AN-1204 LM3478/LM3488 Evaluation Board

User's Guide

Literature Number: SNVA656A
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1 Introduction

The LM3478 and LM3488 are current mode, low side N-channel FET controllers. They can be utilized in numerous configurations including a Boost, Flyback or SEPIC. This evaluation board demonstrates the flexibility of the LM3478 in a boost topology.

2 Features

- 5V Input Voltage Range
- 12V Output Voltage (default setting)
- Up to 1500 mA Output Current
- 1 MHz switching frequency
- PCB size: 43.18 mm x 52.07 mm

3 Adjusting the Output Voltage

The output voltage can be changed from 12V to another voltage by adjusting the feedback resistors using the following equation:

$$V_{OUT} = V_{FB}(1+(R_{FBT}/R_{FBB})) \quad (1)$$

Where V_{FB} is 1.26V.

For more information on components selection and features, see the LM3478 data sheet.

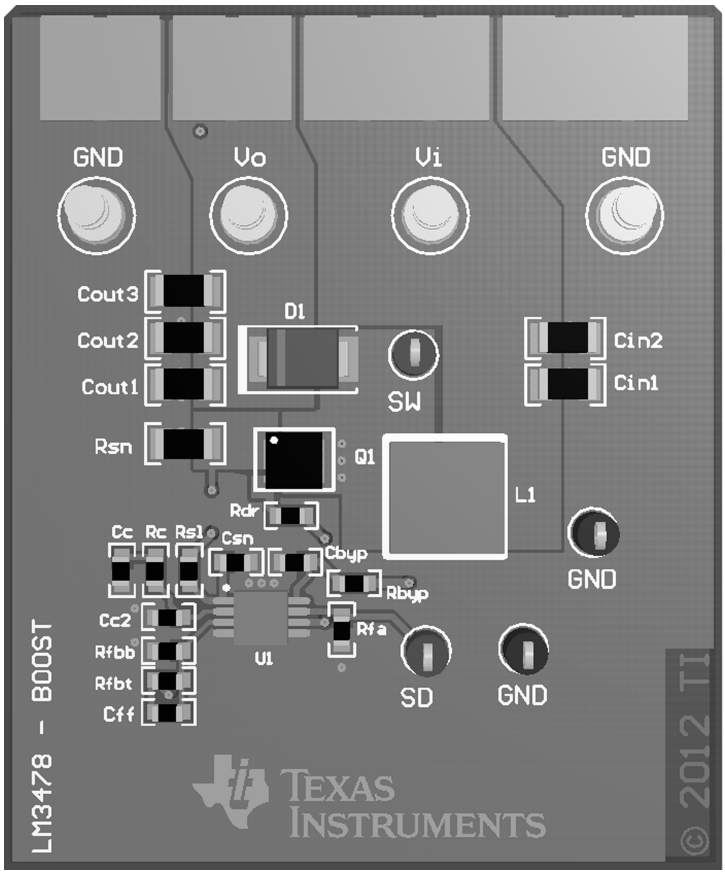
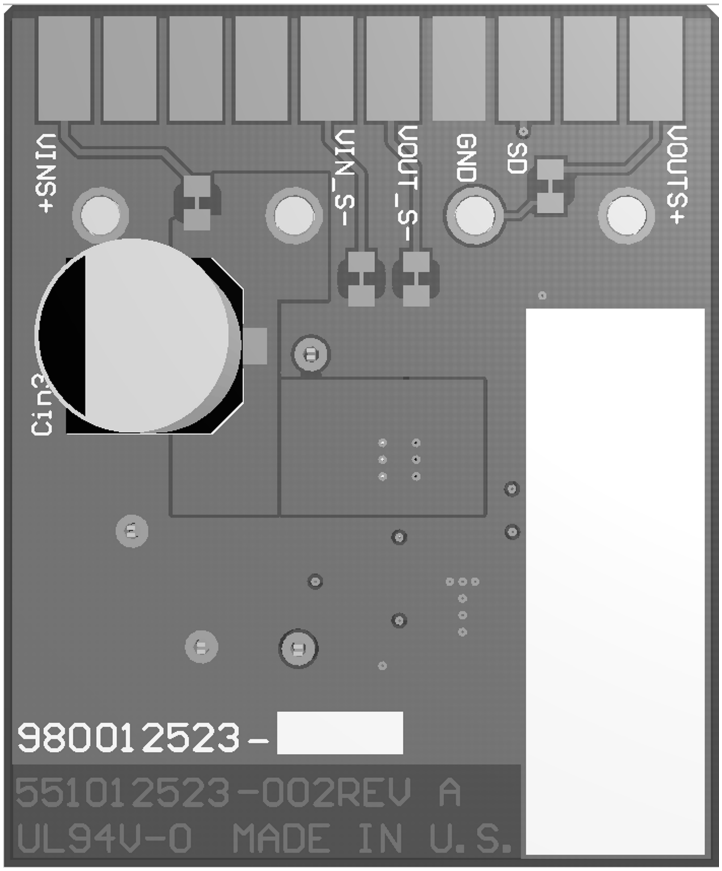


Figure 1. Top View



A Bottom View

Figure 2. LM3478 Evaluation Board

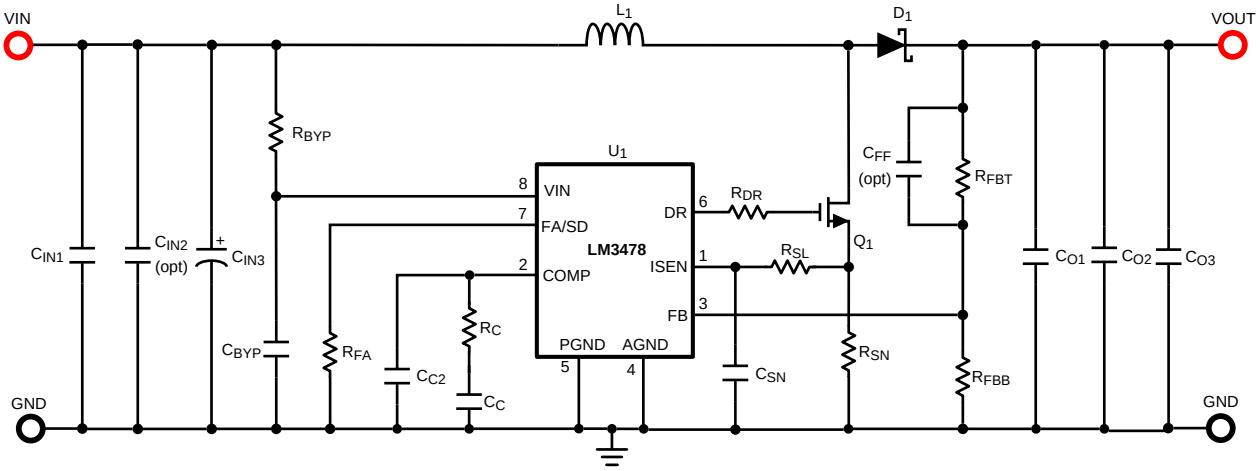


Figure 3. LM3478 Evaluation Board Schematic

Table 1. Bill of Materials (BOM) LM3478

Designation	Description	Size	Manufacturer Part #	Vendor
C_{IN1}	CAP, 47µF, 20%, 25V, X5R	1206	C3216X5R1E476M	TDK
C_{IN2}	optional			

Table 1. Bill of Materials (BOM) LM3478 (continued)

Designation	Description	Size	Manufacturer Part #	Vendor
C_{IN3}	CAP, 150µF, 20%, 8V 15mΩ, Aluminum	7.3mm L x 4.3mm W x 4.2mm H	EEF-UE0K151R	Panasonic
C_{O1},C_{O2}, C_{O3}	CAP, 47µF, 20%, 25V, X5R	1206	C3216X5R1E476M	TDK
C_C	CAP, 0.1µF, 10%, 16V, X7R	0603	GRM188R71C104KA01D	Murata
C_{C2}	CAP, 100pF, 5%, 50V, NP0	0603	GRM1885C1H101JA01D	Murata
C_{BYP}	CAP, 0.1µF, 10%, 16V, X7R	0603	GRM188R71C104KA01D	Murata
C_{FF}	optional			
C_{SN}	CAP, 0.01µF, 10%, 50V, X7R	0603	C0603C103K5RACTU	Kemet
R_C	RES, 1kΩ, 1%, 0.1W	0603	CRCW06031K00FKEA	Vishay
R_{BYP}	RES, 10.0 ohm, 1%, 0.1W	0603	CRCW060310R0FKEA	Vishay
R_{FBT}	RES, 86.6kΩ, 1%, 0.1W	0603	CRCW060386K6FKEA	Vishay
R_{FBB}	RES, 10.2kΩ, 1%, 0.1W	0603	CRCW060310K2FKEA	Vishay
R_{DR}	RES, 0Ω, 1%, 0.1W	0603	CRCW06030000Z0EA	Vishay
R_{SL}	RES, 0Ω, 1%, 0.1W	0603	CRCW06030000Z0EA	Vishay
R_{SN}	RES, 0.015Ω, 1%, 1W	1206	CSR1206FK15L0	Stackpole Electronics
Q_1	NexFET™ N-CH, 25V, 60A, $R_{DS(on)}$= 4.4mΩ	8-SON	CSD16323Q3	TI
D_1	Diode Schottky, 30V, 3A	SOD128	PMEG3030EP	Vishay
L_1	Shielded Inductor, 1.8µH, 10A	6.36mm L x 6.56mm W x 3.1mm H	XAL6030-182ME	Coilcraft
U_1	LM3478MM			TI
	EDGE CONNECTOR		307-020-500-202	EDAC

4 Optional components

C_{IN2} is an additional input capacitor.

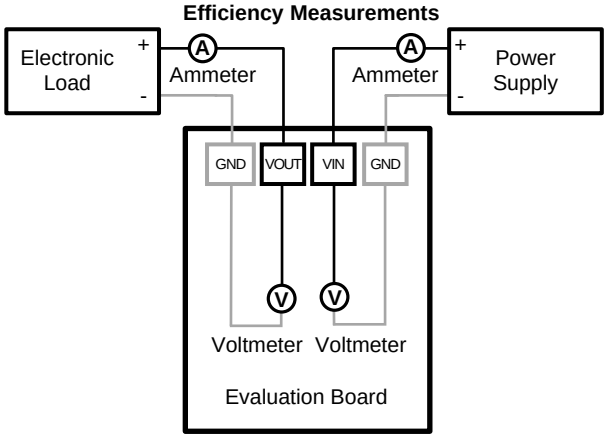
C_{FF} increases the gain of the dynamic loop during load transients.

5 Test Setup

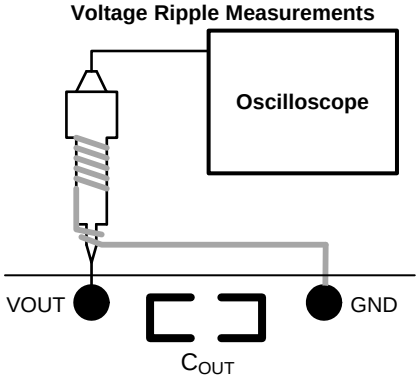
Table 2. Demonstration Board Quick Setup Procedures

Step	Description	Notes
1	Connect a power supply to V_{IN} and GND terminals	V_{IN} range: 4.5V to 5.5V
2	Turn on V_{IN} with 0A load applied, check V_{OUT}	V_{OUT} = 12V
3	Slowly increase the load from 0A to 1.5A, check V_{OUT}	V_{OUT} = 12V

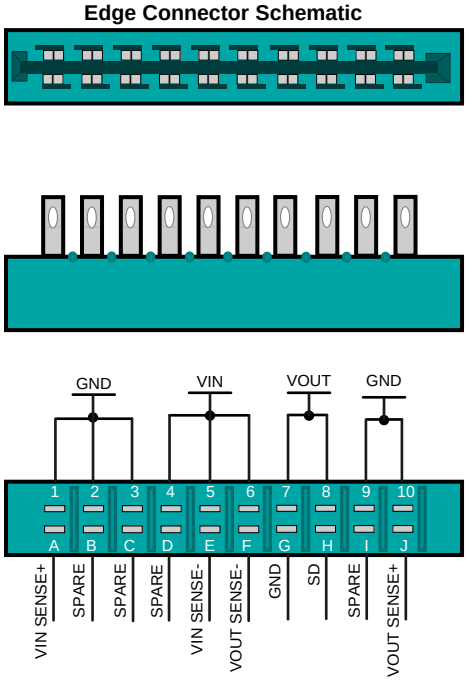
Efficiency Measurements



Voltage Ripple Measurements

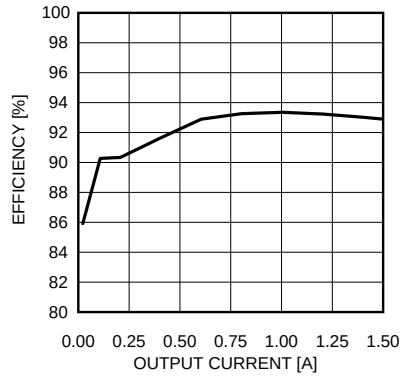


Edge Connector Schematic

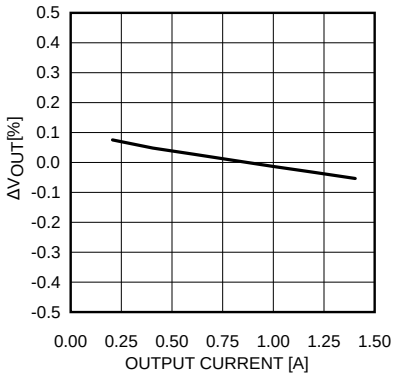


6 Typical Performance Characteristics for LM3478 Evaluation Board

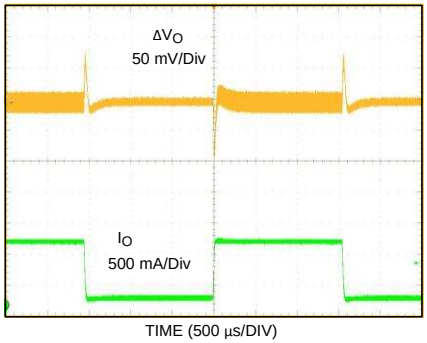
Efficiency vs. Load Current



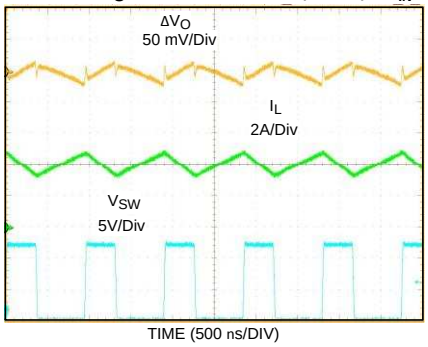
Load Regulation



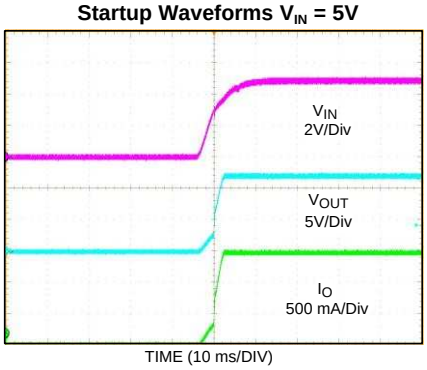
Load Transient Waveforms 500mA to 1500mA, $5V_{IN}$



Switching Waveforms CCM, 1.5A, $5V_{IN}$



Startup Waveforms V_{IN} = 5V



7 Layout

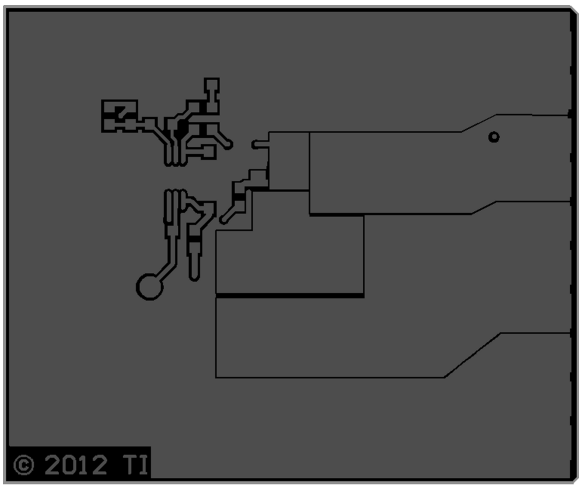


Figure 4. Top Layer

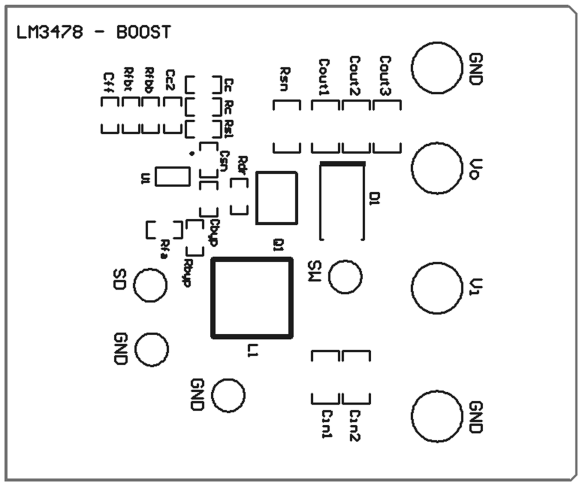


Figure 5. Top Silkscreen

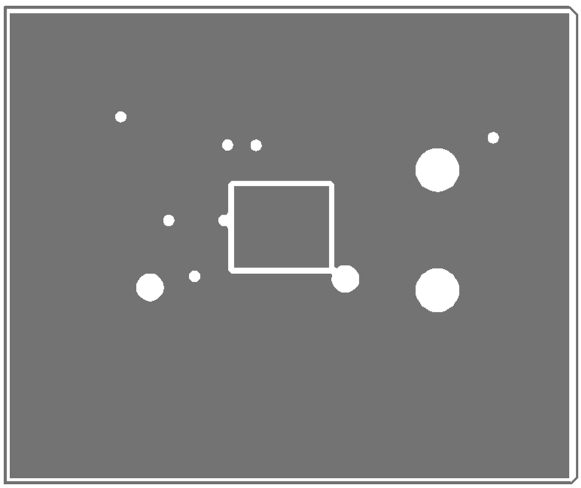


Figure 6. Mid Layer 1

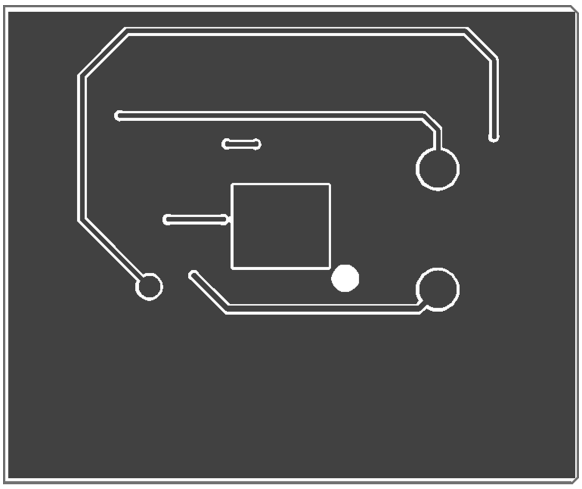


Figure 7. Mid Layer 2

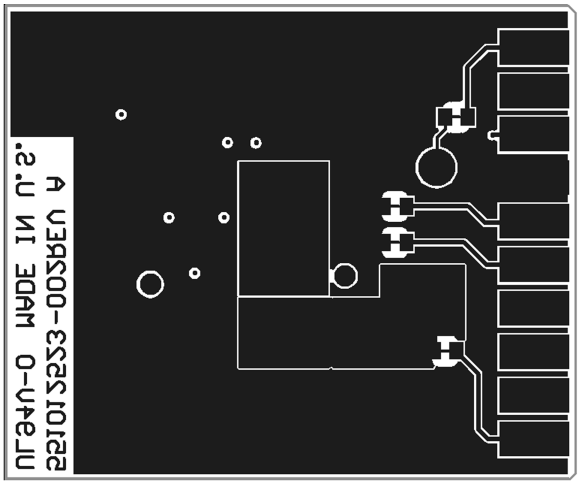


Figure 8. Bottom Layer

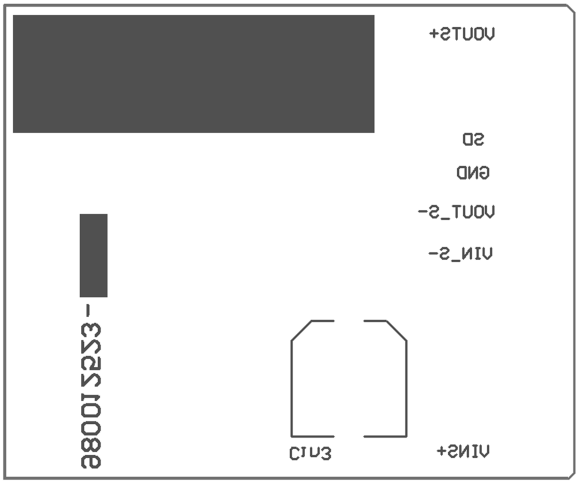


Figure 9. Bottom Silkscreen

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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.

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- 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.

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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.

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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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Mailing Address: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265