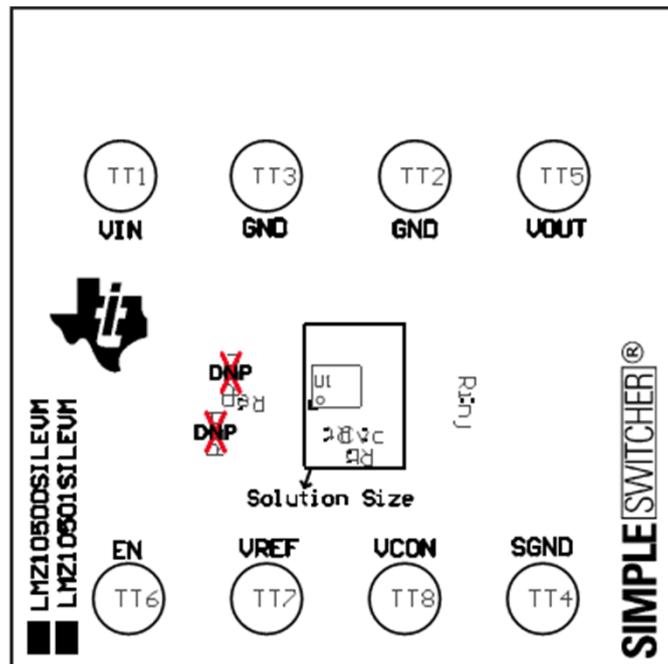


Figure 4. Evaluation Board Assembly (DNP = not populated components)

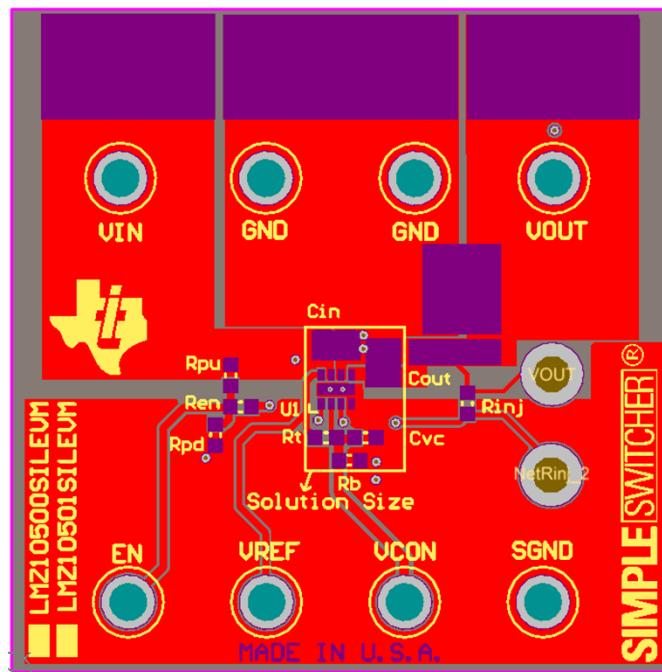


Figure 5. Evaluation Board Layout - Top Layer with Solder Mask and Top Overlay

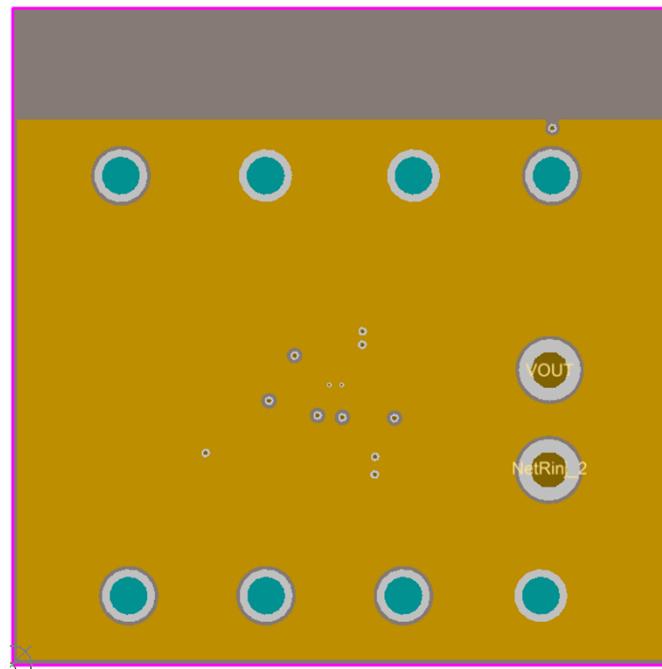


Figure 6. Evaluation Board Layout - Mid Layer 1

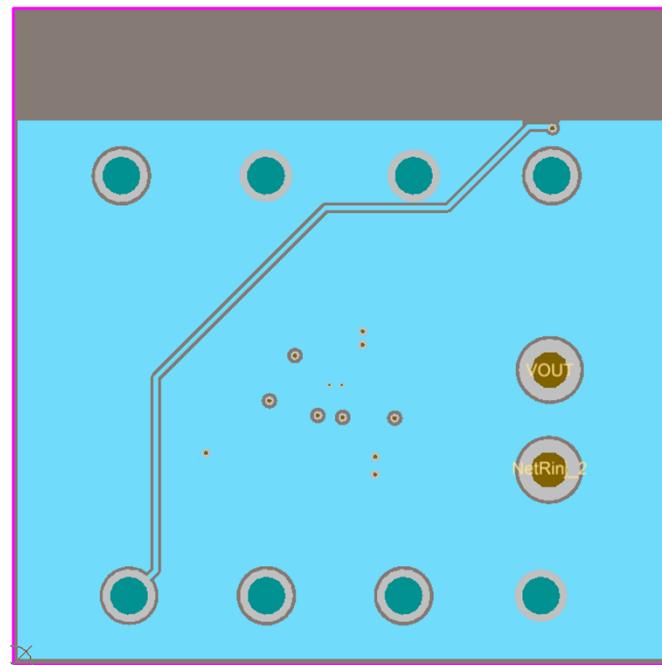


Figure 7. Evaluation Board Layout - Mid Layer 2

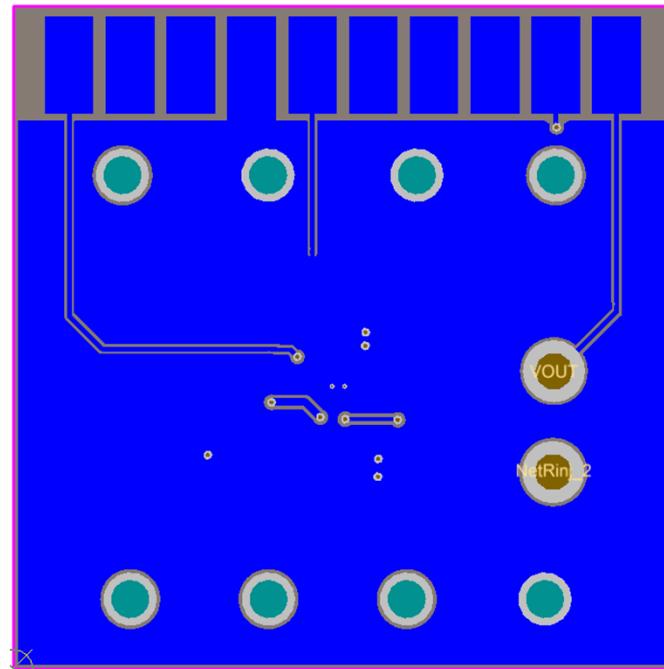
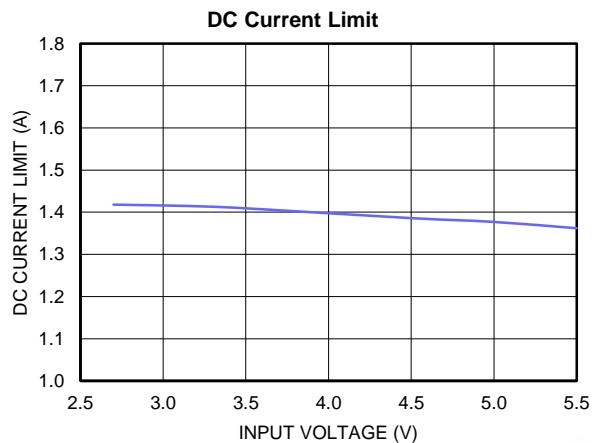
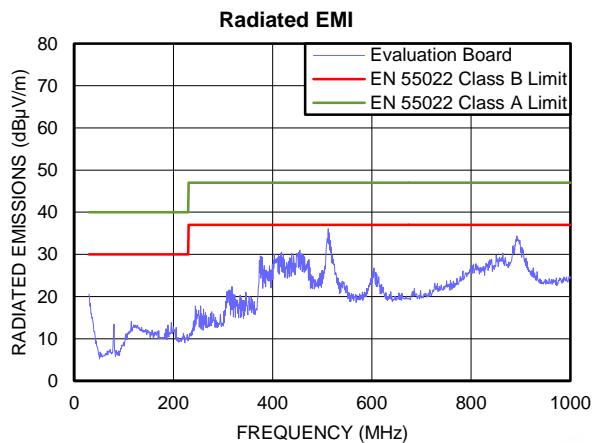
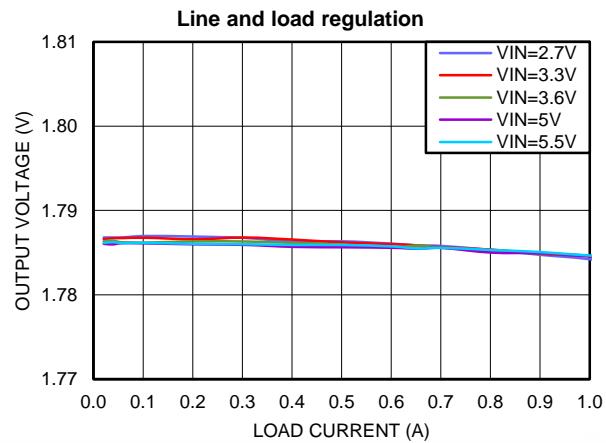
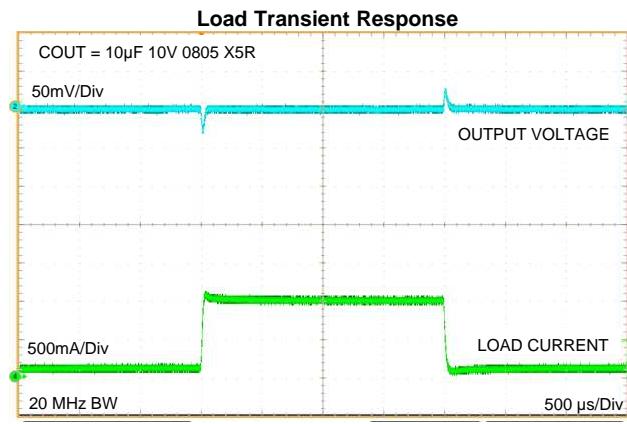
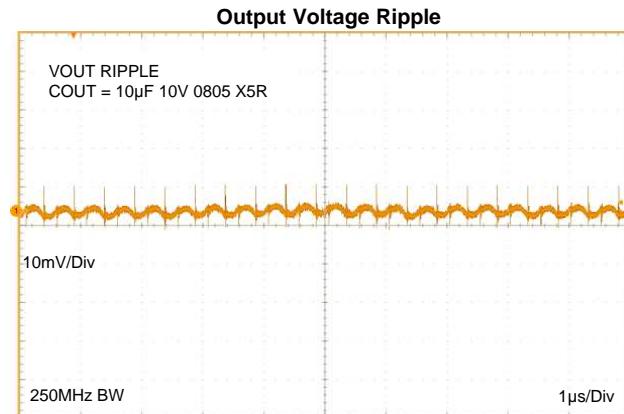
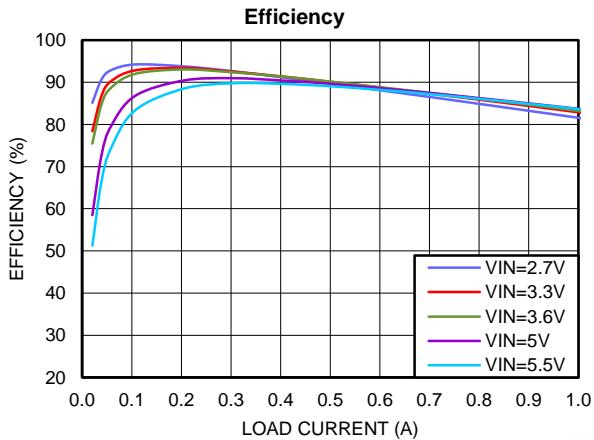
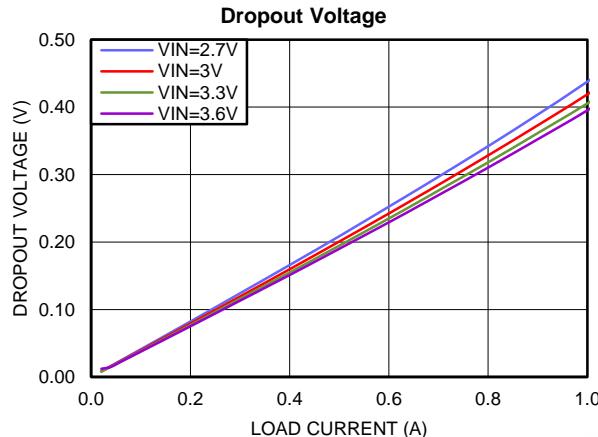
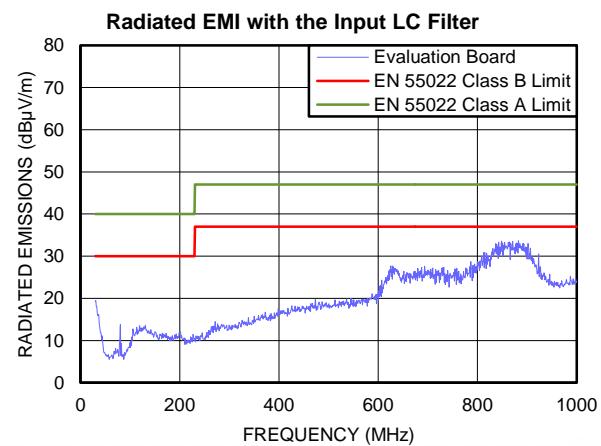
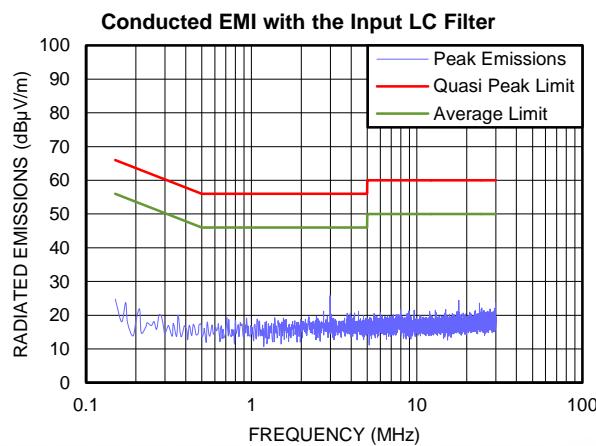
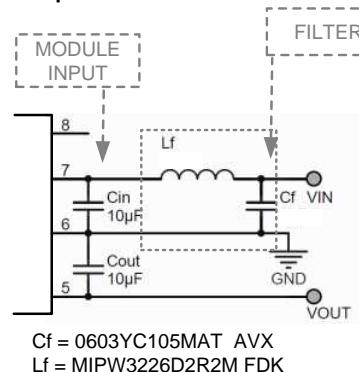


Figure 8. Evaluation Board Layout - Bottom Layer

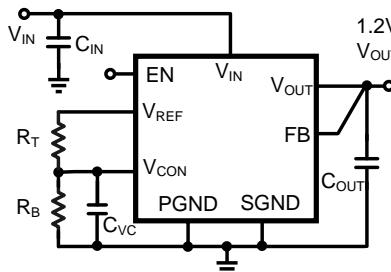
6 Typical Performance for $V_{OUT} = 1.8V$

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



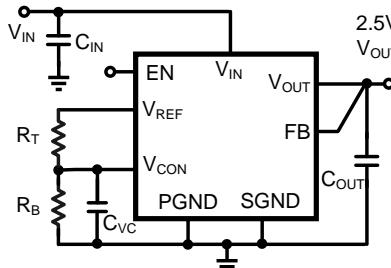

Input LC Filter for Conducted EMI


7 Other Output Voltage Settings



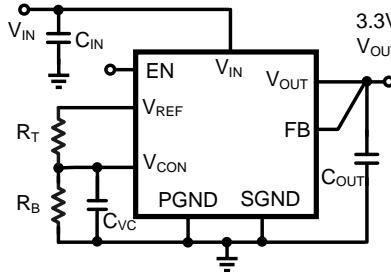
C_{IN}	$10 \mu F$	$\geq 6.3V$	0805	X7R or X5R
C_{OUT}	$10 \mu F$	$\geq 6.3V$	0805	X7R or X5R
C_{VC}	$470 pF$	$\geq 6.3V$	0603	X7R or X5R
R_T	$243 k\Omega$	1%	0603	
R_B	$63.4 k\Omega$	1%	0603	

Figure 9. $V_{OUT} = 1.2V$



C_{IN}	$10 \mu F$	$\geq 6.3V$	0805	X7R or X5R
C_{OUT}	$10 \mu F$	$\geq 6.3V$	0805	X7R or X5R
C_{VC}	$470 pF$	$\geq 6.3V$	0603	X7R or X5R
R_T	$150 k\Omega$	1%	0603	
R_B	$118 k\Omega$	1%	0603	

Figure 10. $V_{OUT} = 2.5V$



C_{IN}	$10 \mu F$	$\geq 6.3V$	0805	X7R or X5R
C_{OUT}	$10 \mu F$	$\geq 6.3V$	0805	X7R or X5R
C_{VC}	$470 pF$	$\geq 6.3V$	0603	X7R or X5R
R_T	$118 k\Omega$	1%	0603	
R_B	$150 k\Omega$	1%	0603	

Figure 11. $V_{OUT} = 3.3V$

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

Then calculate R_B using

$$R_B = V_{OUT} \times R_T / (5.875V - V_{OUT}) \quad (1)$$

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- 3.1 *United States*

- 3.1.1 *Notice applicable to EVMs not FCC-Approved:*

This kit is designed to allow product developers to evaluate electronic components, circuitry, or software associated with the kit to determine whether to incorporate such items in a finished product and software developers to write software applications for use with the end product. This kit is not a finished product and when assembled may not be resold or otherwise marketed unless all required FCC equipment authorizations are first obtained. Operation is subject to the condition that this product not cause harmful interference to licensed radio stations and that this product accept harmful interference. Unless the assembled kit is designed to operate under part 15, part 18 or part 95 of this chapter, the operator of the kit must operate under the authority of an FCC license holder or must secure an experimental authorization under part 5 of this chapter.

- 3.1.2 *For EVMs annotated as FCC – FEDERAL COMMUNICATIONS COMMISSION Part 15 Compliant:*

CAUTION

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

FCC Interference Statement for Class A EVM devices

NOTE: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

FCC Interference Statement for Class B EVM devices

NOTE: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- *Reorient or relocate the receiving antenna.*
- *Increase the separation between the equipment and receiver.*
- *Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.*
- *Consult the dealer or an experienced radio/TV technician for help.*

3.2 Canada

3.2.1 For EVMs issued with an Industry Canada Certificate of Conformance to RSS-210

Concerning EVMs Including Radio Transmitters:

This device complies with Industry Canada license-exempt RSS standard(s). Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

Concernant les EVMs avec appareils radio:

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes: (1) l'appareil ne doit pas produire de brouillage, et (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

Concerning EVMs Including Detachable Antennas:

Under Industry Canada regulations, this radio transmitter may only operate using an antenna of a type and maximum (or lesser) gain approved for the transmitter by Industry Canada. To reduce potential radio interference to other users, the antenna type and its gain should be so chosen that the equivalent isotropically radiated power (e.i.r.p.) is not more than that necessary for successful communication. This radio transmitter has been approved by Industry Canada to operate with the antenna types listed in the user guide with the maximum permissible gain and required antenna impedance for each antenna type indicated. Antenna types not included in this list, having a gain greater than the maximum gain indicated for that type, are strictly prohibited for use with this device.

Concernant les EVMs avec antennes détachables

Conformément à la réglementation d'Industrie Canada, le présent émetteur radio peut fonctionner avec une antenne d'un type et d'un gain maximal (ou inférieur) approuvé pour l'émetteur par Industrie Canada. Dans le but de réduire les risques de brouillage radioélectrique à l'intention des autres utilisateurs, il faut choisir le type d'antenne et son gain de sorte que la puissance isotrope rayonnée équivalente (p.i.r.e.) ne dépasse pas l'intensité nécessaire à l'établissement d'une communication satisfaisante. Le présent émetteur radio a été approuvé par Industrie Canada pour fonctionner avec les types d'antenne énumérés dans le manuel d'usage et ayant un gain admissible maximal et l'impédance requise pour chaque type d'antenne. Les types d'antenne non inclus dans cette liste, ou dont le gain est supérieur au gain maximal indiqué, sont strictement interdits pour l'exploitation de l'émetteur.

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If User uses EVMs in Japan, not certified to Technical Regulations of Radio Law of Japan, User is required by Radio Law of Japan to follow the instructions below with respect to EVMs:

1. Use EVMs in a shielded room or any other test facility as defined in the notification #173 issued by Ministry of Internal Affairs and Communications on March 28, 2006, based on Sub-section 1.1 of Article 6 of the Ministry's Rule for Enforcement of Radio Law of Japan,
2. Use EVMs only after User obtains the license of Test Radio Station as provided in Radio Law of Japan with respect to EVMs, or
3. Use of EVMs only after User obtains the Technical Regulations Conformity Certification as provided in Radio Law of Japan with respect to EVMs. Also, do not transfer EVMs, unless User gives the same notice above to the transferee. Please note that if User does not follow the instructions above, User will be subject to penalties of Radio Law of Japan.

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