SN75LVCP600S EVM User's Guide

The SN75LVCP600S User's Guide is intended to assist in the evaluation of the SN75LVCP600S SATA/SAS Redriver/Equalizer, highlighting key features, operating conditions and the configuration of the EVM for system level evaluation.

The construction of the SN75LVCP600S EVM also serves as a reference design which can be easily modified for the vast majority of intended applications such as Servers and Workstations.

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Trademarks

1 Introduction

The SN75LVCP600S is a single channel SATA/SAS signal conditioner supporting data rates up to 6.0 Gbps. The device complies with the SATA Physical Specification Revision 3.0 and SAS Electrical Specification Revision 2.0.

The SN75LVCP600S operates from a single 3.3-V supply and has 100-Ω line termination with self-biasing feature, making the device suitable for AC coupling. The device offers programmable equalization and de-emphasis as well as Auto Low Power Mode triggered when the channel is in electrical idle state > 100 µs.

2 SN75LVCP600S EVM Kit Contents

This EVM kit should contain the following items:

- SN75LVCP600S EVM board
- This user's guide

3 Description of EVM Board

This EVM is designed to provide easy evaluation of the LVCP600S device though two standard SATA connectors. The EVM is also meant to serve as a reference design to show a practical example of how to design the device in production designs. Figure 1 illustrates the locations of jumpers for the EVM, Table 1 highlights the jumper settings and configuration definitions.

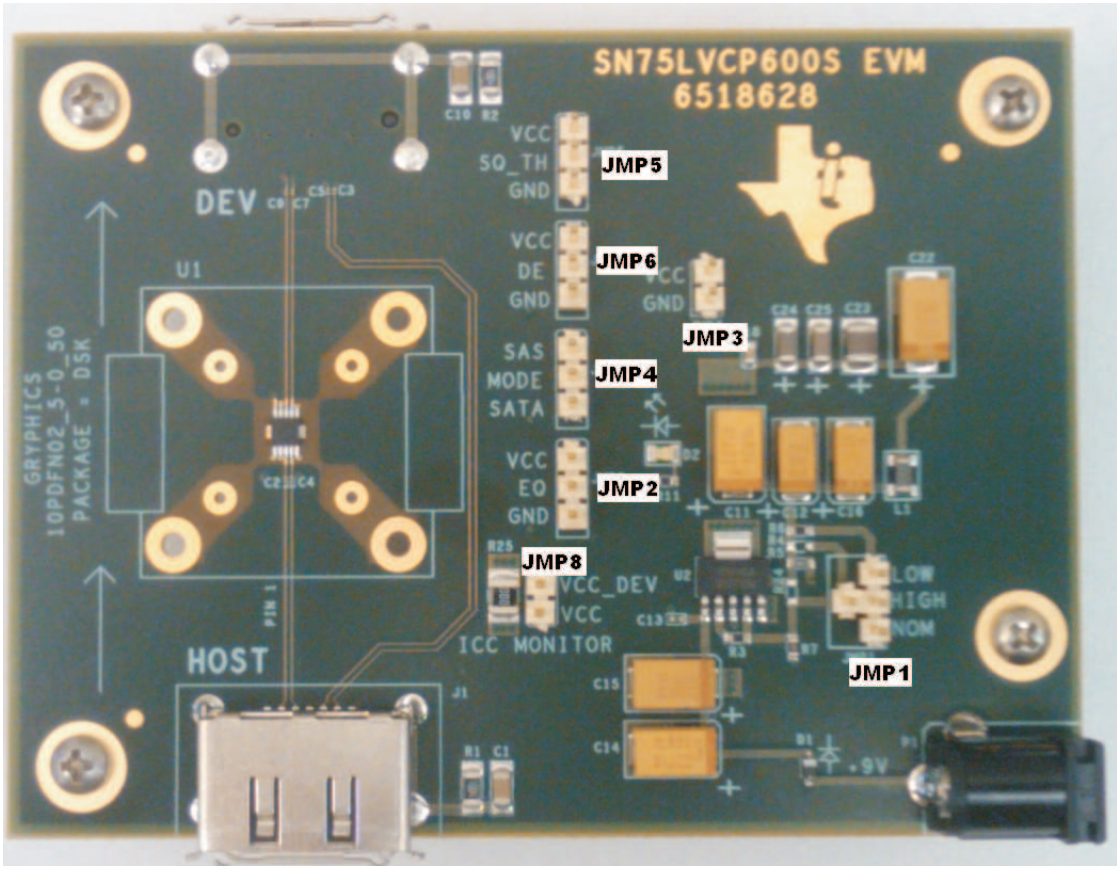

Figure 1. EVM Board Jumper Locations

Table 1. SN75LVCP600S EVM Configuration Jumper Settings

JUMPER NUMBER	FUNCTIONALITY AND CONFIGURATION
JMP1	Device voltage level select
	3.0 V - Shunt pins 2 and 1 (Center pin to "Low") 3.3 V - Shunt pins 2 and 3 (Center pin to "Nom") 3.6 V - Shunt pins 2 and 4 (Center pin to "High")
JMP2	Equalization control settings
	Low (7 dB) = Shunt pins 2 and 3 (Center pin to "GND") High (14 dB) = Shunt pins 2 and 1 (Center pin to "VCC")
JMP3	VCC
	Pin 1 = 3.3 V VCC Pin 2 = GND
JMP4	Mode select
	Low (SATA) = Shunt pins 2 and 3 (Center pin to “SATA”) High (SAS) = Shunt pins 1 and 2 (Center pin to “SAS”)
JMP5	Squelch threshold level select
	Low (100%) = Shunt pins 2 and 1 (Center pin to "GND") High (80%) = Shunt pins 2 and 3 (Center pin to "VCC")
JMP6	De-emphasis control selector
	High = Shunt pins 2 and 1 (-3 dB at 6 Gbps) Low = Shunt pins 2 and 3 (0 dB at 6 Gbps)
JMP8	Test point for measuring current
	Read the "Monitoring Device Current" section before using

4 Power for the SN75LVCP600S EVM

The SN75LVCP600S EVM kit comes with a Plug (P1) to accommodate a 9-V DC power supply. There are several power supplies which could work on this design. Digikey part number 1866-1941-ND is one example.

5 Using a Bench Top Supply to Monitor the Device Current

One of the highlights of the SN75LVCP600S is the power savings features of the device. To observe these power saving features this EVM design includes the option of monitoring the current draw of the device. To enable this feature, the following steps must be taken:

1. Un-install the ferrite bead located at L1.
2. Obtain a 3.3-V power supply (connect current meter in series if power supply does not also display current, or if greater resolution is needed than the power supply can provide). Connect power supply 3 V to pin 1 of the two pin header JMP1. GND from the power supply can be connected to pin 2 of header JMP1.

6 SN75LVCP600S EVM PCB Construction

The following section details the construction of the EVM board including schematics and layout files to demonstrate how the board was designed and manufactured.

7 SN75LVCP600S EVM Board Schematics

This section shows the board schematic sheets for the EVM.

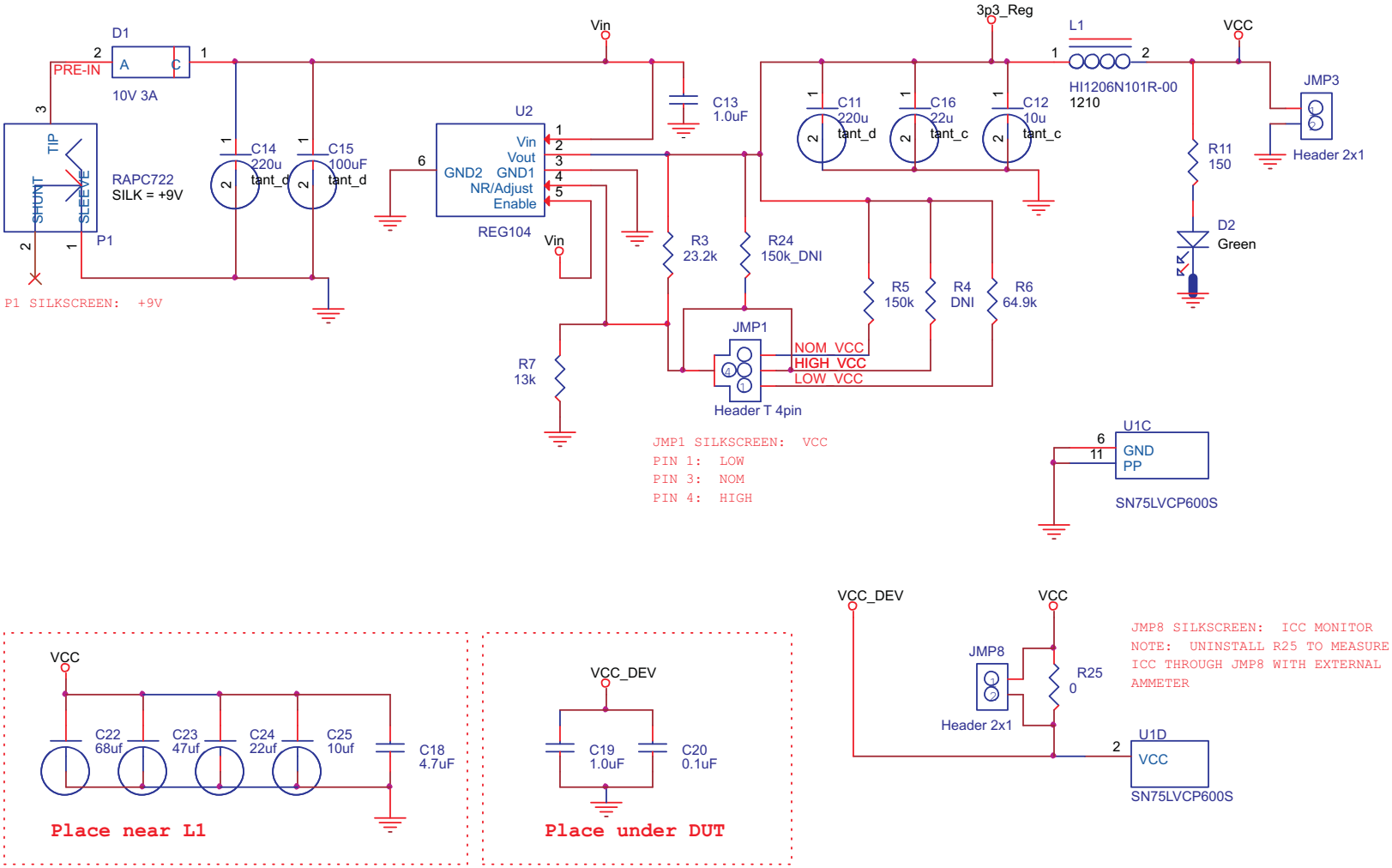

Figure 2. SN75LVCP600S EVM - Power

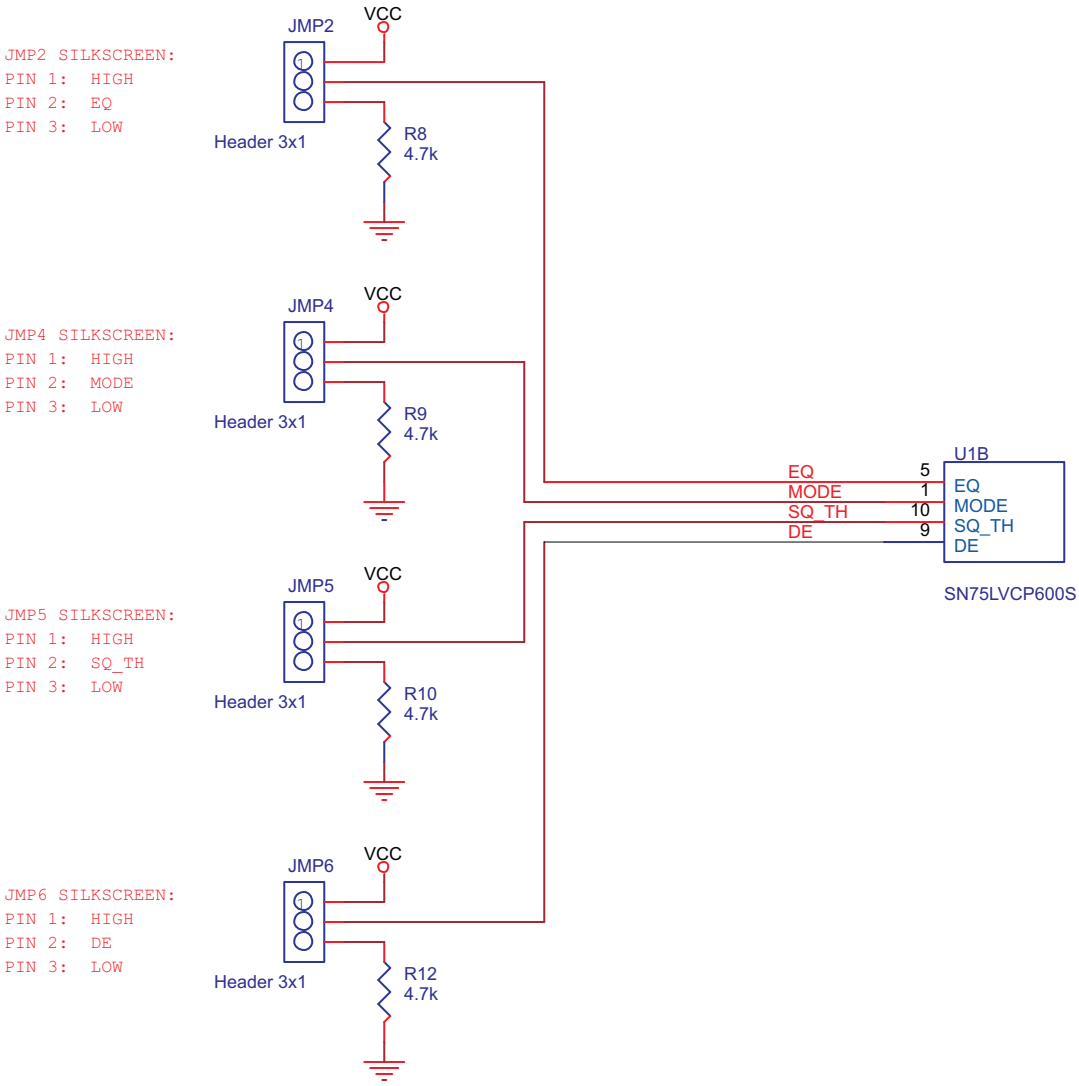

Figure 3. SN75LVCP600S EVM - Control

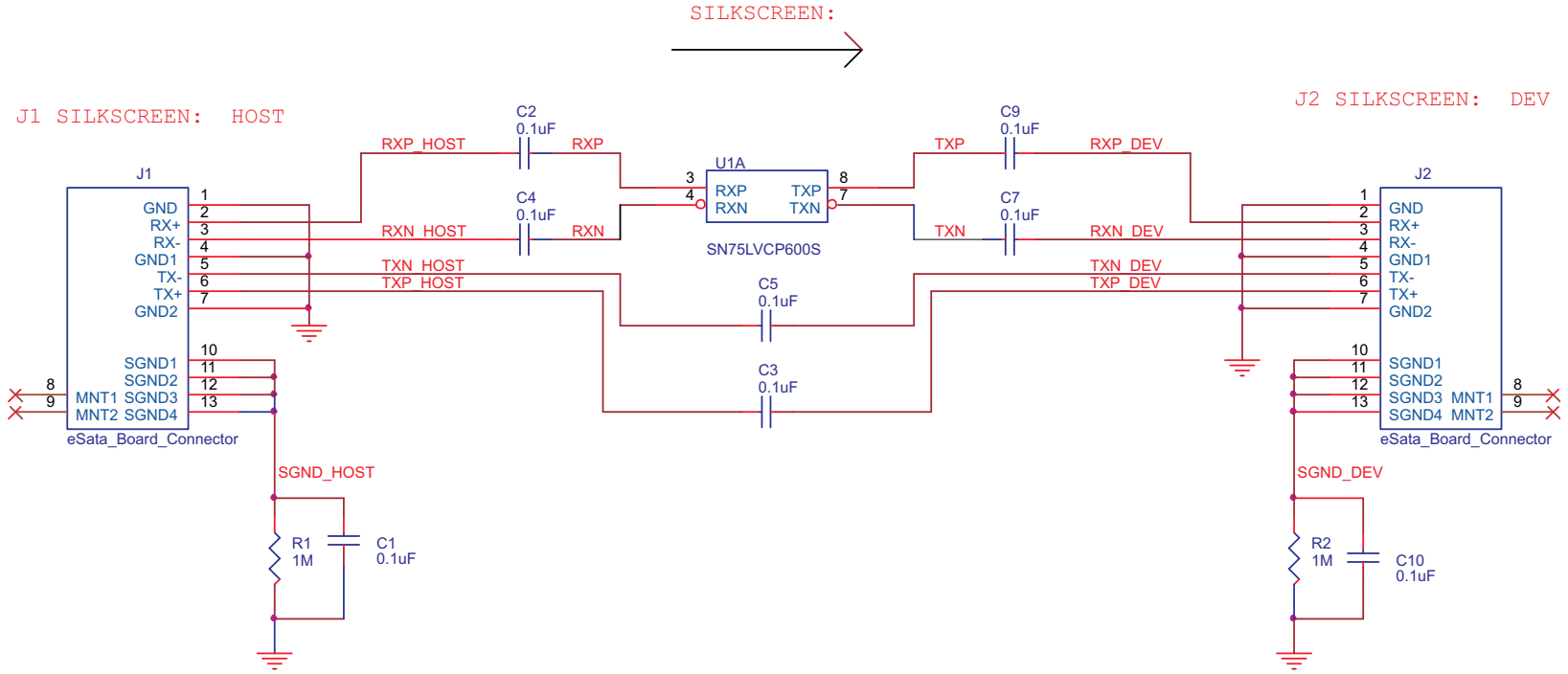

Figure 4. SN75LVCP600S EVM - High Speed

8 SN75LVCP600S EVM Board Layout

The SN75LVCP600S EVM was designed to to demonstrate a 6-layer board layout.

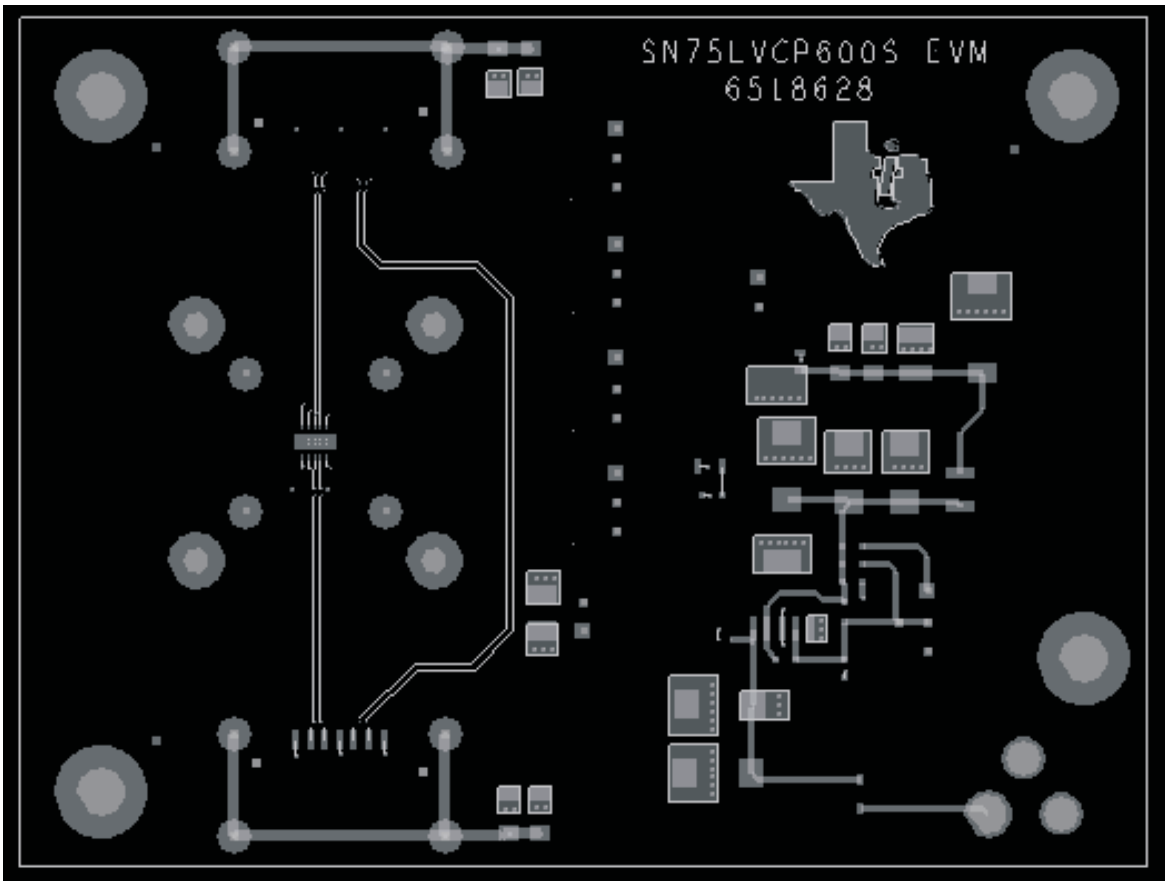

Figure 5. SN75LVCP600S EVM Top Layer

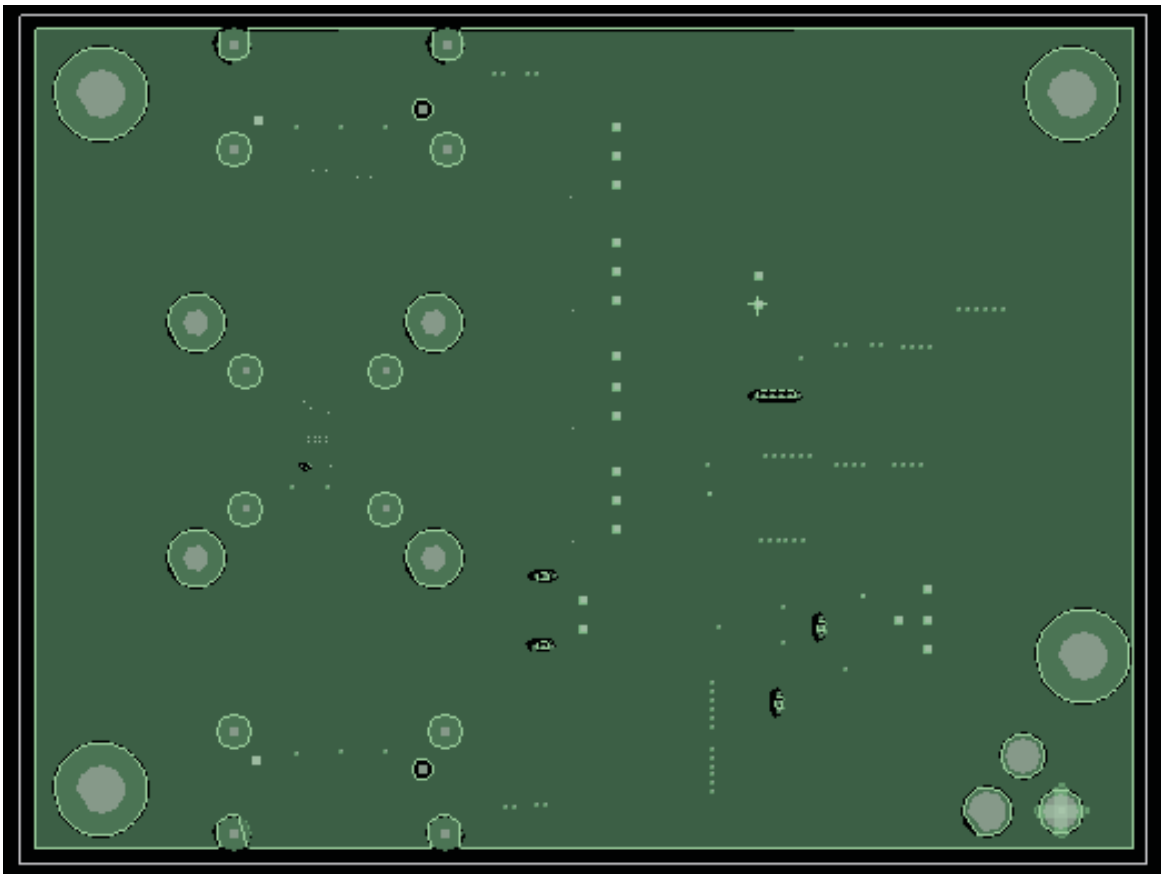

Figure 6. SN75LVCP600S EVM Layer 2 (GND)

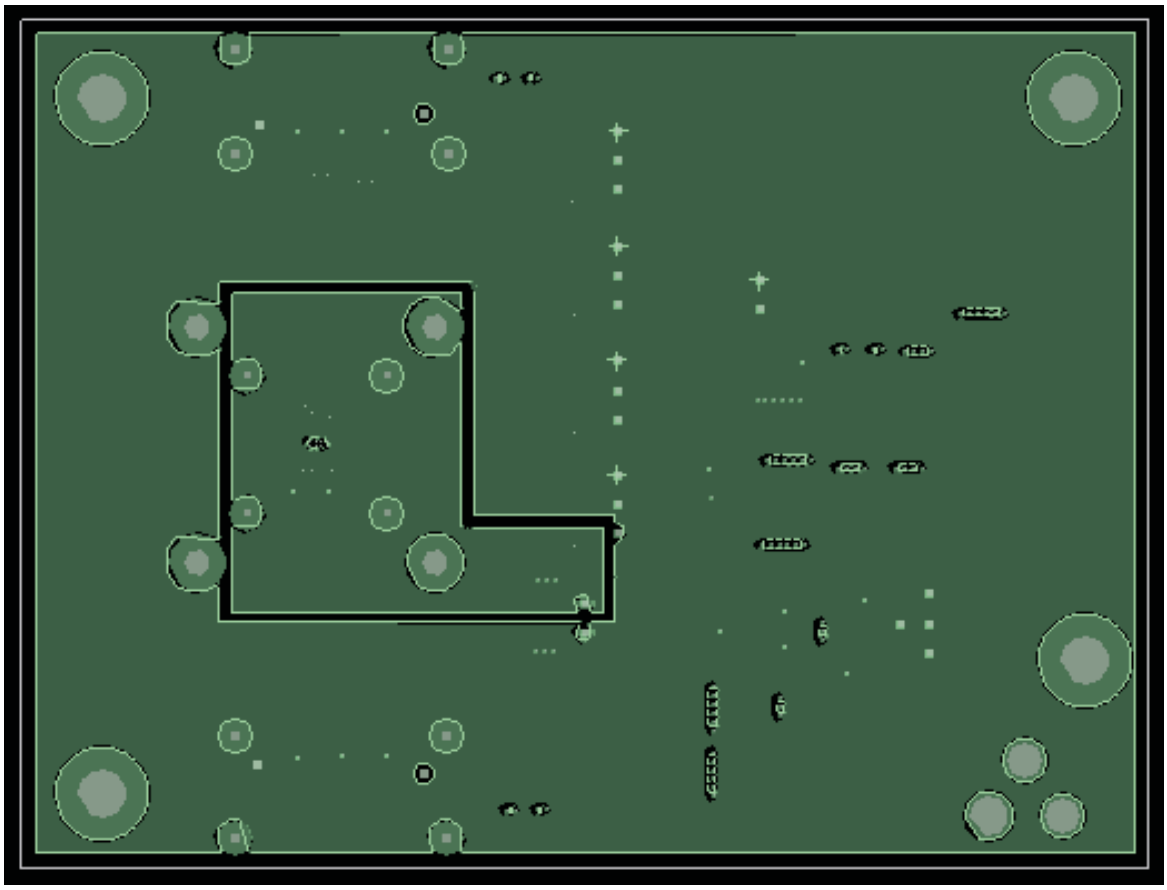

Figure 7. SN75LVCP600S EVM Layer 3 (VCC)

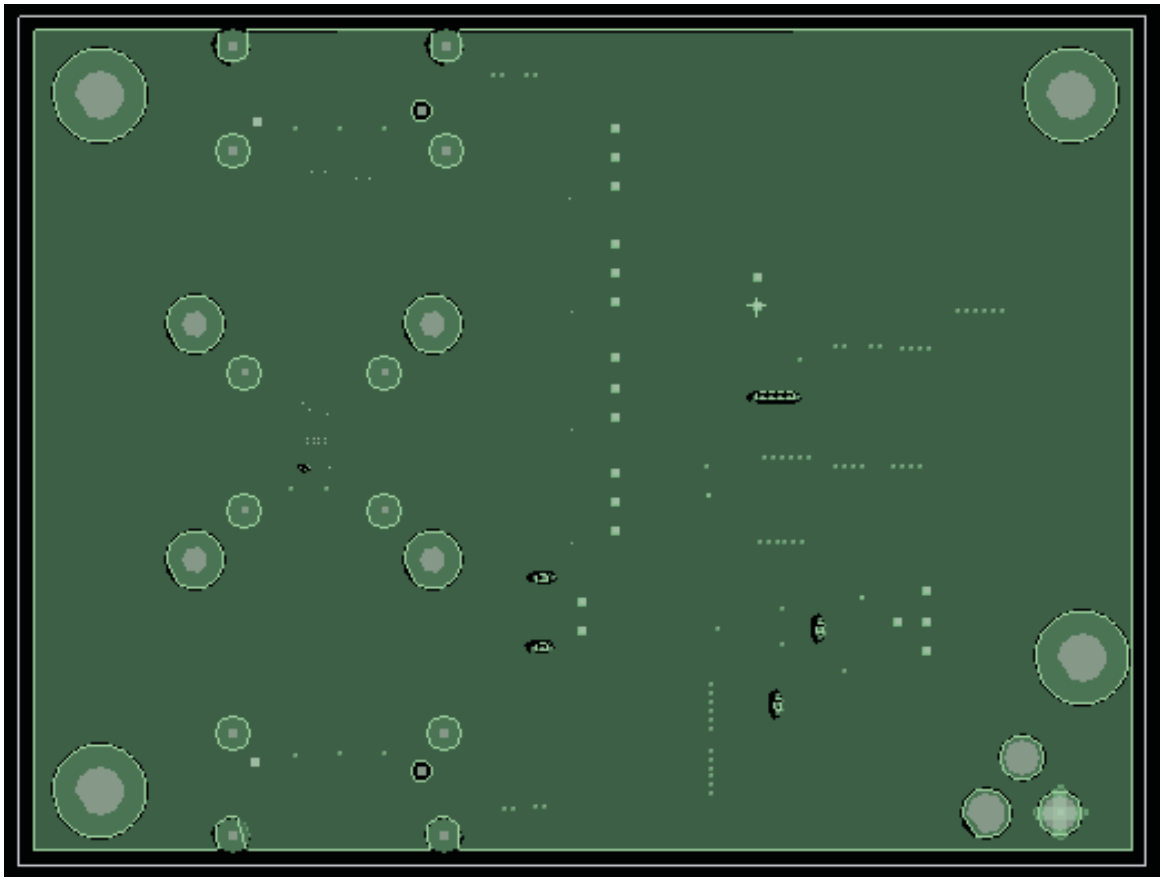

Figure 8. SN75LVCP600S EVM Layer 4 (GND)

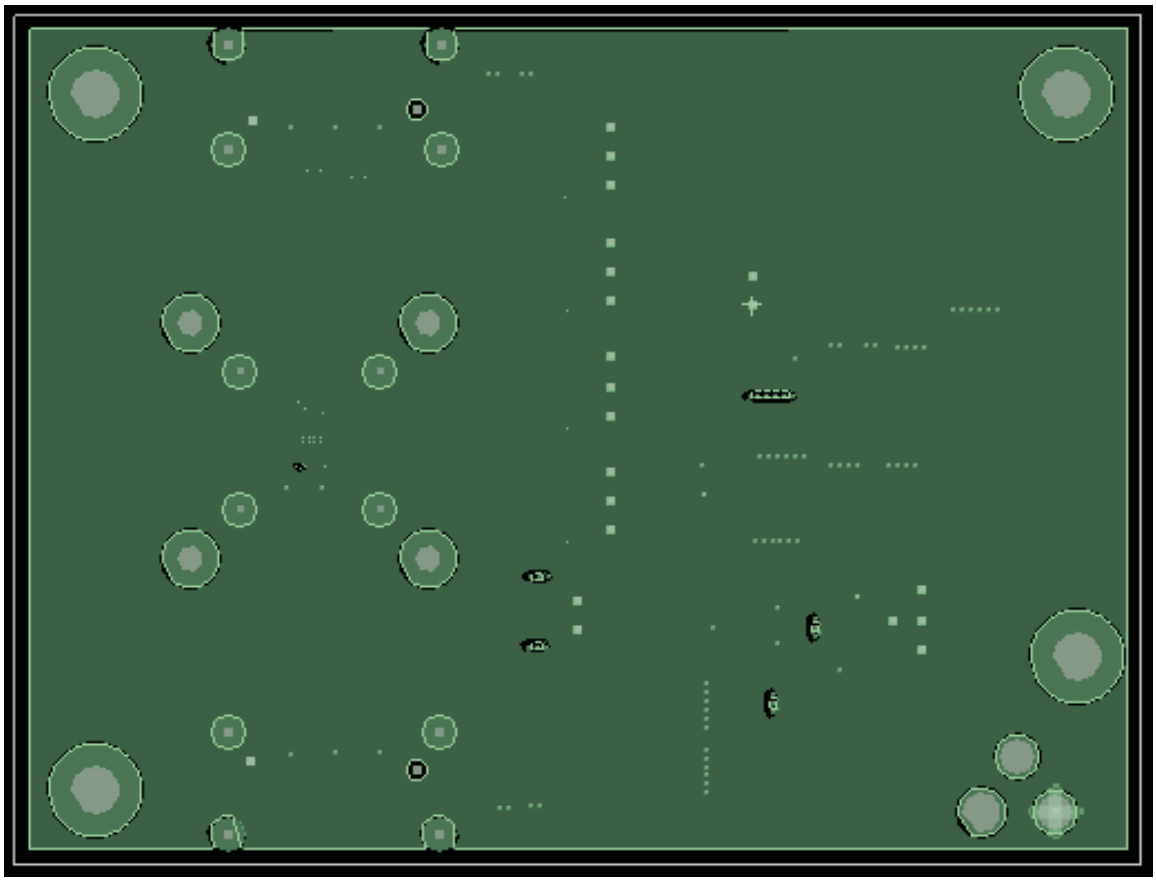

Figure 9. SN75LVCP600S EVM Layer 5 (GND)

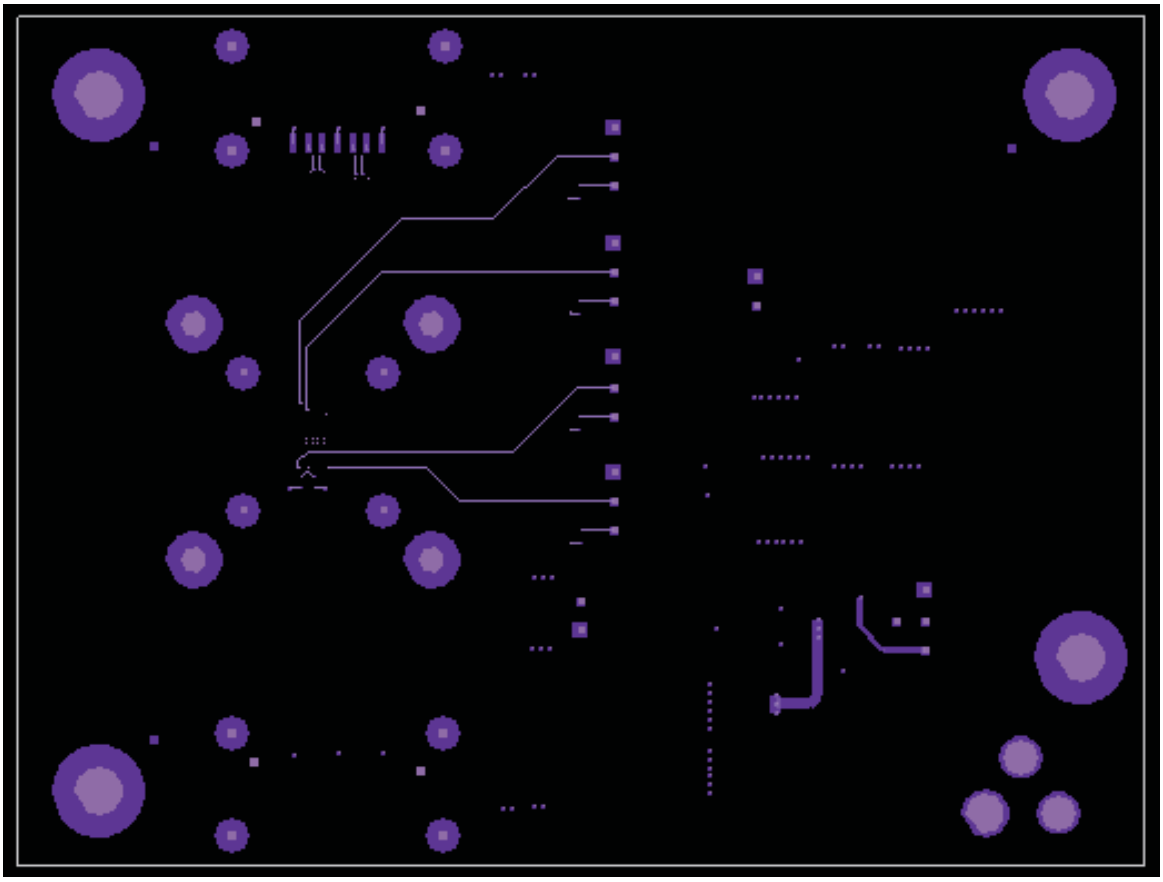

Figure 10. SN75LVCP600S EVM Layer 6 (Bottom)

9 SN75LVCP600S EVM Board Construction

The SN75LVCP600S EVM board is a 6-layer board constructed of FR4 – 370 material. The board stackup consists of a signal layer on top, ground layer, power layer, two ground layers and a signal layer on bottom.

The high-speed data signals of this board were routed as single-ended 50-Ω transmission lines, the differential routing of these signals with 100-Ω impedance matching can be implemented as well.

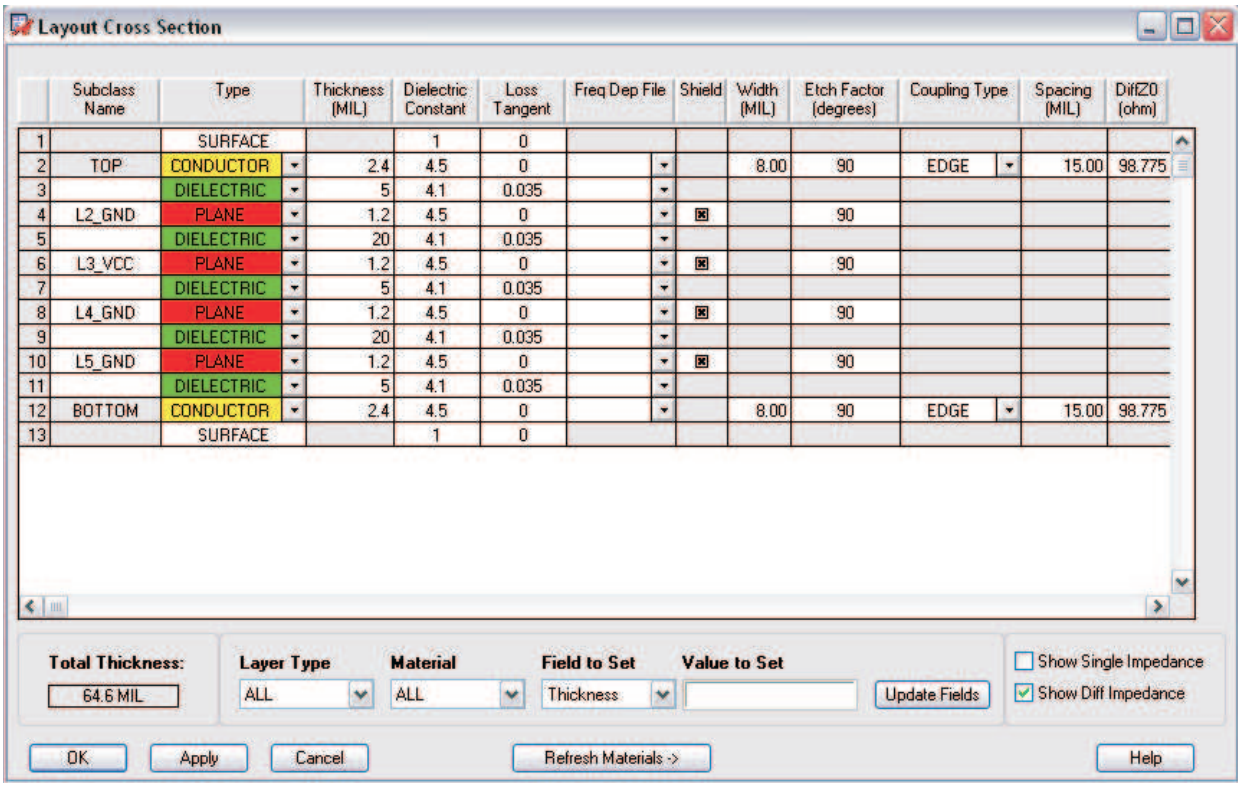

Figure 11. SN75LVCP600S EVM Board Stack-Up

10 SN75LVCP600S EVM Bill of Materials

Table 2. Bill of Materials

Item	Quantity	Value	Reference
1	2	C1, C10	0.1µF
2	6	C2, C3, C4, C5, C7, C9	0.1µF
3	2	C11, C14	220µF
4	1	C12	10µF
5	2	C13, C19	1.0µF
6	1	C15	100µF
7	1	C16	22µF
8	1	C18	4.7µF
9	1	C20	0.1µF
10	1	C22	68µF
11	1	C23	47µF
12	1	C24	22µF
13	1	C25	10µF
14	1	D1	10V 3A
15	1	D2	LED
16	1	JMP1	Header T 4pin
17	4	JMP2, JMP4, JMP5, JMP6	Header 3x1
18	2	JMP3, JMP8	Header 2x1
19	2	J1, J2	eSata_Board_Connector
20	1	L1	HI1206N101R-00
21	1	P1	RAPC722
22	2	R1, R2	1M
23	1	R3	23.2k
24	1	R4	DNI
25	1	R5	150k
26	1	R6	64.9k
27	1	R7	13k
28	4	R8, R9, R10, R12	4.7k
29	1	R11	150
30	1	R24	150k_DNI
31	1	R25	0
32	1	U1	SN75LVCP600S
33	1	U2	REG104

Revision History

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

Changes from Original (March 2011) to A Revision	Page
• Deleted reference to power supply.	2

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   2.2 TI warrants that the TI EVM will conform to TI's published specifications for ninety (90) days after the date TI delivers such EVM to User. Notwithstanding the foregoing, TI shall not be liable for a nonconforming EVM if (a) the nonconformity was caused by neglect, misuse or mistreatment by an entity other than TI, including improper installation or testing, or for any EVMs that have been altered or modified in any way by an entity other than TI, (b) the nonconformity resulted from User's design, specifications or instructions for such EVMs or improper system design, or (c) User has not paid on time. Testing and other quality control techniques are used to the extent TI deems necessary. TI does not test all parameters of each EVM. User's claims against TI under this Section 2 are void if User fails to notify TI of any apparent defects in the EVMs within ten (10) business days after delivery, or of any hidden defects with ten (10) business days after the defect has been detected.

   2.3 TI's sole liability shall be at its option to repair or replace EVMs that fail to conform to the warranty set forth above, or credit User's account for such EVM. TI's liability under this warranty shall be limited to EVMs that are returned during the warranty period to the address designated by TI and that are determined by TI not to conform to such warranty. If TI elects to repair or replace such EVM, TI shall have a reasonable time to repair such EVM or provide replacements. Repaired EVMs shall be warranted for the remainder of the original warranty period. Replaced EVMs shall be warranted for a new full ninety (90) day warranty period.

3 *Regulatory Notices:*

   3.1 *United States*

      3.1.1 *Notice applicable to EVMs not FCC-Approved:*

      FCC NOTICE: This kit is designed to allow product developers to evaluate electronic components, circuitry, or software associated with the kit to determine whether to incorporate such items in a finished product and software developers to write software applications for use with the end product. This kit is not a finished product and when assembled may not be resold or otherwise marketed unless all required FCC equipment authorizations are first obtained. Operation is subject to the condition that this product not cause harmful interference to licensed radio stations and that this product accept harmful interference. Unless the assembled kit is designed to operate under part 15, part 18 or part 95 of this chapter, the operator of the kit must operate under the authority of an FCC license holder or must secure an experimental authorization under part 5 of this chapter.

      3.1.2 *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

      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.

FCC Interference Statement for Class B EVM devices

NOTE: 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.*

3.2 *Canada*

3.2.1 *For EVMs issued with an Industry Canada Certificate of Conformance to RSS-210 or RSS-247*

Concerning EVMs Including Radio Transmitters:

This device complies with Industry Canada license-exempt RSSs. 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.

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.

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.

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

3.3 *Japan*

3.3.1 *Notice for EVMs delivered in Japan:* Please see http://www.tij.co.jp/lsds/ti_ja/general/eStore/notice_01.page 日本国内に輸入される評価用キット、ボードについては、次のところをご覧ください。
http://www.tij.co.jp/lsds/ti_ja/general/eStore/notice_01.page

3.3.2 *Notice for Users of EVMs Considered "Radio Frequency Products" in Japan:* EVMs entering Japan may not be certified by TI as conforming to Technical Regulations of Radio Law of Japan.

If User uses EVMs in Japan, not certified to Technical Regulations of Radio Law of Japan, User is required to follow the instructions set forth by Radio Law of Japan, which includes, but is not limited to, the instructions below with respect to EVMs (which for the avoidance of doubt are stated strictly for convenience and should be verified by User):

1. Use EVMs 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 EVMs only after User obtains the license of Test Radio Station as provided in Radio Law of Japan with respect to EVMs, or
3. Use of EVMs only after User obtains the Technical Regulations Conformity Certification as provided in Radio Law of Japan with respect to EVMs. Also, do not transfer EVMs, unless User gives the same notice above to the transferee. Please note that if User does not follow the instructions above, User will be subject to penalties of Radio Law of Japan.

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3.4 *European Union*

3.4.1 *For EVMs subject to EU Directive 2014/30/EU (Electromagnetic Compatibility Directive)*:

This is a class A product intended for use in environments other than domestic environments that are connected to a low-voltage power-supply network that supplies buildings used for domestic purposes. In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures.

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4.2 User must read and apply the user guide and other available documentation provided by TI regarding the EVM prior to handling or using the EVM, including without limitation any warning or restriction notices. The notices contain important safety information related to, for example, temperatures and voltages.

4.3 *Safety-Related Warnings and Restrictions:*

4.3.1 User shall operate the EVM within TI's recommended specifications and environmental considerations stated in the user guide, other available documentation provided by TI, and any other applicable requirements and employ reasonable and customary safeguards. Exceeding the specified performance ratings and specifications (including but not limited to input and output voltage, current, power, and environmental ranges) for the EVM may cause personal injury or death, or property damage. If there are questions concerning performance ratings and specifications, User should 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 also result in unintended and/or inaccurate operation and/or possible permanent damage to the EVM and/or interface electronics. Please consult the EVM user 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, even with the inputs and outputs kept within the specified allowable ranges, some circuit components may have elevated case temperatures. These components include but are not limited to linear regulators, switching transistors, pass transistors, current sense resistors, and heat sinks, which can be identified using the information in the associated documentation. When working with the EVM, please be aware that the EVM may become very warm.

4.3.2 EVMs are intended solely for use by technically qualified, professional electronics experts who are familiar with the dangers and application risks associated with handling electrical mechanical components, systems, and subsystems. User assumes all responsibility and liability for proper and safe handling and use of the EVM by User or its employees, affiliates, contractors or designees. User assumes all responsibility and liability to ensure 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. User assumes all responsibility and liability for any improper or unsafe handling or use of the EVM by User or its employees, affiliates, contractors or designees.

4.4 User assumes all responsibility and liability to determine whether the EVM is subject to any applicable international, federal, state, or local laws and regulations related to User's handling and use of the EVM and, if applicable, User assumes all responsibility and liability for compliance in all respects with such laws and regulations. User assumes all responsibility and liability for proper disposal and recycling of the EVM consistent with all applicable international, federal, state, and local requirements.

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