LP38798EVM User's Guide

The LP38798EVM evaluation board is designed to demonstrate the capabilities of the LP38798SD-ADJ high performance LDO voltage regulator. It is intended to provide a flexible circuit configurations and access to points of interest. The circuit schematic is shown in Figure 1.

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1 Introduction

The LP38798EVM evaluation board is designed to demonstrate the capabilities of the LP38798-ADJ high performance LDO voltage regulator. It is intended to provide for flexible circuit configurations and access to points of interest. The circuit schematic is shown in Figure 1.

2 Operating Range

- Minimum Operating Input Voltage: 5.50V
- Maximum Operating Input Voltage: 20.0V
- Output Voltage : 5.00V
- Maximum Operating Output Current: 800mA
- Ambient Temperature Operating Range 0°C to 50°C
- Board Size 1.00 inches x 1.33 inches

While the values listed for the Operating Range are all accurate, some combinations of ambient temperature (T_A), device dissipation (P_D), and the maximum junction temperature (T_J) of 125°C may limit the useable range. See the device datasheet for a full discussion of thermal considerations.

Typical evaluation board performance and characteristics curves are shown in the LP38798-ADJ datasheet (Literature Number SNOSCT6). The PCB layout is shown in Figure 3 through Figure 7. Test points are provided on the evaluation board for signal monitoring and optional Enable control.

3 Evaluation Board Start-Up

Before applying power to the LP38798EVM board, all external connections should be verified. The external power supply must be turned off before being connected, Confirm proper polarity to the 'VIN' and 'GND' terminals before turning the external power supply on. An appropriate load should be connected between the 'VOUT' and 'GND' terminals. Under basic evaluation conditions all of the test points can be left open. The evaluation board will be in the normal operating mode when input power is applied.

Use of the ENABLE function is optional. Pulling the ENABLE pin low, either by connecting to voltage lower than the typical OFF threshold of 1.00V, or by connecting directly to ground, will disable the output. Do not connect the ENABLE pin to any voltage above the $EN_{(CLAMP)}$ voltage of 5.0V (typical).

4 Setting the Output Voltage

The LP38798EVM board is assembled with R1= 47.5 kΩ and R2= 15.0 kΩ, to set the output voltage to 5.00V.

Resistors R1 and R2 may be replaced, as needed, to achieve the desired output voltage as long as the value for R2 is no less than 12.9 kΩ

The following formula is used to determine the typical output voltage:

$$V_{OUT} = ((V_{FB} \times (1 + (R1 / R2))) + V_{OS}) \quad (1)$$

Alternately, the following formula can be used to determine the appropriate R1 value for a given R2 value with a $V_{OUT} \geq 1.20V$:

$$R1 = (((V_{OUT} / V_{FB}) - 1) \times R2) \quad (2)$$

The following table suggests some ±1% tolerance values for R1, keeping R2 held at the installed value of 15.0 kΩ , for a range of output voltages using the typical V_{FB} value of 1.200V. This is not a definitive list, as other combinations R1 and R2 exist that will provide similar, possibly better, performance.

Target V_{OUT}	R1	R2	Typical V_{OUT}
1.50V	3.74 kΩ	15.0 kΩ	1.499V
1.80V	7.50 kΩ	15.0 kΩ	1.800V
1.90V	8.66 kΩ	15.0 kΩ	1.893V
2.00V	10.0 kΩ	15.0 kΩ	2.000V
2.50V	16.2 kΩ	15.0 kΩ	2.496V

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Target V_{OUT}	R1	R2	Typical V_{OUT}
3.00V	22.6 kΩ	15.0 kΩ	3.008V
3.30V	26.1 kΩ	15.0 kΩ	3.288V
4.70V	44.2 kΩ	15.0 kΩ	4.736V
5.00V	47.5 kΩ	15.0 kΩ	5.000V

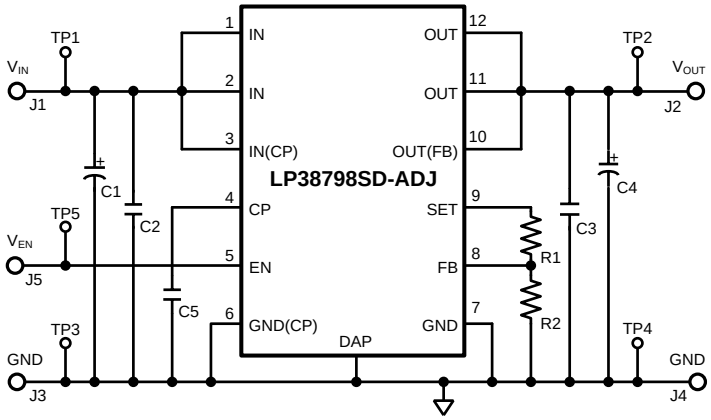


Figure 1. LP38798EVM Schematic

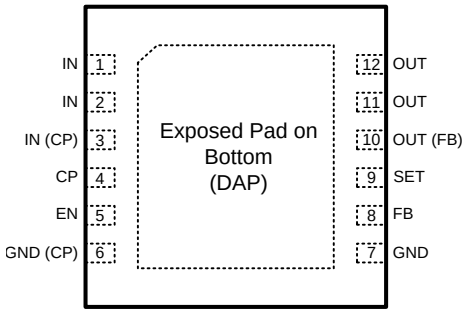


Figure 2. LP38798SD-ADJ (12-lead WSON) Connection Diagram

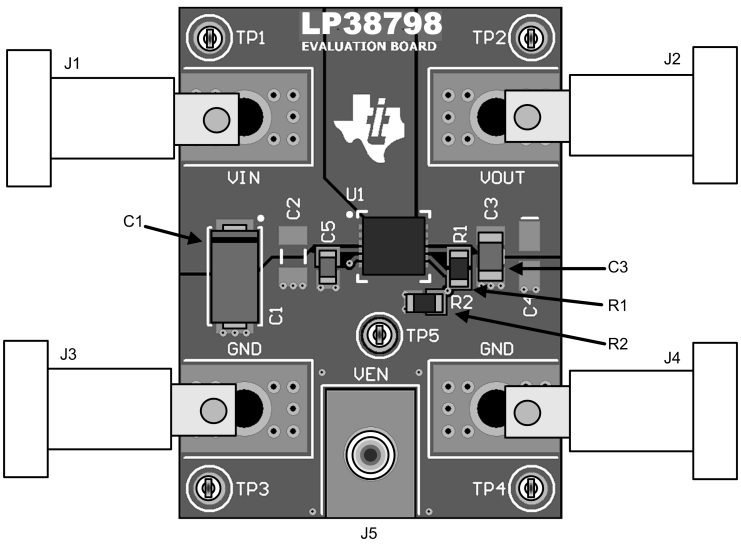


Figure 3. Top Layer as Viewed from Top

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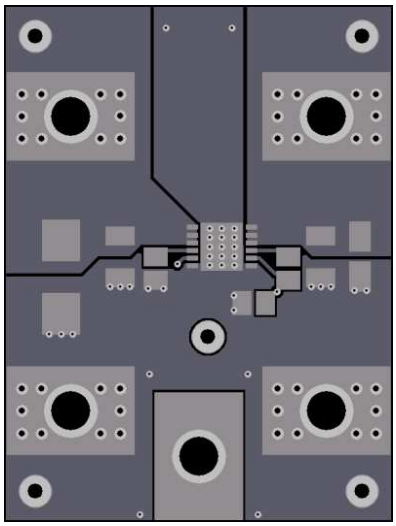


Figure 4. Copper Layer 1 (Top Layer) as Viewed from Top

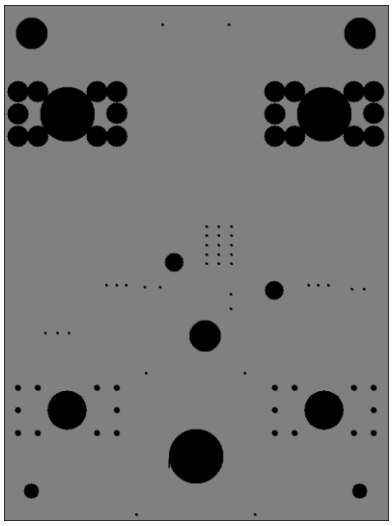


Figure 5. Copper Layer 2 (Mid-Layer 1) as Viewed from Top

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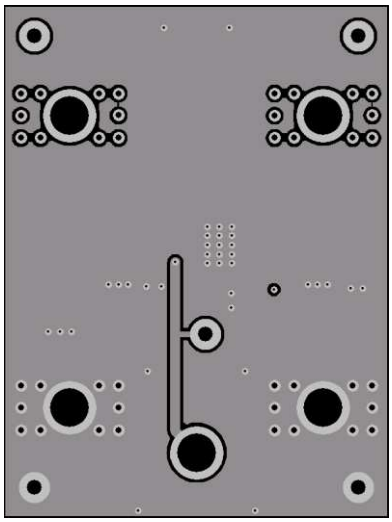


Figure 6. Copper Layer 3 (Mid-Layer 2) as Viewed from Top

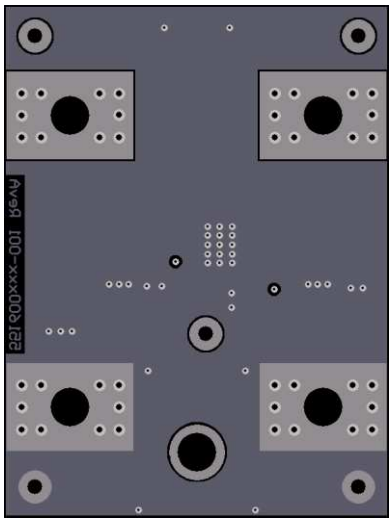
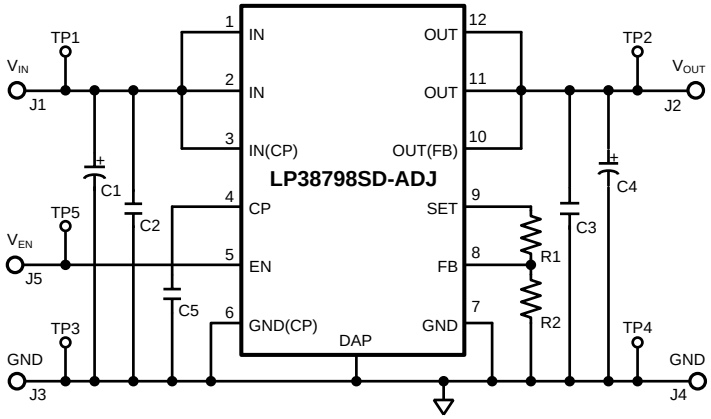


Figure 7. Copper Layer 4 (Bottom Layer) as Viewed from Top

5 Schematic for LP38798EVAL



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Table 1. Bill of Materials for LP38798EVAL

Designator	Description	Manufacturer	Manufacturer Part Number	Digi-Key Number
IC1	Voltage Regulator, LDO	Texas Instruments	LP38798SD-ADJ	-
C1	Capacitor, Tantalum, 10uF +/- 10%, 25V, 500mΩ, 2312	AVX Corporation	TPSC106K025R0500	478-1762-1-ND
C2	Capacitor, MLCC, 1uF +/-10%, 25V, X7R, 1206	AVX Corporation	12103C105KAT2A	478-3816-1-ND
C3	Capacitor, MLCC, 10uF +/-10%, 16V, X7R, 1206	AVX Corporation	1206YC106KAT2A	478-5725-1-ND
C4	Capacitor, Tantalum, 10uF +/- 10%, 10V, 0.9 ohm, 3216-18	AVX Corporation	TPSA106K010R0900	478-1751-1-ND
C5	Capacitor, MLCC, 10,000 pF (10nF), 10%, 50V, X7R, 0805	AVX Corporation	08055C103KAT2A	478-1383-1-ND
J1, J2	Connector, Jack, Banana RED	Emerson Network Power Connectivity Solutions	108-0902-001	J151-ND
J3, J4	Connector, Jack, Banana BLACK	Emerson Network Power Connectivity Solutions	108-0903-001	J152-ND
J5	Terminal, Double Turret, 0.109in hole	Keystone Electronics	1502-2	1502–2K-ND
R1	Resistor, 47.5kΩ, 1%, 0.125W, 0805	Vishay-Dale	CRCW080547K5FKEA	541-47.5KCCT-ND
R2	Resistor, 15.0kΩ, 1%, 0.125W, 0805	Vishay-Dale	CRCW080515K0FKEA	541-15.0KCCT-ND
TP1, TP2	Test Point, Miniature RED	Keystone Electronics	5000	5000K-ND
TP3, TP4	Test Point, Miniature BLACK	Keystone Electronics	5001	5001K-ND
TP5	Test Point, Miniature WHITE	Keystone Electronics	5002	5002K-ND

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General Statement for EVMs including a radio

User Power/Frequency Use Obligations: This radio is intended for development/professional use only in legally allocated frequency and power limits. Any use of radio frequencies and/or power availability of this EVM and its development application(s) must comply with local laws governing radio spectrum allocation and power limits for this evaluation module. It is the user's sole responsibility to only operate this radio in legally acceptable frequency space and within legally mandated power limitations. Any exceptions to this are strictly prohibited and unauthorized by Texas Instruments unless user has obtained appropriate experimental/development licenses from local regulatory authorities, which is responsibility of user including its acceptable authorization.

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

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

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.

For EVMs annotated as IC – INDUSTRY CANADA Compliant

This Class A or B digital apparatus complies with Canadian ICES-003.

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

Concerning EVMs including radio transmitters

This device complies with Industry Canada licence-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.

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.

Cet appareil numérique de la classe A ou B est conforme à la norme NMB-003 du Canada.

Les changements ou les modifications pas expressément approuvés par la partie responsable de la conformité ont pu vider l'autorité de l'utilisateur pour actionner l'équipement.

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.

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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2. Use this product only after you obtained the license of Test Radio Station as provided in Radio Law of Japan with respect to this product, or
3. Use of this product only after you obtained the Technical Regulations Conformity Certification as provided in Radio Law of Japan with respect to this product. Also, please do not transfer this product, unless you give the same notice above to the transferee. Please note that if you could not follow the instructions above, you will be subject to penalties of Radio Law of Japan.

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2. You have full and exclusive responsibility to assure the safety and compliance of your products with all such laws and other applicable regulatory requirements, and also to assure the safety of any activities to be conducted by you and/or your employees, affiliates, contractors or designees, using the EVM. Further, you are responsible to assure that any interfaces (electronic and/or mechanical) between the EVM and any human body are designed with suitable isolation and means to safely limit accessible leakage currents to minimize the risk of electrical shock hazard.
3. You will employ reasonable safeguards to ensure that your use of the EVM will not result in any property damage, injury or death, even if the EVM should fail to perform as described or expected.
4. You will take care of proper disposal and recycling of the EVM's electronic components and packing materials.

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