User's Guide
SLVUAM5A–February 2016–Revised June 2016

TPS61021A-PWR723 Evaluation Module

This user's guide describes the characteristics, operation, and the use of the TPS61021EVM-723 evaluation module (EVM). The EVM contains the TPS61021A, which is a 3-A boost converter with 0.5-V ultra-low input voltage. This user's guide includes EVM specifications, recommended test setup, test results, a schematic diagram, bill of materials (BOM), and the board layout.

Contents

List of Figures

List of Tables

1 Introduction

1.1 Performance Specification

Table 1 provides a summary of the TPS61021A EVM performance specifications. All the specifications are given for an ambient temperature of 25°C.

Table 1. Performance Specification Summary

Specification	Test Conditions	MIN	TYP	MAX	Unit
Input voltage		0.9	2.4	3.2	V
Output voltage	TPS61021A EVM, V_{IN} = 2.4 V, $I_O \leq 2$ A	3.2	3.3	3.4	V
Output current	V_{IN} = 1.2 V			1	A
	V_{IN} = 2.4 V			2.3	A

1.2 Modification

The printed-circuit board (PCB) for this EVM is designed to accommodate some modifications by the user. The external component can be changed according to the real application.

1.3 Input Capacitor

A 150-µF tantalum capacitor, C1, is added as the input capacitor in the EVM. The ESR of the tantalum capacitor is 0.1 Ω, to damp the ringing of the input voltage when the EVM is powered by a power supply with a long cable. The capacitor is not required for proper operation and can be removed in a real application.

1.4 Feedforward Capacitor

A feedforward capacitor, C7 in Figure 7, is used to improve the phase margin of the boost converter. Equation 1 calculates the zero frequency formed by the feedforward capacitor C7, and the resistor R1 of the feedback resistor divider.

$$f_Z = \frac{1}{2\pi \times R1 \times C7} \quad (1)$$

TI recommends setting f_Z at 50 kHz to boost the phase margin at the crossover frequency. When R1 = 316 kΩ, C7 is 10 pF on the EVM.

2 Setup

This section describes how to properly connect, set up, and use the TPS61021EVM-723.

2.1 Input/Output Connector Descriptions

The following :

J1-VIN	Positive input connection from the input supply for the EVM
J2-GND	Return connection from the input supply for the EVM
J5-VOUT	Positive connection for the output voltage
J6-GND	Return connection for the output voltage
J7-EN	EN pin input jumper. Place a jumper across EN and pin 1 to turn on the IC, place a jumper across EN and pin 3 to turn off the IC

3 Test Results

3.1 Startup Waveform

The startup waveform is shown in Figure 1.

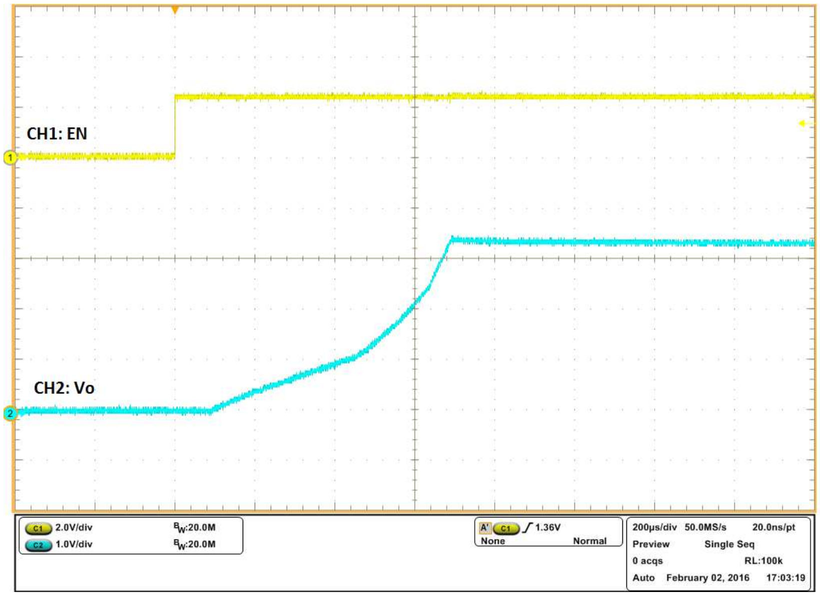

Figure 1. Startup Waveforms (No Load)

3.2 Efficiency

The conversion efficiency is shown in Figure 2.

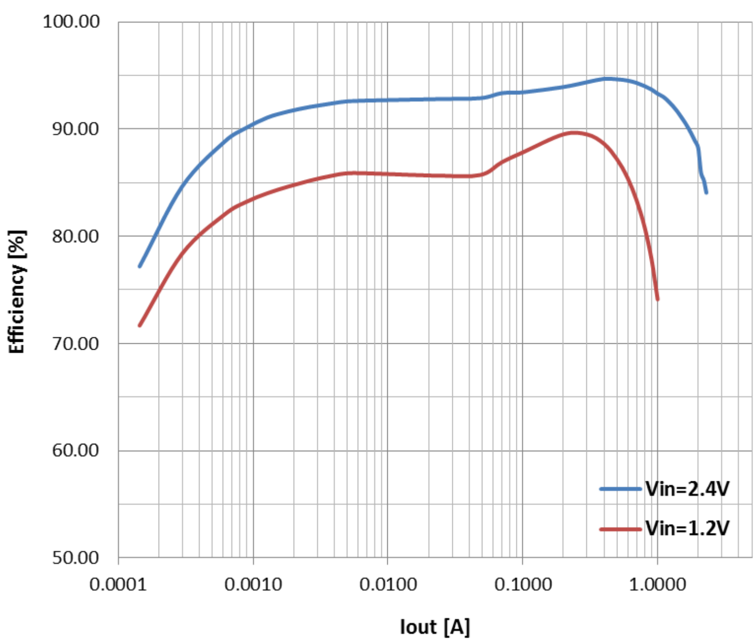

Figure 2. TPS61021A EVM Efficiency vs Load Current

3.3 Load Transient

The load transient waveform is shown in Figure 3. Note that the effective output capacitance is about 31 µF under V_O = 3.3 V DC bias, although two 22-µF ceramic capacitors are used in the EVM. Larger effective capacitance helps to improve the load transient.

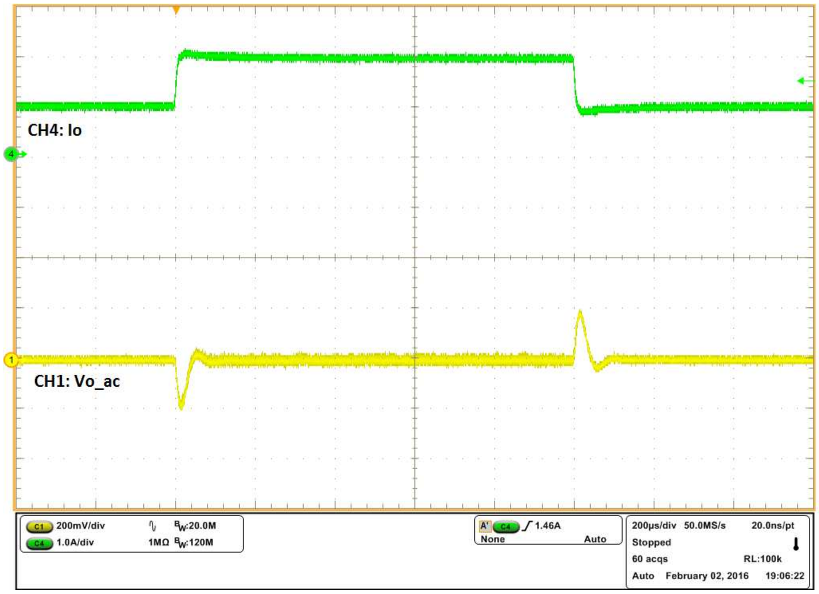

Figure 3. Load Transient (V_O = 3.3 V, I_O = 1 A to 2 A)

3.4 Loop Characteristics

The loop Bode plot is shown in Figure 4.

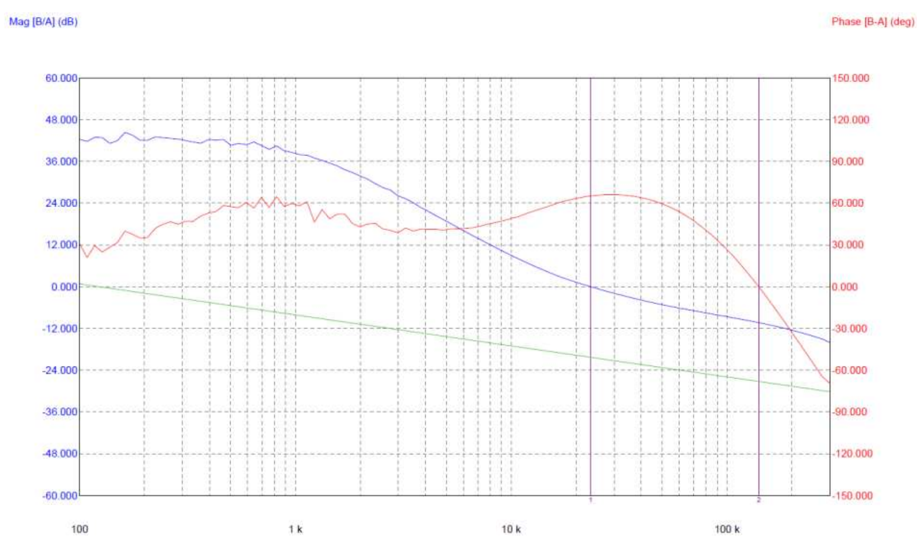

Figure 4. Loop Bode Plot (V_{IN} = 2.4 V, V_O = 3.3 V / I_O = 2 A)

3.5 Output Voltage Ripple

Figure 5 shows the output voltage ripple , switching waveforms, and the inductor current ripple in CCM mode.

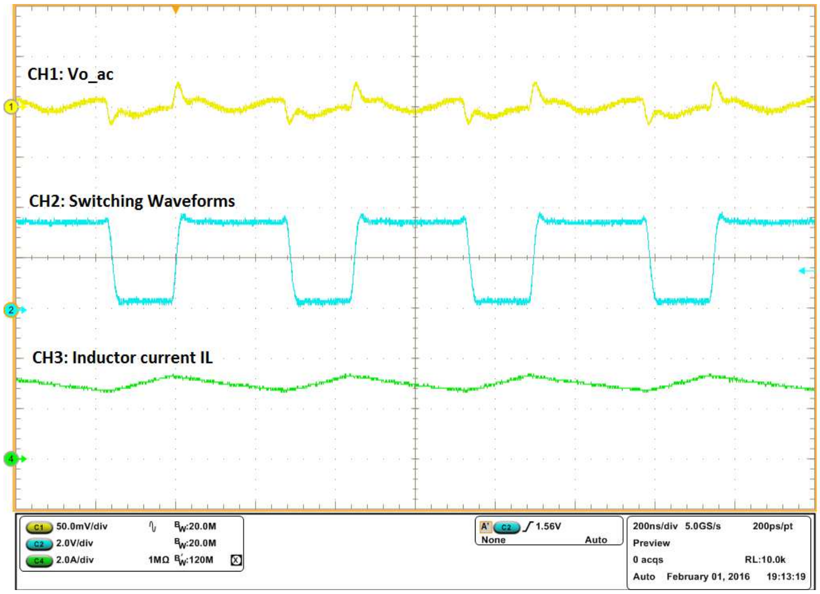

Figure 5. Output Ripple in CCM (V_{IN} = 2.4 V, V_O = 3.3 V / I_O = 2 A)

Figure 6 shows the output voltage ripple, switching waveforms, and the inductor current ripple in PFM mode when the converter is operating at light load.

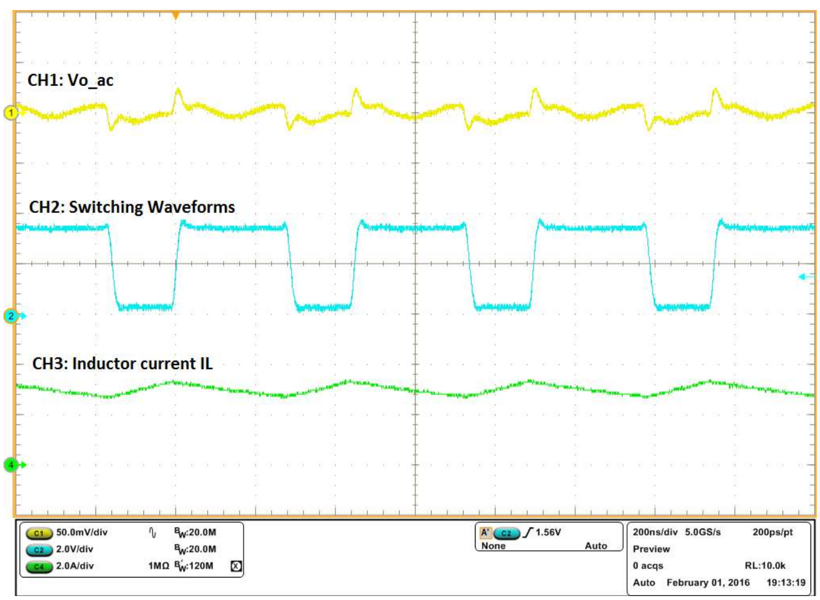

Figure 6. Output Ripple in PFM (V_{IN} = 2.4 V, V_O = 3.3 V / I_O = 160 mA)

4 Schematic and Bill of Materials

This section provides the TPS61021EVM-723 schematic, bill of materials (BOM), and board layout.

4.1 Schematic

Figure 7 illustrates the EVM schematic.

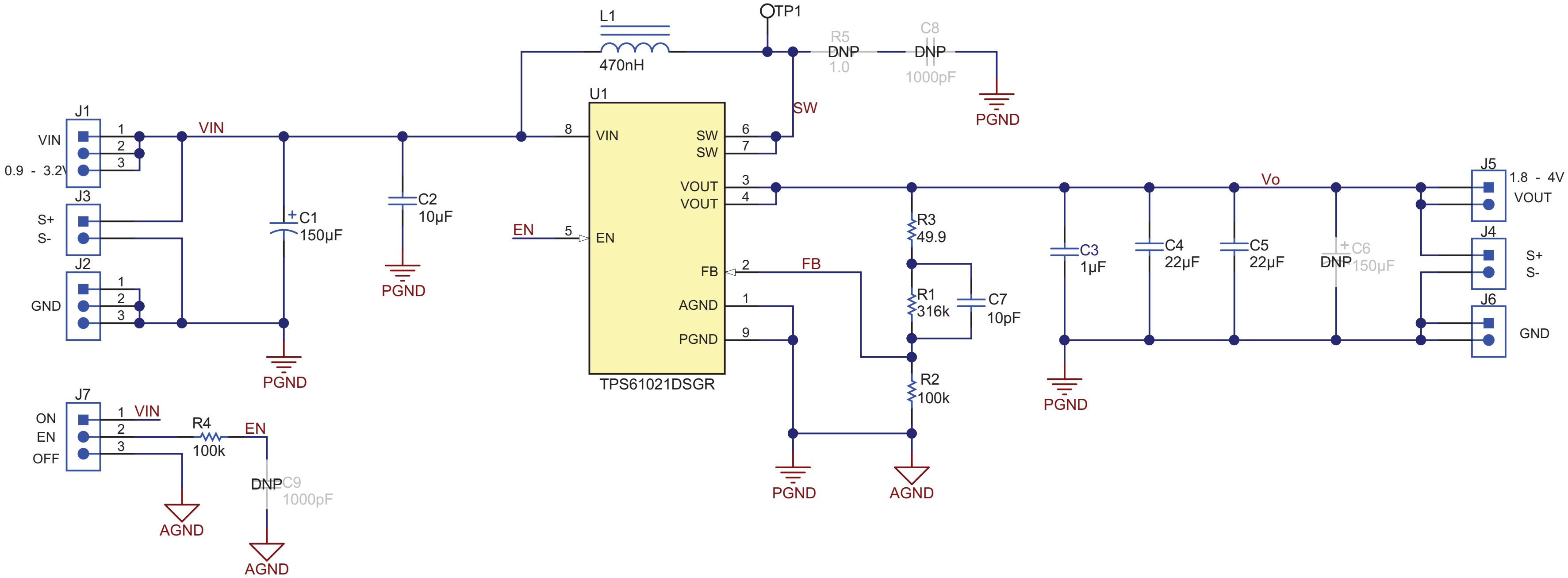

Figure 7. TPS61021EVM-723 Schematic

4.2 Bill of Materials

Table 2 displays the EVM bill of materials.

Table 2. TPS61021EVM-723 Bill of Materials

Designator	QTY	Value	Description	Package	Part Number	MFG
C1	1	150uF	CAP, TA, 150 µF, 10 V, +/- 10%, 0.1 ohm, SMD	7343-31	T495D157K010ATE100	Kemet
C2	1	10uF	CAP, CERM, 10 µF, 6.3 V, +/- 20%, X5R, 0603	0603	GRM188R60J106ME47D	MuRata
C3	1	1uF	CAP, CERM, 1 µF, 25 V, +/- 10%, X7R, 0603	0603	GRM188R71E105KA12D	MuRata
C4, C5	2	22uF	CAP, CERM, 22 µF, 10 V, +/- 20%, X5R, 0805	0805	GRM21BR61A226ME44L	MuRata
C7	1	10pF	CAP, CERM, 10 pF, 100 V, +/- 5%, C0G/NP0, 0603	0603	GRM1885C2A100JA01D	MuRata
J1, J2, J7	3		Header, 100mil, 3x1, Gold, TH	3x1 Header	TSW-103-07-G-S	Samtec
J3, J4, J5, J6	4		Header, 100mil, 2x1, Gold, TH	2x1 Header	TSW-102-07-G-S	Samtec
L1	1	470nH	Inductor, Shielded, Composite, 470 nH, 3.5 A, 0.0076 ohm, SMD	SMD, 4x4x1.5mm	XFL4015-471MEC	Coilcraft
R1	1	316k	RES, 316 k, 1%, 0.1 W, 0603	0603	RC0603FR-07316KL	Yageo America
R2, R4	2	100k	RES, 100 k, 1%, 0.1 W, 0603	0603	CRCW0603100KFKEA	Vishay-Dale
R3	1	49.9	RES, 49.9, 1%, 0.1 W, 0603	0603	RC0603FR-0749R9L	Yageo America
U1	1		3-A BOOST CONVERTER WITH 0.5V ULTRA-LOW INPUT VOLTAGE, DSG0008A	DSG0008A	TPS61021ADSGR	Texas Instruments
C6	0	150uF	CAP, TA, 150 µF, 10 V, +/- 10%, 0.1 ohm, SMD	7343-31	T495D157K010ATE100	Kemet
C8, C9	0	1000pF	CAP, CERM, 1000 pF, 50 V, +/- 10%, X7R, 0603	0603	C0603C102K5RACTU	Kemet
R5	0	1.0	RES, 1.0, 5%, 0.1 W, 0603	0603	CRCW06031R00JNEA	Vishay-Dale

5 Board Layout

Figure 8 and Figure 9 show the design of the TPS61021EVM-723 PCB layout.

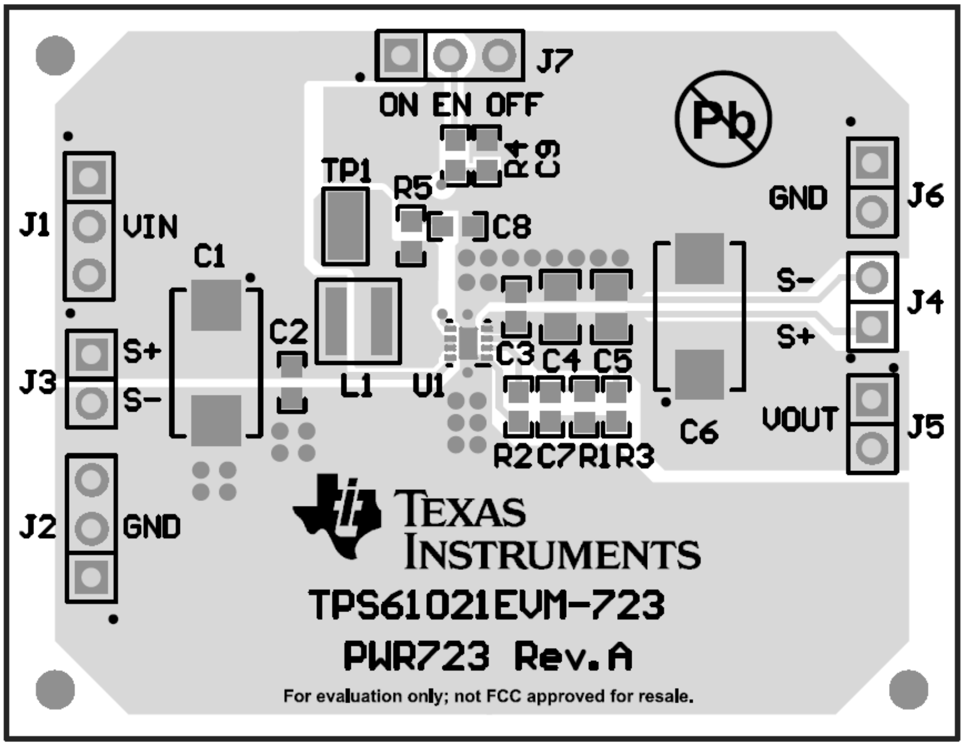

Figure 8. TPS61021EVM-723 Top-Side Layout

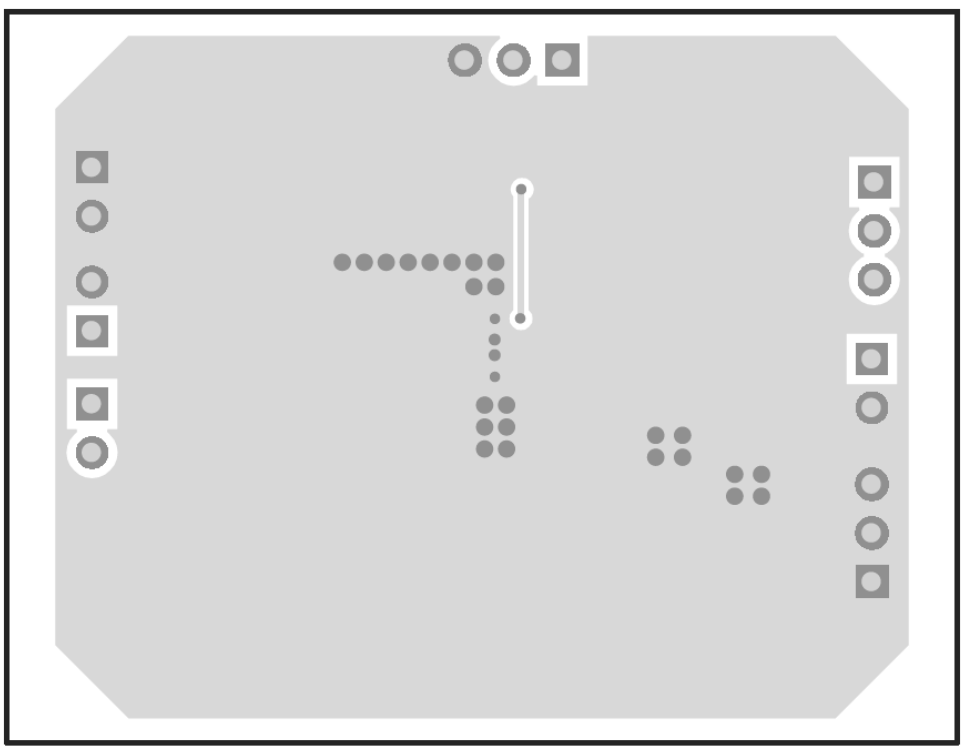

Figure 9. TPS61021EVM-723 Bottom-Side Layout

Revision History

NOTE: Page numbers for previous revisions may differ from page numbers in the current version.

Changes from Original (February 2016) to A Revision	Page
• Changed device name to TPS61021A throughout document.	1

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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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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.

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