HD3SS215 Evaluation Module

This is the user's guide for the evaluation module (EVM) of the HD3SS215. The purpose of this user's guide is to facilitate an easy evaluation process for the HD3SS215 HDMI switch.

The contents of this user's guide are meant to provide an overview of the HD3SS215, which includes highlighting its key features, operating conditions, and how to setup this EVM for use in a system-level evaluation.

The construction of the HD3SS215 EVM also serves as a reference design that can be easily modified for any intended application. Target applications include notebooks, desktops, and docking stations. Schematics and layout information are included near the end.

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1 Introduction

The HD3SS215 is a high-speed passive switch capable of switching two full 4-lane ports from one of two sources to one target location in an application or from one source to one of two targets. The signal pass through the switch can be DisplayPort or HDMI/DVI signal. For DisplayPort applications, the HD3SS215 also supports switching of the auxiliary (AUX), display data channel (DDC), and hot plug detect (HPD) signals.

This EVM was designed to be used as a medium connection between one HDMI source and one of two HDMI sinks. The interface to the EVM consists of a standard HDMI connector to connect the EVM to your system setup with standard HDMI cables. Your test setup should look similar to Figure 1.

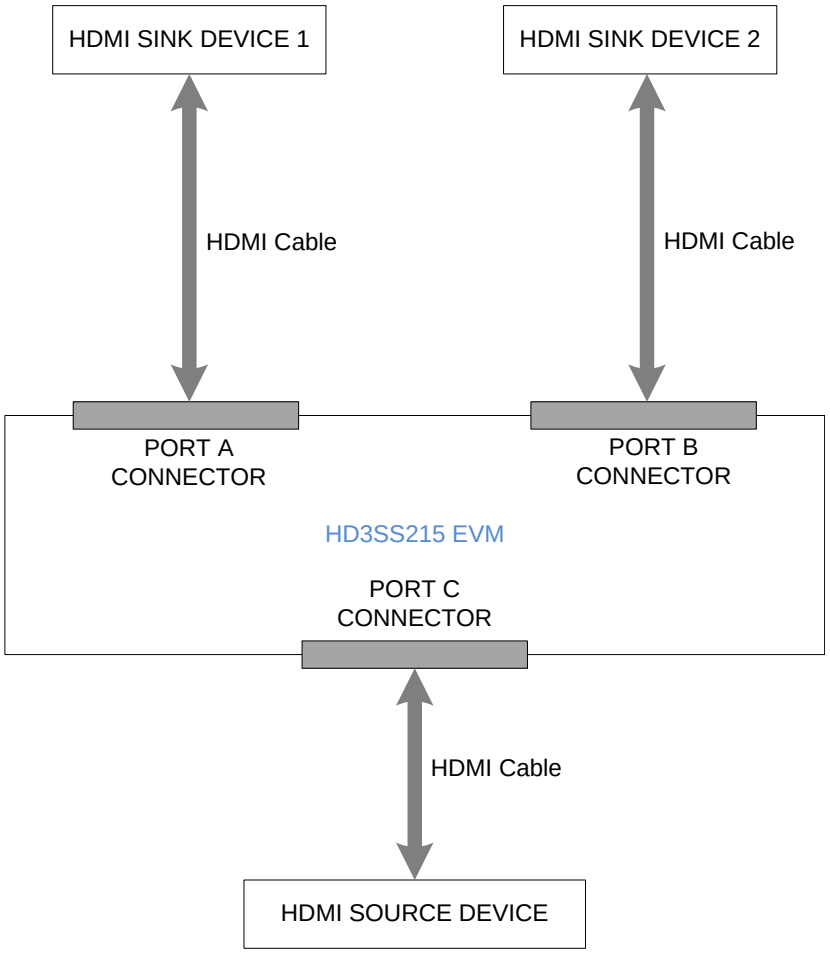


Figure 1. HD3SS215 EVM Simple System Block Diagram

2 HD3SS215 EVM Kit Contents

This EVM kit should contain the following items:

- HD3SS215 EVM board
- User's guide

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3 Description of EVM Board

The HD3SS215 EVM is designed to provide easy evaluation of the HD3SS215 device. It is also meant to serve as a reference design to show a practical example of how to use the device in a mass-production system. Table 1 highlights the EVM jumper functionality and configuration.

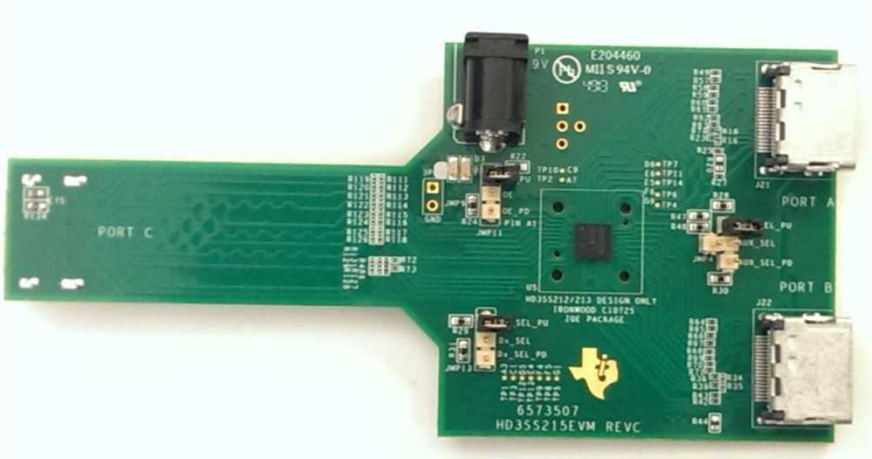


Figure 2. HD3SS215 EVM (Top Side)

Table 1. HD3SS215 EVM Jumper Description and Settings

Jumper	Description	Jumper Configuration
JMP10	VDD selection	No Connect for Nominal 3.3-V supply voltage Jumper pins 1 to 2 for 3.6-V supply voltage Jumper pins 2 to 3 for 3.0-V supply voltage
JMP11	HD3SS215 output enable	Jumper pins 1 to 2 to enable device outputs (default) Jumper pins 2 to 3 to disable device outputs
JMP4	HD3SS215 AUX SEL	Jumper pins 1 to 2 to enable Port B to C connection Jumper pins 2 to 3 to enable Port A to C connection
JMP13	HD3SS215 Dx SEL	Jumper pins 1 to 2 to enable Port B to C connection Jumper pins 2 to 3 to enable Port A to C connection

4 Power for the HD3SS215 EVM

The EVM should be powered with a +9-V DC power supply.

5 Monitoring the Device Current

To observe current consumption of the HD3SS215 in the device evaluation, the HD3SS215 EVM includes the option to monitor the current draw of the device. To enable this feature, take the following steps:

1. Uninstall the ferrite bead located at L2.
2. Obtain a power supply with the ability to display its current draw (or connect a current meter in series to the power supply) and connect to JMP9.
3. Turn on the power supply and observe the measured current on the power supply display (or current meter).

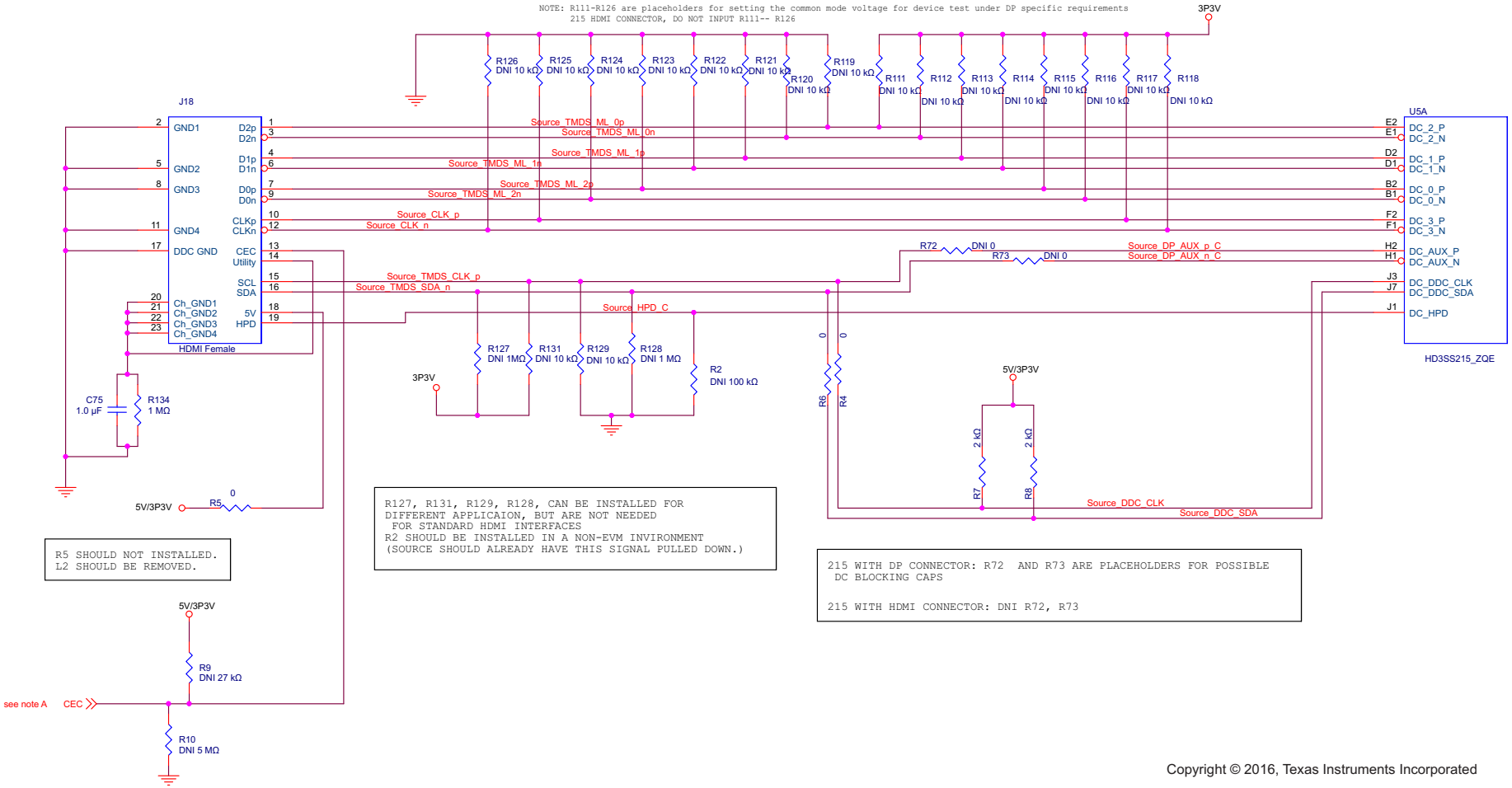
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6 PCB Construction

This section discusses the construction of the EVM boards. It includes the board schematics and layout files to show how the board was built.

6.1 HD3SS215 EVM Board Schematics

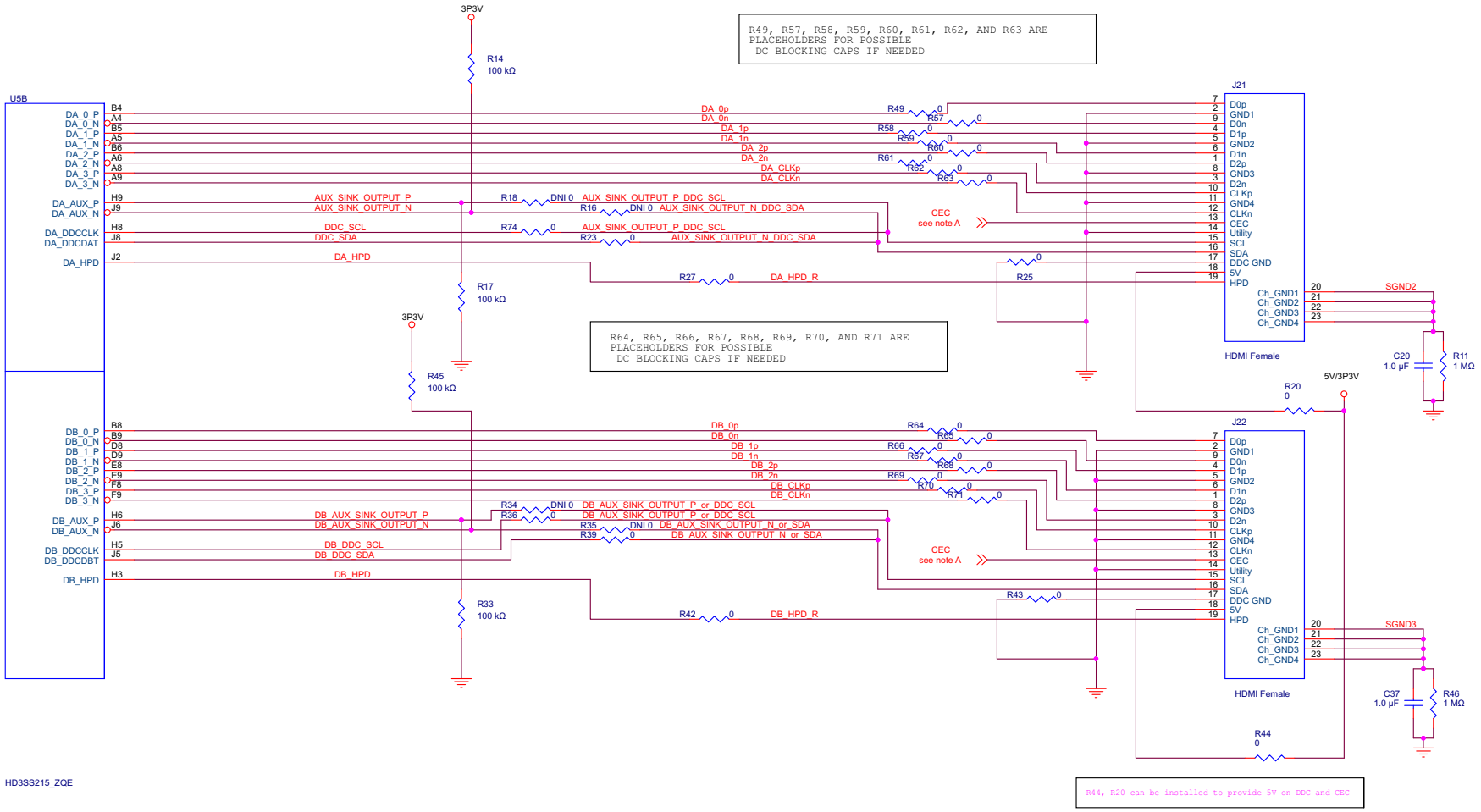
This section shows the board schematics for the EVM.



A For CEC, also see Figure 4.

Figure 3. HD3SS215 EVM Schematic Source Port C

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A For CEC, also see Figure 3.

B See Table 2.

Figure 4. HD3SS215 EVM Schematic Sink Ports A and B

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Table 2. Section A BOM Changes

Reference Designator	DP Value	HDMI Value
C21	0.1 µF	0
C22	0.1 µF	0
C23	0.1 µF	0
C24	0.1 µF	0
C25	0.1 µF	0
C26	0.1 µF	0
C27	0.1 µF	0
C28	0.1 µF	0
R14	100 k	
R15	0	
R16	0	
R17	100 k	
R18	DNI	0
R19	DNI	0
R21	0	
R23	DNI	0
R25	0	
R26	DNI	0
R27	0	
R32	DNI	0
R13	1M	
J13	DP Rect	HDMI Rect
J14	DP Rect	HDMI Rect

Table 3. Switch Control Logic(1)(2)

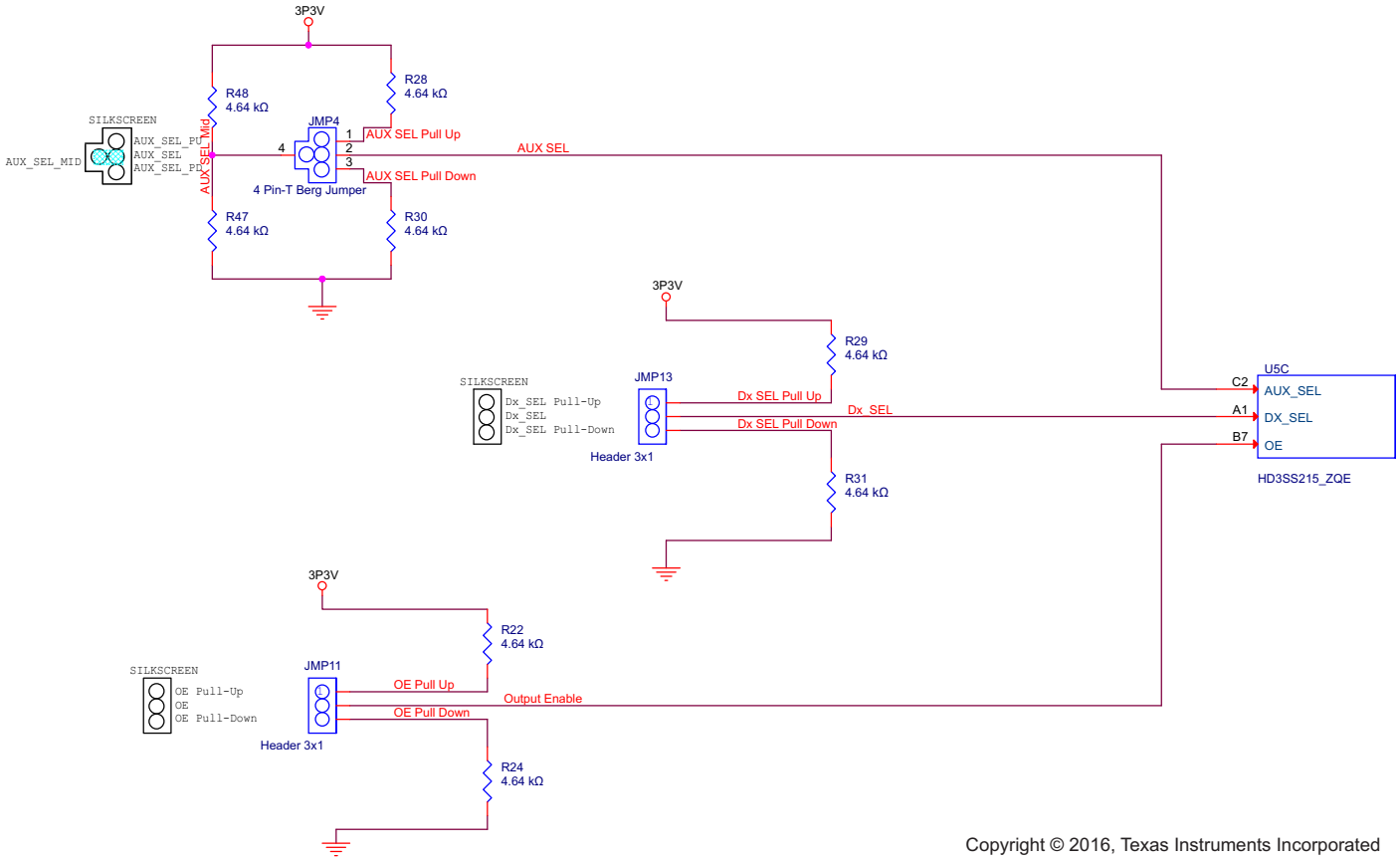
Control Lines	Switched I/O Pins			
Dx_SEL	DCz(p) Pin z = 0, 1, 2, or 3	DCz(n) Pin z = 0, 1, 2, or 3	HDPC Pin	CADC Pin (RSH)
L	DAz(p)	DAz(n)	HPDA	CADA
H	DBz(p)	DBz(n)	HPDB	CADB

(1) OE pin – For normal operation, drive OE high. Driving the OE pin low will disable the switch.
(2) Note: The ports which are not selected by the control lines will be in high impedance state.

Table 4. AUX/DDC Switch Control Logic

Control Lines		Switched I/O Pins			
AUX_SEL	Dx_SEL		AUXA	AUXB	AUXC
L	L	213 / 215	To or from AUXC	Z	To or from AUXA
L	H	213 / 215	Z	To or from AUXC	To or from AUXB
H	L	213 / 215	Z	Z	To or from DDCA
H	H	213 / 215	Z	Z	To or from DDCB
M	L	213	To or from DDCC	Z	Z

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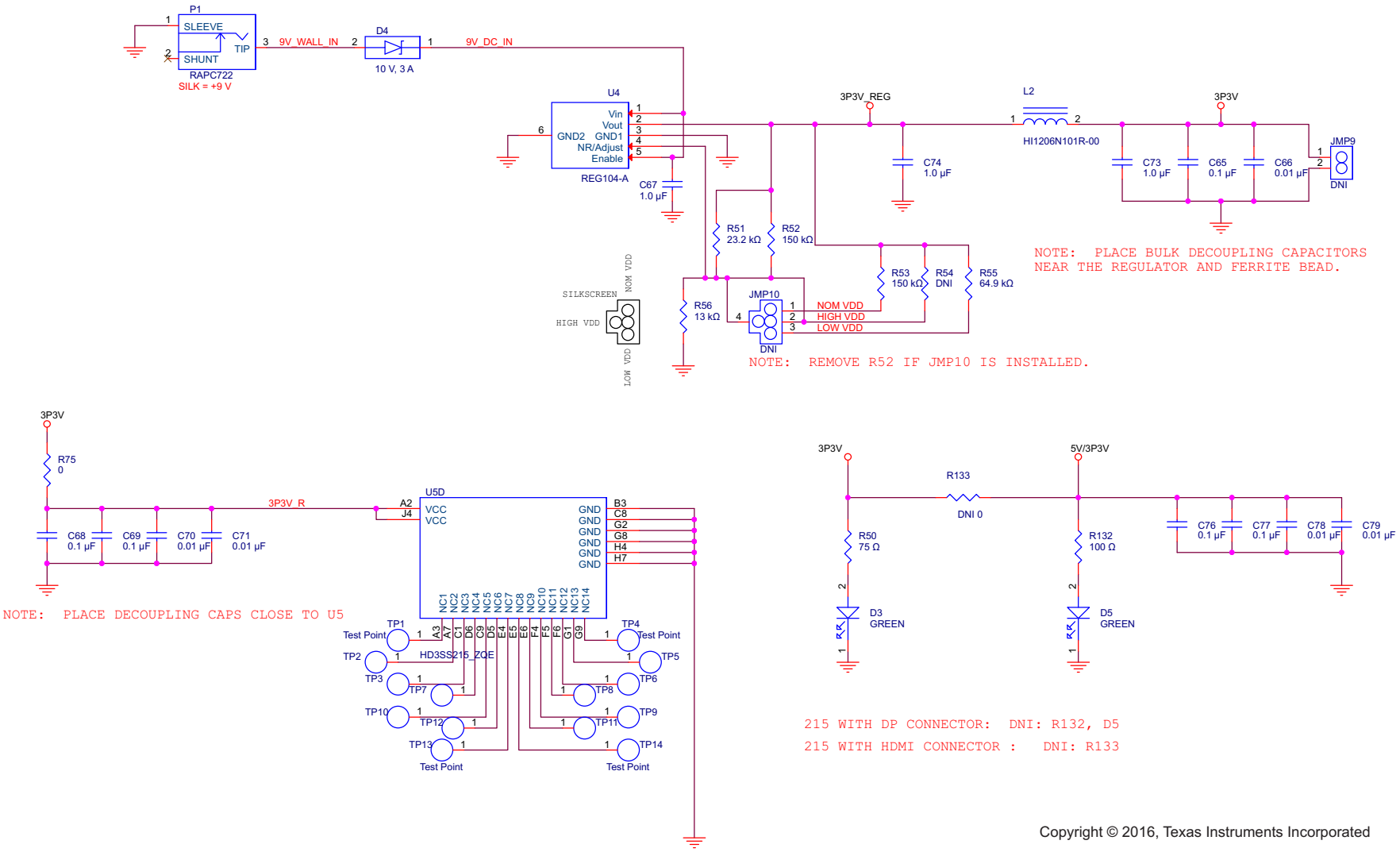


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A See Table 3 and Table 4.

Figure 5. HD3SS215 EVM Control

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Figure 6. HD3SS215 EVM Power

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6.2 HD3SS215 EVM Board Layout

This EVM was designed to show the implementation of this device on a 4-layer board.

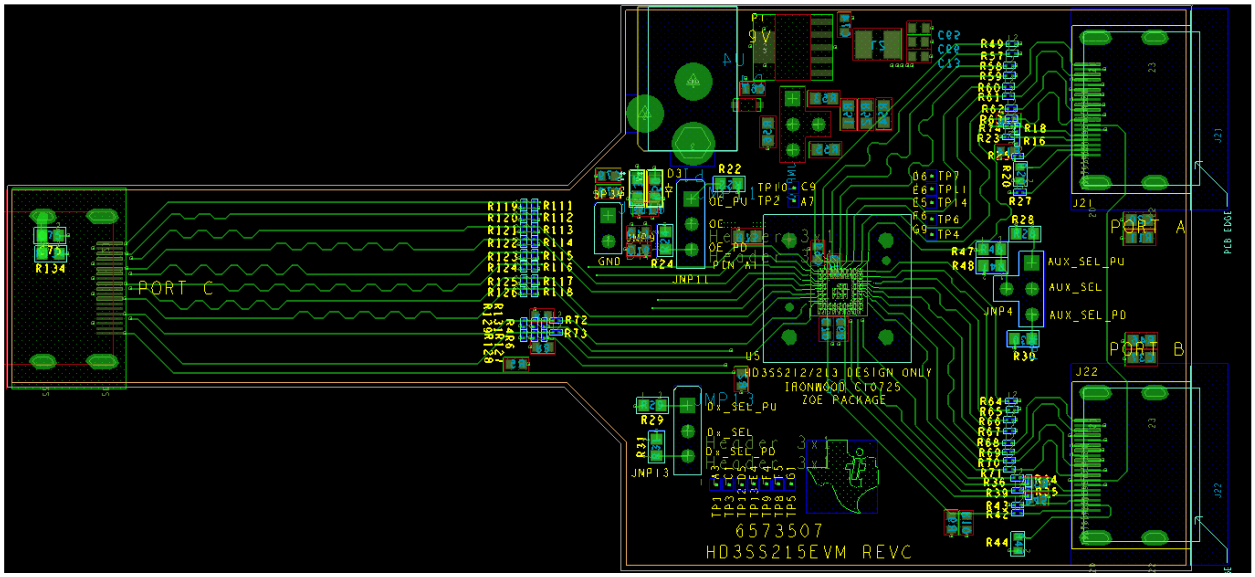


Figure 7. HD3SS215 EVM Layout Layer 1 (Top)

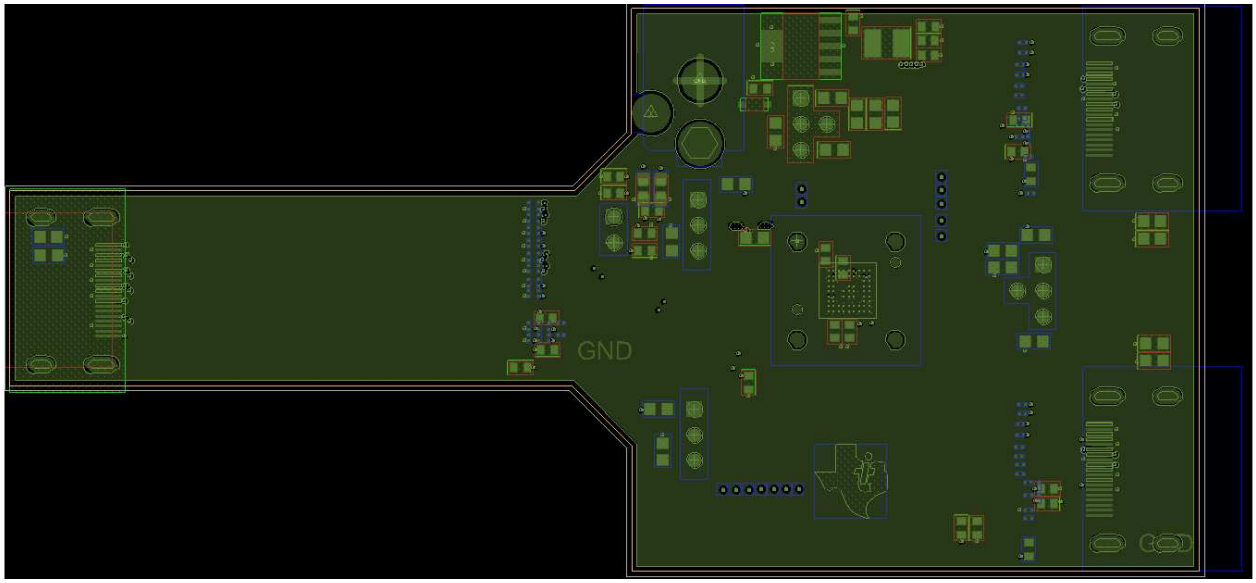


Figure 8. HD3SS215 EVM Layout Layer 2 (GND)

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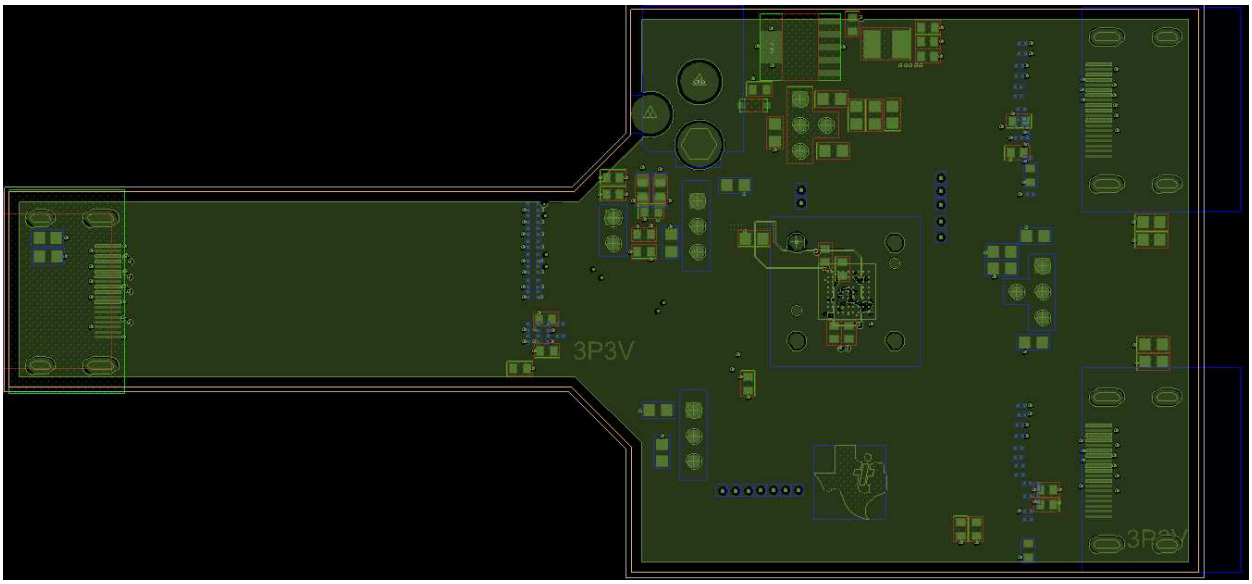


Figure 9. HD3SS215 EVM Layout Layer 3 (VCC)

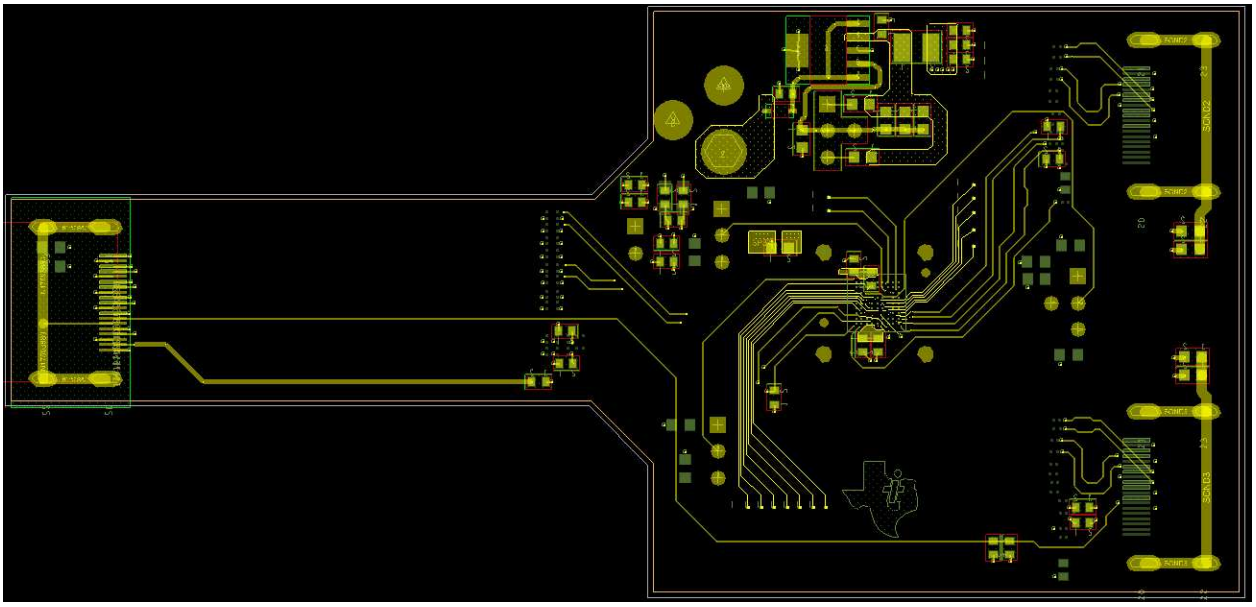


Figure 10. HD3SS215 EVM Layout Layer 4 (Bottom)

7 HD3SS215 EVM Board Construction

The HD3SS215 EVM board is a 4-layer board constructed of FR4 – TurboClad 370 material. The board stack-up consists of a signal layer on top, a ground layer, power layer, and a signal layer on bottom.

NOTE: To achieve the desired impedance, TI recommends that the user consult the board manufacturer for their process and design requirements.

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8 HD3SS215 EVM Material Listing

Table 5. EVM Bill of Materials

Item	Quantity	Reference	Part
1	4	C20,C37,C67,C75	1.0uF
2	5	C65,C68,C69,C76,C77	0.1uF
3	5	C66,C70,C71,C78,C79	0.01uF
4	2	C73,C74	1.0 uF
5	2	D3,D5	GREEN
6	1	D4	10V, 3A
7	1	JMP4	4 Pin-T Berg Jumper
8	3	JMP9, JMP10, R54	DNI
9	2	JMP11, JMP13	Header 3x1
10	1	J18	HDMI Female C
11	1	J21	HDMI Female A
12	1	J22	HDMI Female B
13	1	L2	HI1206N101R-00
14	1	P1	RAPC722
15	1	R2	DNI 100k
16	30	R4, R5, R6, R20, R23, R25, R27, R36, R39, R42, R43, R44, R49, R57, R58, R59, R60, R61, R62, R63, R64, R65, R66, R67, R68, R69, R70, R71, R74, R75	0
17	2	R7, R8	2K
18	1	R9	DNI 27K
19	1	R10	DNI 5M
20	3	R11, R46, R134	1M
21	4	R14, R17, R33, R45	100K
22	7	R16, R18, R34, R35, R72, R73, R133	DNI 0
23	8	R22, R24, R28, R29, R30, R31, R47, R48	4.64K
24	1	R50	75
25	1	R51	23.2K
26	2	R52, R53	150K
27	1	R55	64.9K
28	1	R56	13K
29	18	R111, R112, R113, R114, R115, R116, R117, R118, R119, R120, R121, R122, R123, R124, R125, R126, R129, R131	DNI 10K
30	2	R127, R128	DNI 1M
31	1	R132	100
32	14	TP1, TP2, TP3, TP4, TP5, TP6, TP7, TP8, TP9, TP10, TP11, TP12, TP13, TP14	Test Point
33	1	U4	REG104-A
34	1	U5	HD3SS213/5_ZQE
35	1	U5	HD3SS213/5_ZQE

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Revision History

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

Changes from Original (April 2014) to A Revision	Page
• Changed Figure 3, terminal B2 To: DC_0_P, B1 To: DC_0_N and E2 To: DC_2_P, E1 To: DC_2_N	4

Revision History

Changes from A Revision (April 2016) to B Revision	Page
• Deleted list item: "9-V DC power supply" from Section 2	2
• Changed the sentence in Section 4	3

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1. *Delivery:* TI delivers TI evaluation boards, kits, or modules, including any accompanying demonstration software, components, and/or documentation which may be provided together or separately (collectively, an “EVM” or “EVMs”) to the User (“User”) in accordance with the terms set forth herein. User's acceptance of the EVM is expressly subject to the following terms.

   1.1 EVMs are intended solely for product or software developers for use in a research and development setting to facilitate feasibility evaluation, experimentation, or scientific analysis of TI semiconductors products. EVMs have no direct function and are not finished products. EVMs shall not be directly or indirectly assembled as a part or subassembly in any finished product. For clarification, any software or software tools provided with the EVM (“Software”) shall not be subject to the terms and conditions set forth herein but rather shall be subject to the applicable terms that accompany such Software

   1.2 EVMs are not intended for consumer or household use. EVMs may not be sold, sublicensed, leased, rented, loaned, assigned, or otherwise distributed for commercial purposes by Users, in whole or in part, or used in any finished product or production system.

2 *Limited Warranty and Related Remedies/Disclaimers*:

   2.1 These terms do not apply to Software. The warranty, if any, for Software is covered in the applicable Software License Agreement.

   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。
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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.

4 *EVM Use Restrictions and Warnings:*

4.1 EVMS ARE NOT FOR USE IN FUNCTIONAL SAFETY AND/OR SAFETY CRITICAL EVALUATIONS, INCLUDING BUT NOT LIMITED TO EVALUATIONS OF LIFE SUPPORT APPLICATIONS.

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.

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