

## **OPA2835DGS, OPA2836DGS EVM**

The OPA2835DGS EVM is an evaluation module for the dual, OPA2835 in the DGS (10-lead MSOP) package.

The OPA2836DGS EVM is an evaluation module for the dual, OPA2836 in the DGS (10-lead MSOP) package.

The OPA2835DGS and OPA2836DGS EVMs are designed to quickly demonstrate the functionality and versatility of the amplifier(s). The EVM is ready to connect to power, signal source, and test instruments through the use of on-board connectors. The default amplifier configuration is non-inverting gain of 2 configuration and split supply. It can be easily configured for other gains, and single supply operation.

### **1 Features**

- Configured for split supply operation and modified for single supply
- Default non-inverting gain of 2 configuration can be reconfigured for other gains
- Designed for connection to standard 50-Ω input/output impedance test equipment
- Inputs and Outputs include SMA connectors

### **2 EVM Specifications**

This section gives a general description of the OPA2835DGS and OPA2836DGS EVMs.

Parameters		MIN	TYP	MAX
Single Supply voltage range ( $V_S^- = \text{ground}$ )		2.5V		5.5V
Split Supply voltage range ( $V_S^\pm$ )		$\pm 1.25V$		$\pm 2.75V$
Supply current, $I_S$	OPA2835DGS		250μA/amp	
	OPA2836DGS		1mA/amp	
Input voltage, $V_I$				$V_S^\pm$
Output drive, $I_o$ with $\pm 2.5V$ or 5V Supply	OPA2835DGS		$\pm 40mA$	
	OPA2836DGS		$\pm 50mA$	

## 2.1 Power Connections

The OPA2835DGS and OPA2836DGS EVMs are equipped with banana jacks for easy connection of power. The positive supply input is labeled  $V_{S+}$ . The Negative supply input is labeled  $V_{S-}$ . Ground is labeled GND.

### 2.1.1 Split Supply Operation

To operate split supply, apply the positive supply voltage to  $V_{S+}$ , negative supply voltage to  $V_{S-}$ , and the ground reference from supply to GND.

### 2.1.2 Single Supply Operation

To operate single supply, jumper  $V_{S-}$  to GND and apply the positive supply voltage to  $V_{S+}$ . Inputs and outputs must be biased per data sheet specifications for proper operation.

## 2.2 Input and Output Connections

The OPA2835DGS and OPA2836DGS EVMs are equipped with SMA connectors for easy connection of signal generators and analysis equipment. As shipped the EVMs are configured for non-inverting gain of 2 configuration and split supply with termination for connection to 50- $\Omega$  test equipment. For best results, signals should be routed to and from the EVM with cables having 50- $\Omega$  characteristic impedance. See the OPA2835 data sheet ([SLOS713](#)) and the OPA2836 data Sheet ([SLOS712](#)), and schematics and layouts for details on how to reconfigure for other gain configurations.

## 3 EVM Schematic, Layout, and Bill of Material (BOM)

This section provides a complete schematic diagram, board layouts, and bill of materials for the OPA2835DGS and OPA2836DGS EVMs.

### 3.1 EVM Schematic

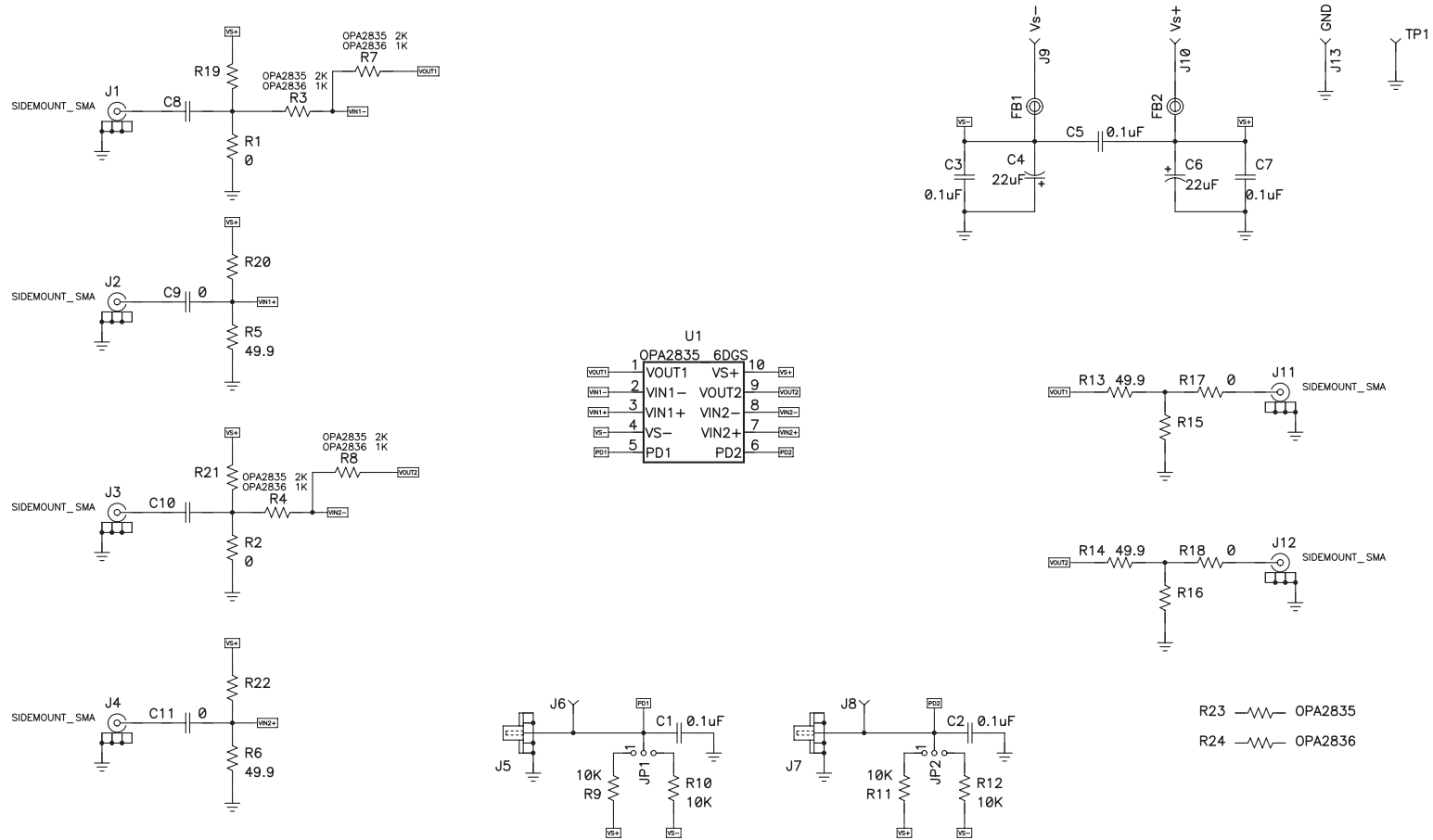


Figure 1. OPA2835DGS and OPA2836DGS EVM Schematic

### 3.2 EVM Layers

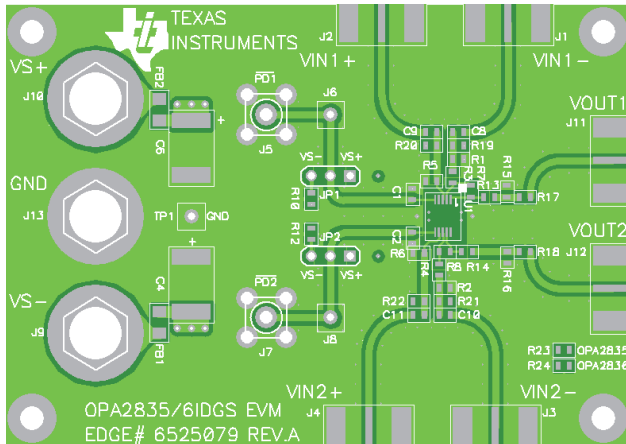


Figure 2. Top Layer

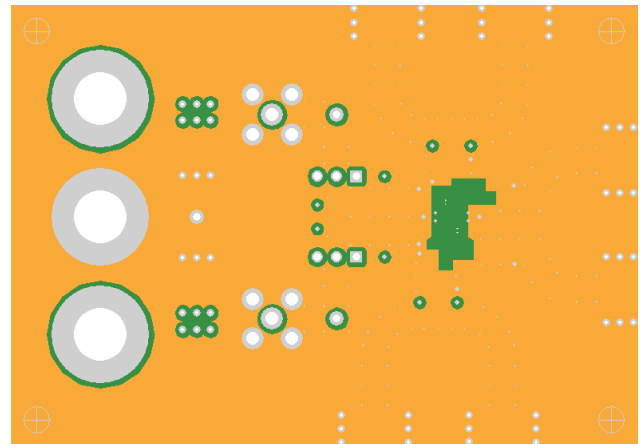


Figure 3. Layer 2

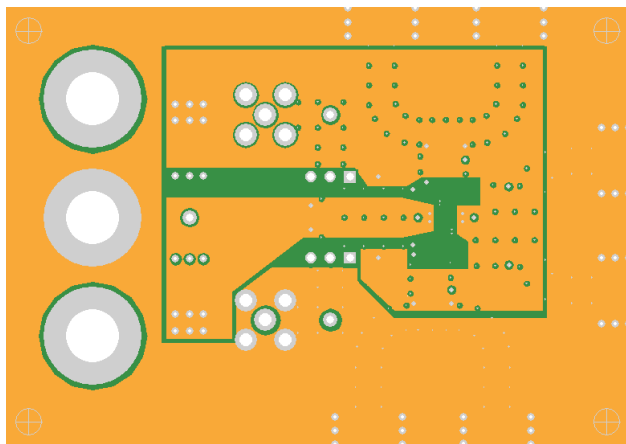


Figure 4. Layer 3

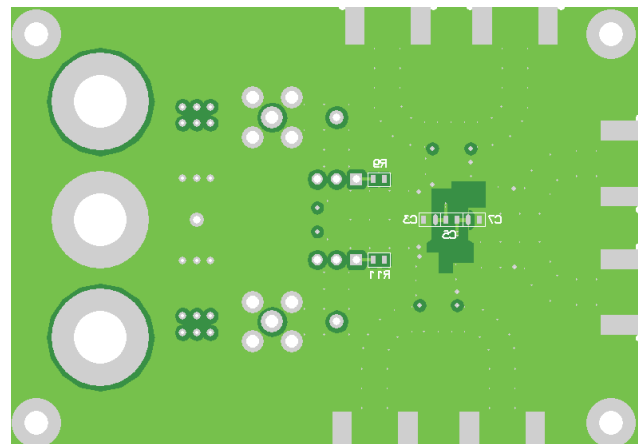


Figure 5. Bottom Layer

### 3.3 Bill of Materials

**Table 1. OPA2835DGS EVM Bill of Materials**

Item	Description	SMD Size	Reference Designator	PCB Qty	Manufacturer's Part Number	Distributor's Part Number
1	BEAD, FERRITE, 3A, 80 OHM	1206	FB1, FB2	2	(STEWART) HI1206N800R-10	(DIGI-KEY) 240-2409-1-ND
2	CAP, 22.0uF, TANTALUM, 10%, 16V	D	C4, C6	2	(AVX) TAJD226KO16RNJ	(DIGI-KEY) 478-3922-1-ND
3	CAP, 0.1uF, CERAMIC, 50V, X7R	0603	C1, C2, C3, C5, C7	5	(AVX) 06035C104KAT2A	(DIGI-KEY) 478-5052-1-ND
4	OPEN	0603	C8, C10	2		
5	OPEN	0603	R15, R16, R19, R20, R21, R22, R24	7		
6	RESISTOR, 0 OHM,	0603	C9, C11, R1, R2, R17, R18, R23	7	(ROHM) MCR03EZPJ000	(DIGI-KEY) RHM0.0GCT-ND
7	RESISTOR, 49.9 OHM, 1/10W, 1%	0603	R5, R6, R13, R14	4	(ROHM) MCR03EZPFX49R9	(DIGI-KEY) RHM49.9HCT-ND
8	RESISTOR, 2.00K OHM, 1/10, 1%	0603	R3, R4, R7, R8	4	(ROHM) MCR03EZPFX2001	(DIGI-KEY) RHM2.00KHCT-ND
9	RESISTOR, 10K OHM,	0603	R9, R10, R11, R12	4	(ROHM) MCR03EZPFX1002	(DIGI-KEY) RHM10.0KHCT-ND
10	CONN, JACK, BANANA, UNINS		J9, J10, J13	3	(EMERSION) 108-0740-001	(DIGI-KEY) J147-ND
11	CONNECTOR, EDGE, SMA PCB JACK		J1, J2, J3, J4, J11, J12	6	(JOHNSON) 142-0701-801	(DIGI-KEY) J502-ND
12	CONNECTOR, STRAIGHT, SMA		J5, J7	DNI	(AMPHENOL) 901-144-8RFX	(DIGI-KEY) ARFX1231-ND
13	TEST POINT, BLACK		TP1	1	(KEYSTONE) 5001	(DIGI-KEY) 5001K-ND
14	TEST POINT, RED		J6, J8	2	(KEYSTONE) 5000	(DIGI-KEY) 5000K-ND
15	HEADER, 0.1" CTRS, 0.025" SQ. PINS	3 POS.	JP1, JP2	2	(SULLINS) PBC36SAAN	(DIGI-KEY) S1011E-36-ND
16	SHUNTS		JP1, JP2	2	(SULLINS) SSC02SYAN	(DIGI-KEY) S9002-ND
17	IC, OPA2835IDGS		U1	1	(TI) OPA2835IDGS	
18	STANDOFF, 4-40 HEX, 0.625" LENGTH			4	(KEYSTONE) 1808	(DIGI-KEY) 1808K-ND
19	SCREW, PHILLIPS, 4-40, .250"			4	(BF) PMS4400031PH	(DIGI-KEY) H343-ND
20	BOARD, PRINTED CIRCUIT			1	(TI) EDGE# 6525079	

**Table 2. OPA2836DGS EVM Bill of Materials**

Item	Description	SMD Size	Reference Designator	PCB Qty	Manufacturer's Part Number	Distributor's Part Number
1	BEAD, FERRITE, 3A, 80 OHM	1206	FB1, FB2	2	(STEWART) HI1206N800R-10	(DIGI-KEY) 240-2409-1-ND
2	CAP, 22.0uF, TANTALUM, 10%, 16V	D	C4, C6	2	(AVX) TAJD226KO16RNJ	(DIGI-KEY) 478-3922-1-ND
3	CAP, 0.1uF, CERAMIC, 50V, X7R	0603	C1, C2, C3, C5, C7	5	(AVX) 06035C104KAT2A	(DIGI-KEY) 478-5052-1-ND
4	OPEN	0603	C8, C10	2		
5	OPEN	0603	R15, R16, R19, R20, R21, R22, R23	7		
6	RESISTOR, 0 OHM,	0603	C9, C11, R1, R2, R17, R18, R24	7	(ROHM) MCR03EZPJ000	(DIGI-KEY) RHM0.0GCT-ND
7	RESISTOR, 49.9 OHM, 1/10W, 1%	0603	R5, R6, R13, R14	4	(ROHM) MCR03EZPFX49R9	(DIGI-KEY) RHM49.9HCT-ND
8	RESISTOR, 1.00K OHM, 1/10, 1%	0603	R3, R4, R7, R8	4	(ROHM) MCR03EZPFX1001	(DIGI-KEY) RHM1.00KHCT-ND
9	RESISTOR, 10K OHM,	0603	R9, R10, R11, R12	4	(ROHM) MCR03EZPFX1002	(DIGI-KEY) RHM10.0KHCT-ND
10	CONN, JACK, BANANA, UNINS		J9, J10, J13	3	(EMERSION) 108-0740-001	(DIGI-KEY) J147-ND
11	CONNECTOR, EDGE, SMA PCB JACK		J1, J2, J3, J4, J11, J12	6	(JOHNSON) 142-0701-801	(DIGI-KEY) J502-ND
12	CONNECTOR, STRAIGHT, SMA		J5, J7	DNI	(AMPHENOL) 901-144-8RFX	(DIGI-KEY) ARFX1231-ND
13	TEST POINT, BLACK		TP1	1	(KEYSTONE) 5001	(DIGI-KEY) 5001K-ND
14	TEST POINT, RED		J6, J8	2	(KEYSTONE) 5000	(DIGI-KEY) 5000K-ND
15	HEADER, 0.1" CTRS, 0.025" SQ. PINS	3 POS.	JP1, JP2	2	(SULLINS) PBC36SAAN	(DIGI-KEY) S1011E-36-ND
16	SHUNTS		JP1, JP2	2	(SULLINS) SSC02SYAN	(DIGI-KEY) S9002-ND
17	IC, OPA2836IDGS		U1	1	(TI) OPA2836IDGS	
18	STANDOFF, 4-40 HEX, 0.625" LENGTH			4	(KEYSTONE) 1808	(DIGI-KEY) 1808K-ND
19	SCREW, PHILLIPS, 4-40, .250"			4	(BF) PMS4400031PH	(DIGI-KEY) H343-ND
20	BOARD, PRINTED CIRCUIT			1	(TI) EDGE# 6525079	

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## EVM Warnings and Restrictions

It is important to operate this EVM within the input voltage range of 2.5V to 5.5V and the output voltage range of 2.5V to 5.5V.

Exceeding the specified input range may cause unexpected operation and/or irreversible damage to the EVM. If there are questions concerning the input range, please contact a TI field representative prior to connecting the input power.

Applying loads outside of the specified output range may result in unintended operation and/or possible permanent damage to the EVM. Please consult the EVM User's Guide prior to connecting any load to the EVM output. If there is uncertainty as to the load specification, please contact a TI field representative.

During normal operation, some circuit components may have case temperatures greater than 85°C. The EVM is designed to operate properly with certain components above 85°C as long as the input and output ranges are maintained. These components include but are not limited to linear regulators, switching transistors, pass transistors, and current sense resistors. These types of devices can be identified using the EVM schematic located in the EVM User's Guide. When placing measurement probes near these devices during operation, please be aware that these devices may be very warm to the touch.

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## REGULATORY COMPLIANCE INFORMATION

As noted in the EVM User's Guide and/or EVM itself, this EVM and/or accompanying hardware may or may not be subject to the Federal Communications Commission (FCC) and Industry Canada (IC) rules.

For EVMs **not** subject to the above rules, this evaluation board/kit/module is intended for use for ENGINEERING DEVELOPMENT, DEMONSTRATION OR EVALUATION PURPOSES ONLY and is not considered by TI to be a finished end product fit for general consumer use. It generates, uses, and can radiate radio frequency energy and has not been tested for compliance with the limits of computing devices pursuant to part 15 of FCC or ICES-003 rules, which are designed to provide reasonable protection against radio frequency interference. Operation of the equipment may cause interference with radio communications, in which case the user at his own expense will be required to take whatever measures may be required to correct this interference.

### 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.

## **【Important Notice for Users of this Product in Japan】**

**This development kit is NOT certified as Confirming to Technical Regulations of Radio Law of Japan**

If you use this product in Japan, you are required by Radio Law of Japan to follow the instructions below with respect to this product:

1. Use this product 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 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.

**Texas Instruments Japan Limited**  
**(address) 24-1, Nishi-Shinjuku 6 chome, Shinjuku-ku, Tokyo, Japan**

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日本テキサス・インスツルメンツ株式会社  
東京都新宿区西新宿6丁目24番1号  
西新宿三井ビル

<http://www.tij.co.jp>

## EVALUATION BOARD/KIT/MODULE (EVM) WARNINGS, RESTRICTIONS AND DISCLAIMERS

**For Feasibility Evaluation Only, in Laboratory/Development Environments.** Unless otherwise indicated, this EVM is not a finished electrical equipment and not intended for consumer use. It is intended solely for use for preliminary feasibility evaluation in laboratory/development environments by technically qualified electronics experts who are familiar with the dangers and application risks associated with handling electrical mechanical components, systems and subsystems. It should not be used as all or part of a finished end product.

Your Sole Responsibility and Risk. You acknowledge, represent and agree that:

1. You have unique knowledge concerning Federal, State and local regulatory requirements (including but not limited to Food and Drug Administration regulations, if applicable) which relate to your products and which relate to your use (and/or that of your employees, affiliates, contractors or designees) of the EVM for evaluation, testing and other purposes.
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.

**Certain Instructions.** It is important to operate this EVM within TI's recommended specifications and environmental considerations per the user guidelines. Exceeding the specified EVM ratings (including but not limited to input and output voltage, current, power, and environmental ranges) may cause property damage, personal injury or death. If there are questions concerning these ratings please contact a TI field representative prior to connecting interface electronics including input power and intended loads. Any loads applied outside of the specified output range may result in unintended and/or inaccurate operation and/or possible permanent damage to the EVM and/or interface electronics. Please consult the EVM User's Guide prior to connecting any load to the EVM output. If there is uncertainty as to the load specification, please contact a TI field representative. During normal operation, some circuit components may have case temperatures greater than 60°C as long as the input and output are maintained at a normal ambient operating temperature. These components include but are not limited to linear regulators, switching transistors, pass transistors, and current sense resistors which can be identified using the EVM schematic located in the EVM User's Guide. When placing measurement probes near these devices during normal operation, please be aware that these devices may be very warm to the touch. As with all electronic evaluation tools, only qualified personnel knowledgeable in electronic measurement and diagnostics normally found in development environments should use these EVMs.

**Agreement to Defend, Indemnify and Hold Harmless.** You agree to defend, indemnify and hold TI, its licensors and their representatives harmless from and against any and all claims, damages, losses, expenses, costs and liabilities (collectively, "Claims") arising out of or in connection with any use of the EVM that is not in accordance with the terms of the agreement. This obligation shall apply whether Claims arise under law of tort or contract or any other legal theory, and even if the EVM fails to perform as described or expected.

**Safety-Critical or Life-Critical Applications.** If you intend to evaluate the components for possible use in safety critical applications (such as life support) where a failure of the TI product would reasonably be expected to cause severe personal injury or death, such as devices which are classified as FDA Class III or similar classification, then you must specifically notify TI of such intent and enter into a separate Assurance and Indemnity Agreement.

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**Наши контакты:**

**Телефон:** +7 812 627 14 35

**Электронная почта:** [sales@st-electron.ru](mailto:sales@st-electron.ru)

**Адрес:** 198099, Санкт-Петербург,  
Промышленная ул, дом № 19, литера Н,  
помещение 100-Н Офис 331