User's Guide

TPS22999 Evaluation Module

ABSTRACT

This user's guide describes the characteristics, operation, and use of the TPS22999 load switch evaluation module (EVM). This document contains the complete EVM schematic diagram, printed-circuit board layouts, bill of materials, and necessary instructions on how to operate the EVM.

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Trademarks

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1 Introduction

The TPS22999 EVM is a two-layer PCB containing the TPS22999 load switch device. The VIN and VOUT connections to the device and the PCB layout routing are capable of handling high continuous currents and provide a low-resistance pathway into and out of the device under test. Test point connections allow the EVM user to control the device with user-defined test conditions and make accurate R_{ON} measurements.

1.1 Description

Table 1-1 lists a short description of the TPS22999 load switch performance specification. For additional details on load switch performance, application notes, and device data sheets, see www.ti.com/loadswitch.

Table 1-1. TPS22999 Characteristics

EVM	Device	Rise Time Typical (µs)	V_{BIAS} (V)	V_{IN} (V)	Enable (ON Pin)	Power Good (PG Pin)	Quick Output Discharge Typical
PSIL249	TPS22999	Fixed	2.3 V to 5.5 V	0.1 V to Vbias – 1 V	Active High	Active Low	5.3 Ω

1.2 Features

This EVM has the following features:

- V_{IN} input voltage range: 0.1 V to Vbias
- Access to the VIN, VOUT, EN, VBIAS, PG, and GND pins of the TPS22999 load switch
- Onboard CIN and COUT capacitors with landing pads for optional additional capacitance

2 Electrical Performance

See the *TPS22999 4.5-V, 7.5-mΩ, 1.5-A Fast Turn-On Load Switch With Limited Inrush Current* data sheet for detailed electrical characteristics of the TPS22999.

Please note that some TPS22999EVMs are populated with pre-production units. On these EVMs, the PG pin may not assert low during operation if VIN < 0.5V.

3 Schematic

Figure 3-1 illustrates the TPS22999EVM schematic.

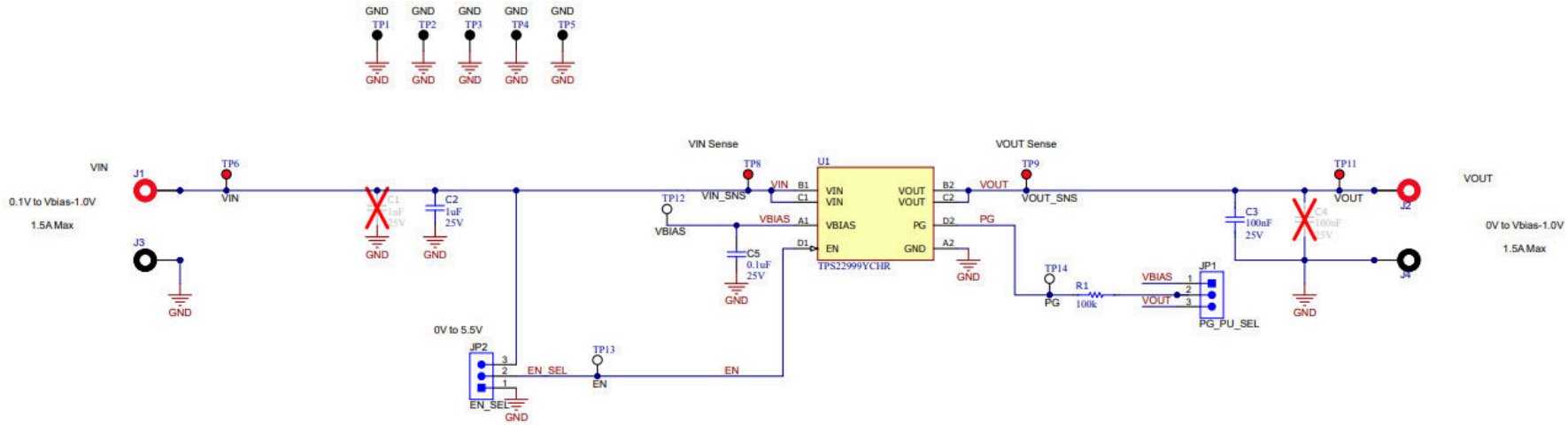

Figure 3-1. TPS22999EVM Schematic

4 PCB Layout

Figure 4-1 and Figure 4-2 show the PCB layout images.

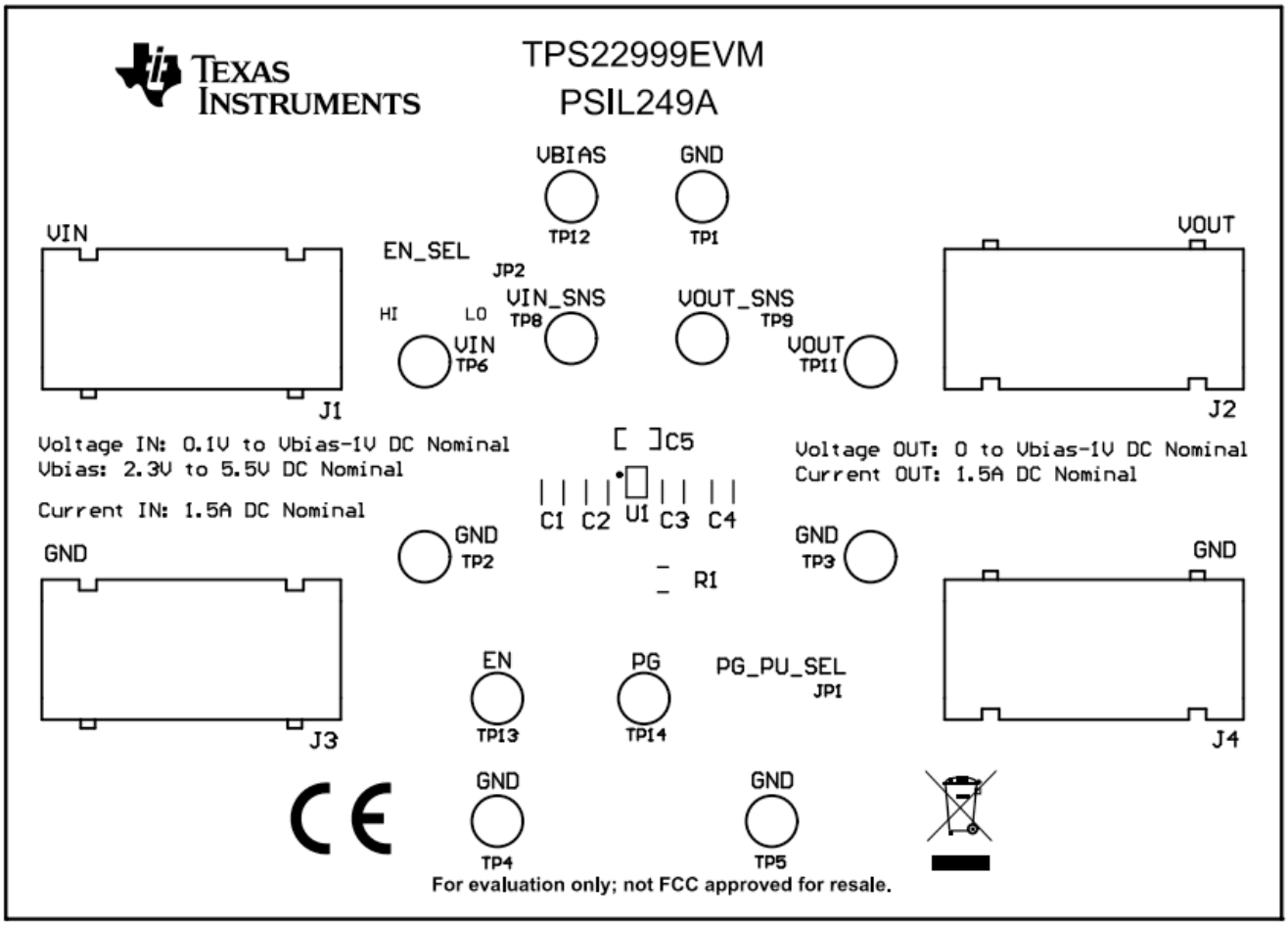

Figure 4-1. TPS22999EVM Top Layout

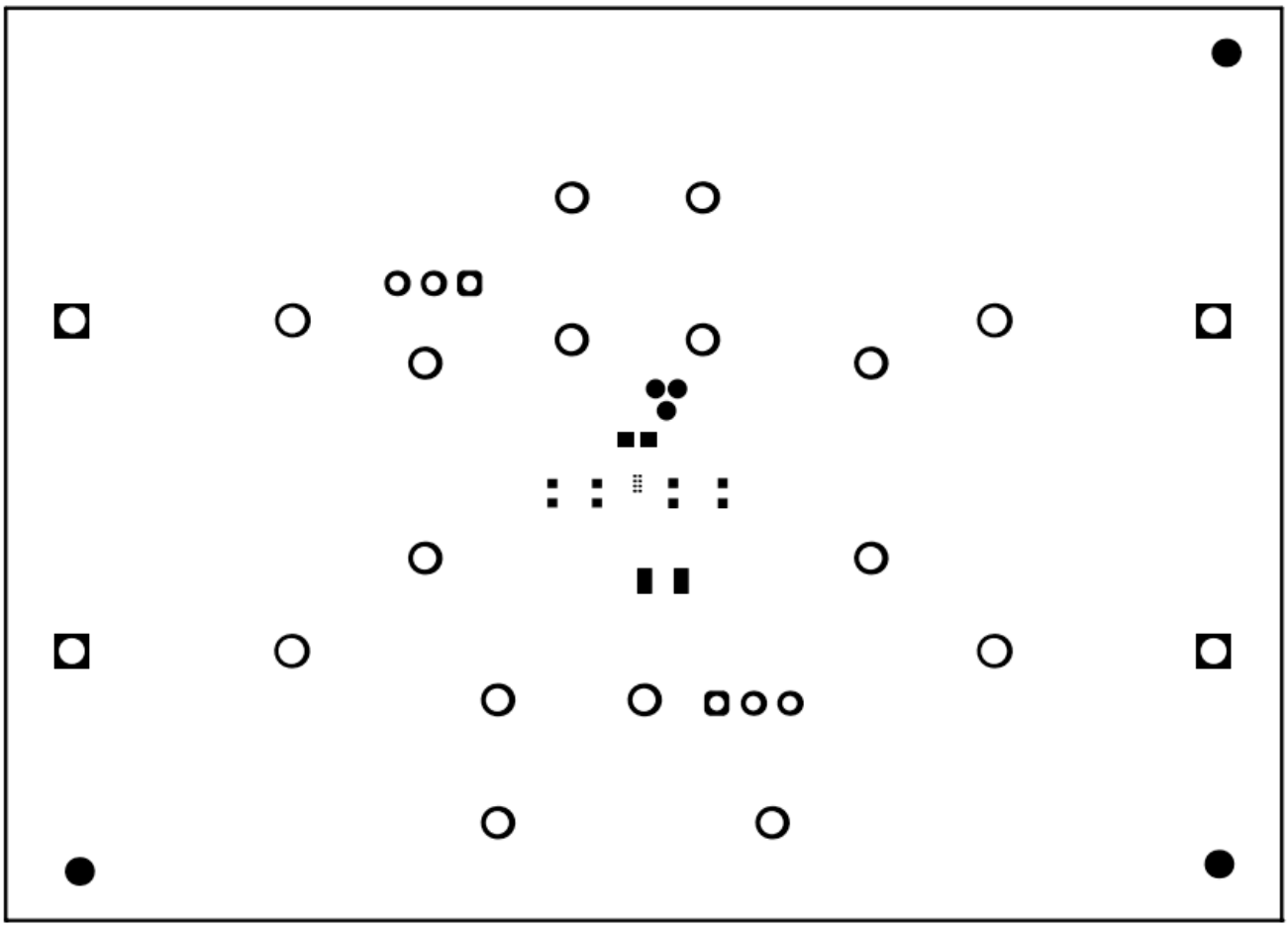

Figure 4-2. TPS22999EVM Bottom Layout

4.1 Setup

This section describes the jumpers and connectors on the EVM as well as how to properly connect, set up and use the EVM. Table 4-1 describes the input and output connectors and jumpers. Table 4-2 describes the different test points and functionality. Table 4-3 describes the jumper functionality and configurations.

Table 4-1. TPS22999EVM Input and Output Connector Functionality

Input	Connector and Test Point	Label	Description
VIN	J1	J1	Input banana connector for VIN
	TP6	VIN	Input test point for VIN
	TP8	VIN_SNS	Sense test point for VIN
VOUT	J2	J2	Output banana connector for VOUT
	TP11	VOUT	Output test point for VOUT
	TP9	VOUT_SNS	Sense test point for VOUT
GND	TP1, TP2, TP3, TP4, TP5	GND	Test point for GND
	J3, J4	J3, J4	Banana connector for GND

Table 4-2. TPS22999EVM Test Point Description

Pin	Test Point	Label	Description
EN	TP13	ON	Enable signal test point
VBIAS	TP12	VBIAS	Bias voltage test point
PG	TP14	PG	Power good signal test point

Table 4-3. TPS22999EVM Jumper Configuration

Input	Jumper	Label	Description
VIN	JP2	EN_SEL	ON-pin enable signal • Position 1 and 2 pulls ON-pin LO • Position 2 and 3 pulls ON-pin to VIN
VOUT and VBIAS	JP1	PG_PU_SEL	PG pullup setting • Position 1 and 2 pulls PG-pin to VBIAS • Position 2 and 3 pulls PG-pin to VOUT

5 Operation

Connect the VIN power supply to the J1 terminal. The input voltage range of the TPS22999EVM is 0.1 V to VBIAS – 1 V. Connect an acceptable bias voltage to TP12. The bias voltage range of TPS22999EVM is 0.1 V to 5.5 V. Note that VIN cannot be greater than VBIAS – 1 V for correct operation of the device.

External output loads can be applied to the switch by using the J2 terminal. When the ON pin is asserted high, the output of the TPS22999 is enabled. When the device is disabled, the output rail discharges through the internal quick output discharge resistance of the device.

The status of the MOSFET being fully turned on can be viewed using the power good, PG, pin. This is an open drain pin that is pulled up to VBIAS and asserted low when the output is full load ready.

6 Test Configurations

6.1 On-Resistance (R_{ON}) Test Setup

Figure 6-1 shows the typical setup for measuring on-resistance. The voltage drop across the switch is measured using the sense connections, and this can be divided by the load current to calculate the R_{ON} resistance.

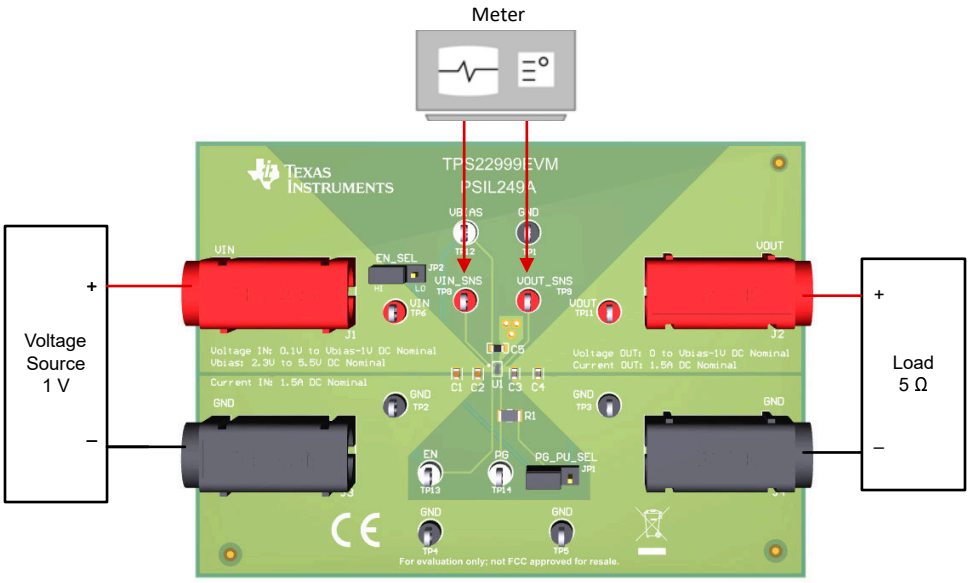

Figure 6-1. R_{ON} Test Setup

6.2 Rise Time Test Setup

Figure 6-2 shows the test setup for measuring the rise time of the TPS22999. Do note the JP1 jumper is depopulated so the ON pin can be applied independently of VIN. Apply a square wave to the ON pin of the switch using a function generator and apply a voltage to the VIN terminal using a power supply. Observe the waveform at VOUT Sense with an oscilloscope to measure the slew rate and rise time of the switch with a given input voltage.

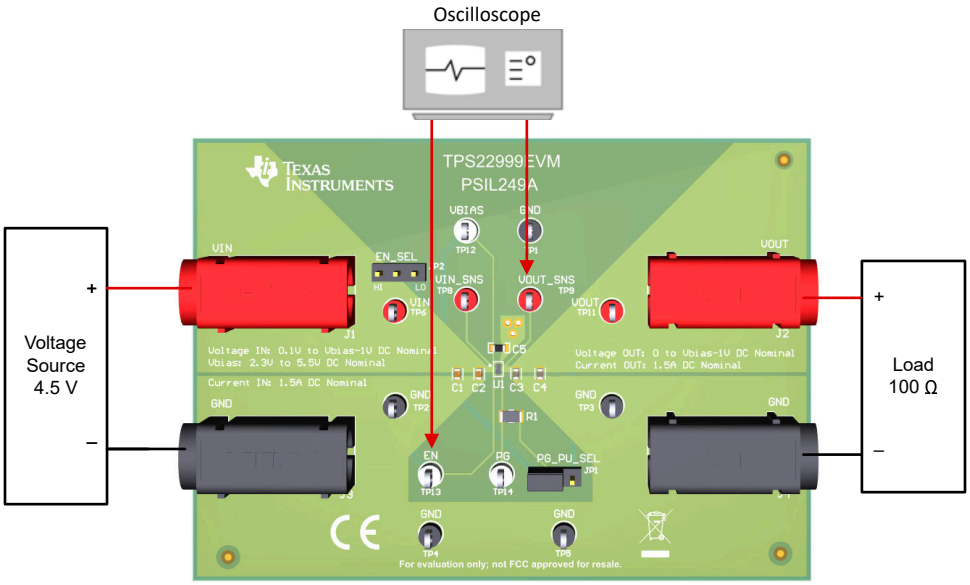

Figure 6-2. Rise Time Test Setup

7 Bill of Materials (BOM)

Table 7-1 lists the TPS22999EVM BOM.

Table 7-1. TPS22999EVM BOM

Designator	Quantity	Value	Description	Package Reference	Part Number	Manufacturer
PCB	1		Printed Circuit Board		PSIL249	Any
C2	1	1 µF	1 µF ±10% 25 V Ceramic Capacitor X5R 0603 (1608 Metric)	0603	GRM188R61E105KAADD	Murata
C3	1	100 nF	0.1µF ±10% 25 V Ceramic Capacitor X8R 0603 (1608 Metric)	0603	C1608X8R1E104K080AA	TDK Corporation
C5	1	0.1uF	CAP, CERM, 0.1 uF, 25 V, +/- 5%, X7R, 0603	0603	C0603C104J3RACTU	Kemet
H1, H2, H3, H4	4		Bumpon, Hemisphere, 0.44 X 0.20, Clear	Transparent Bumpon	SJ-5303 (CLEAR)	3M
J1, J2	2		Standard Banana Jack, insulated, 10 A, red	571-0500	571-0500	DEM Manufacturing
J3, J4	2		Standard Banana Jack, insulated, 10 A, black	571-0100	571-0100	DEM Manufacturing
JP1, JP2	2		Header, 100mil, 3x1, Gold, TH	3x1 Header	TSW-103-07-G-S	Samtec
R1	1	100k	100 kOhms ±1% 0.25W, 1/4W Chip Resistor 1206 (3216 Metric) High Voltage Thick Film	1206	RCV1206100KFKEA	Vishay
SH-J1, SH-J2	2	1x2	Shunt, 100mil, Flash Gold, Black	Closed Top 100mil Shunt	SPC02SYAN	Sullins Connector Solutions
TP1, TP2, TP3, TP4, TP5	5		Test Point, Multipurpose, Black, TH	Black Multipurpose Testpoint	5011	Keystone
TP6, TP8, TP9, TP11	4		Test Point, Multipurpose, Red, TH	Red Multipurpose Testpoint	5010	Keystone
TP12, TP13, TP14	3		Test Point, Multipurpose, White, TH	White Multipurpose Testpoint	5012	Keystone Electronics
U1	1		5-V 1.5-A 10-mΩ On-Resistance Load Switch with Regulated Inrush Current, DSBGA8	DSBGA8	TPS22999YCHR	Texas Instruments

8 Revision History

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

Changes from Revision * (June 2023) to Revision A (November 2023)	Page
• Added information to *Electrical Performance* section	2

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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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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.

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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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Concernant les EVMs avec appareils radio:

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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.

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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https://www.ti.com/ja-jp/legal/notice-for-evaluation-kits-delivered-in-japan.html

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