User's Guide
SNLU236–May 2018

DS90C189-Q1EVM User Guide

The DS90C189-Q1EVM (Evaluation Module) helps designers evaluate the performance of the DS90C189-Q1 Low Power 1.8V RGB-to-Open LDI (LVDS) Bridge. The device operates from a single 1.8V supply and can drive up to SXGA+ 1400x1050 at 60Hz (Single In / Single Out) or WUXGA+ 1920x1440 at 60 Hz (Single In / Dual Out). The DS90C189-Q1 converts up to 24 bits (single pixel 24 bit color) of 1.8V LVCMOS data into one or two channels of 4 data + clock (4D+C) reduced width interface LVDS compatible data streams.

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1 Features

- Qualified for Automotive Applications
- AEC-Q100 Qualified for Automotive Applications with the following results:
  - Device Temperature Grade 2: -40°C to +105°C Ambient Operating Temperature
  - Device HBM ESD Classification Level ±8kV
  - Device CDM ESD Classification Level ±750V
- 150 mW typical power consumption at 185 MHz (SIDO mode)
- Drives QXGA and WQXGA class displays
- Two operating modes:
  - Single Pixel In, Single Pixel Out (SISO), 105MHz max
  - Single Pixel In, Dual Pixel Out (SIDO), 185MHz
- Supports 24 bit RGB
- Supports 3D+C, 4D+C, 6D+C, 6D+2C, 8D+C, and 8D+2C LVDS configurations
- Compatible with FPD-Link, and FlatLink Devices
- 1.8V VDDIO and Core Supply
- Interfaces directly with 1.8V LVCMOS
- Less than 1mW power consumption in Sleep Mode
- Spread Spectrum Clock compatible
- Small 9mm x 9mm x 0.9 mm 64-pin VQFN package

2 Applications

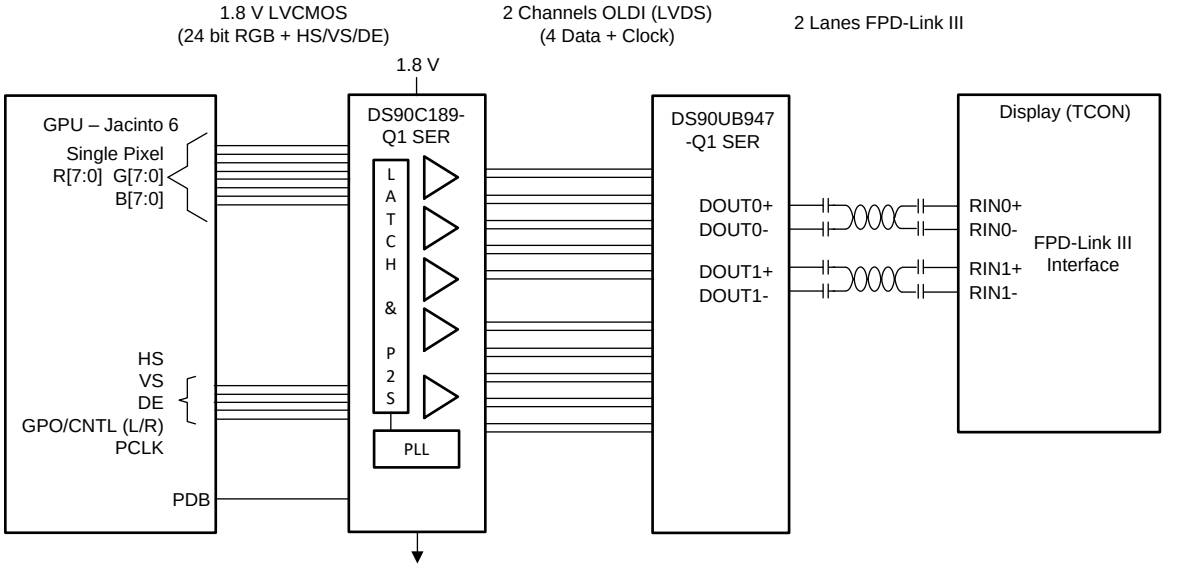


Figure 1. Applications Diagram

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3 Major Components

- U1 – DS90C189-Q1
- J1,J2 – Input
- J3, J6 – Output
- J4, J5 – Power
- S1 – Setup Switch

4 EVM Setup

4.1 Contents of the Demo Evaluation Kit

One EVM board with the DS90C189-Q1.

4.2 Quick Start Guide

1. Configure switch S1 to set device's operating modes
   - S1.1: MODE0 = OFF
   - S1.2: RFB = OFF
   - S1.3: VODSEL = OFF
   - S1.4: PDB = OFF
2. Connect J4 to 1.8V power supply, and connect J5 to GND
3. Connect RGB input to J2
4. Connect to J3 and J6 for output of DS90C189-Q1

4.3 Default Switch Settings

Ensure that the board has the default board switch settings:

Table 1. Board Switch Settings

SWITCH S1	SWITCH SETTINGS	FUNCTION
MODE0	OFF (default)	SIDO - Single Pixel In / Dual Pixel Out
	ON	SISO - Single Pixel In / Single Pixel Out
RFB	OFF (default)	Rising edge clock select
	ON	Falling edge clock select
VODSEL	OFF (default)	Normal VOD level select
	ON	Low VOD level select
PDB	OFF (default)	Device active
	ON	Power down mode

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4.4 Demo Board Connections

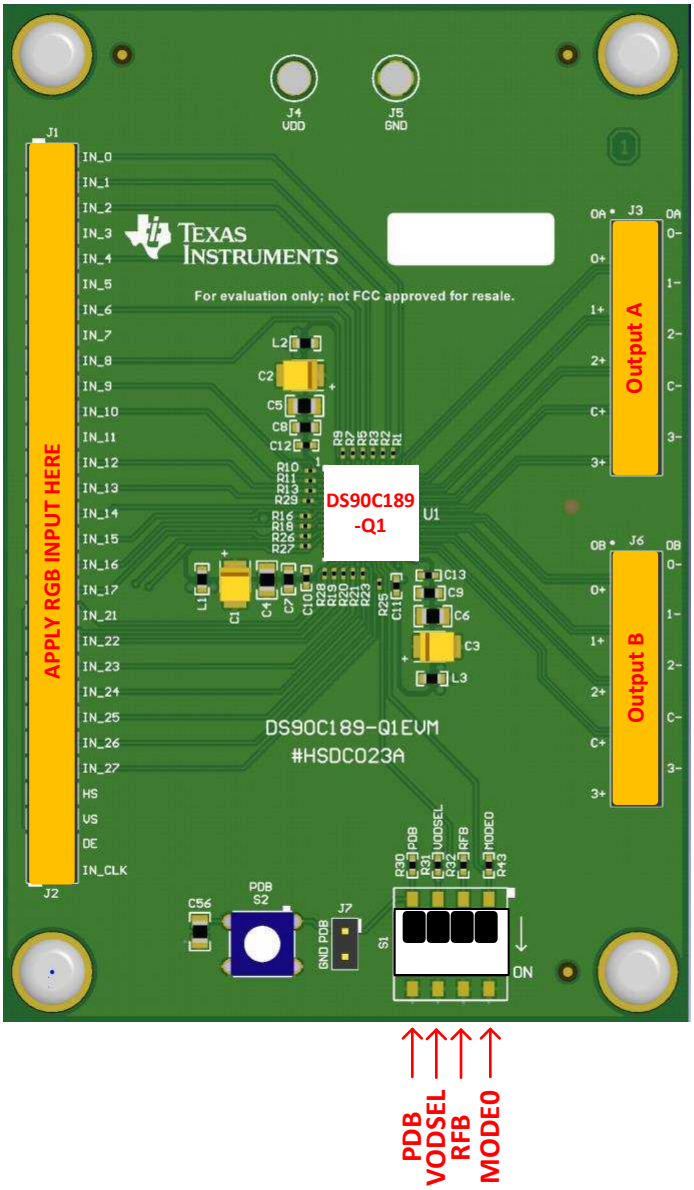
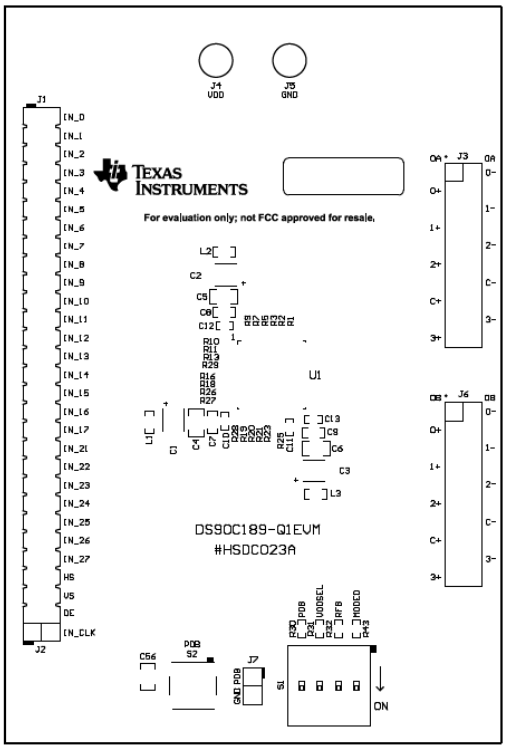


Figure 2. Demo Board Connections

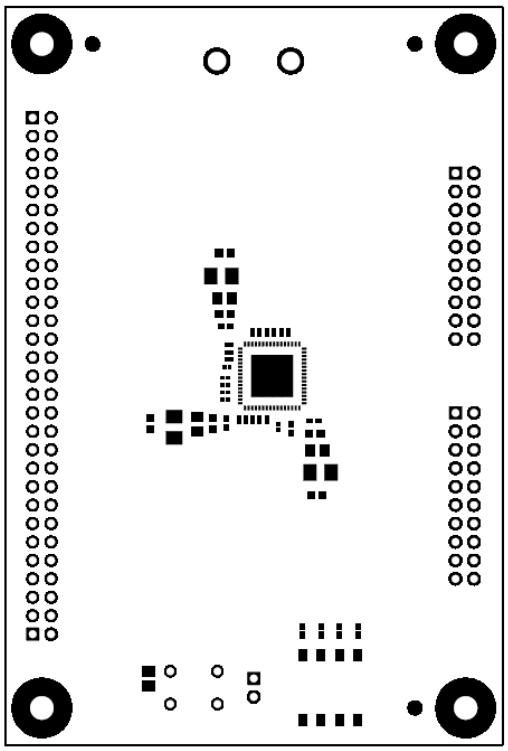
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5 Board Layout



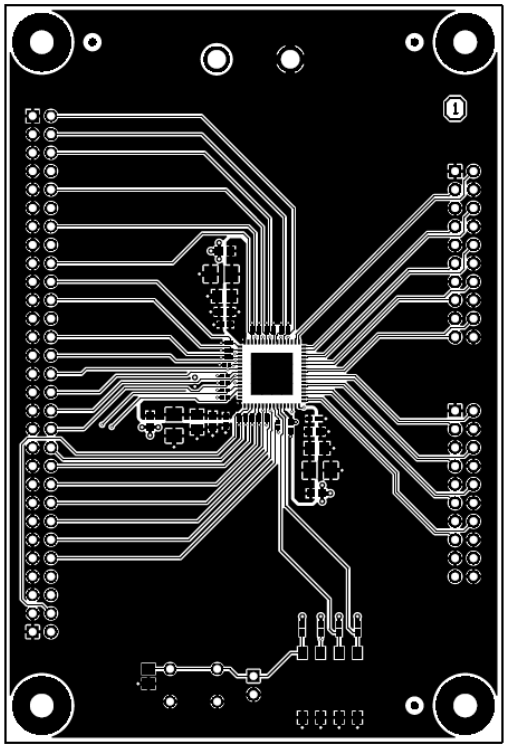
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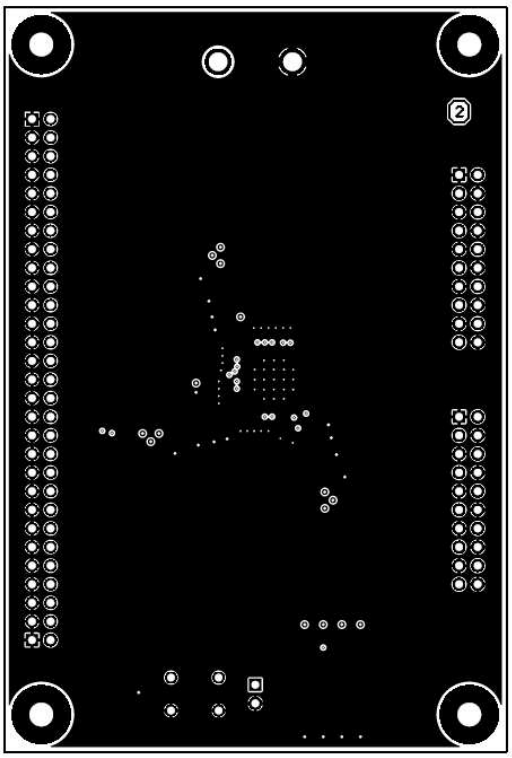
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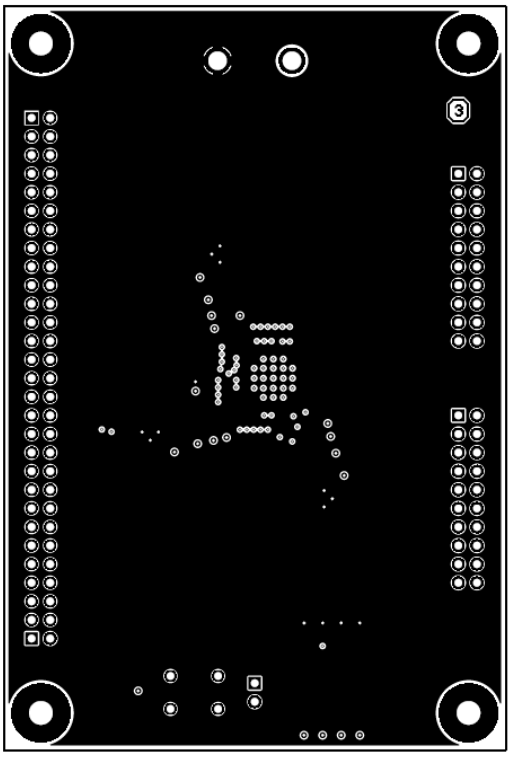
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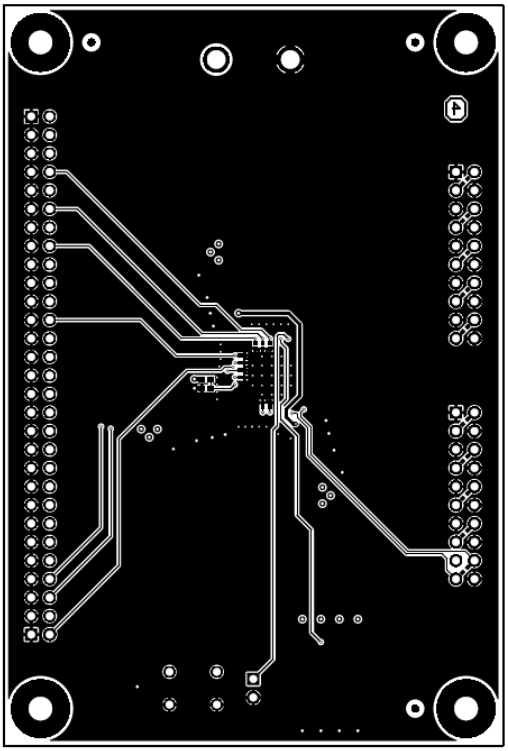
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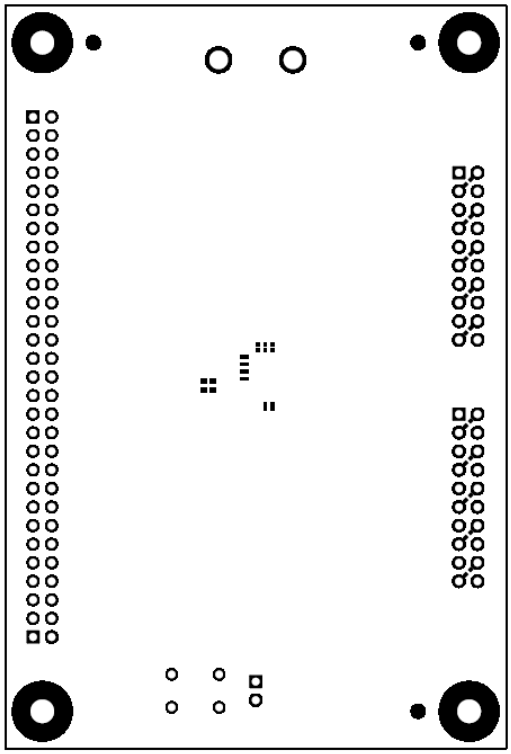
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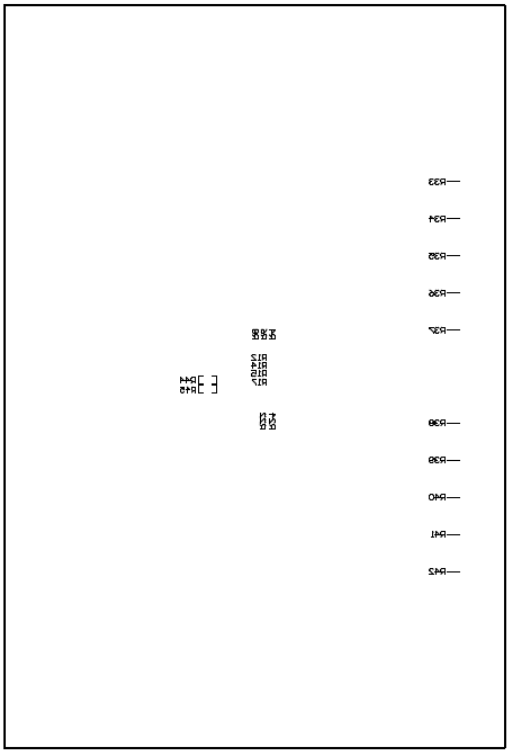
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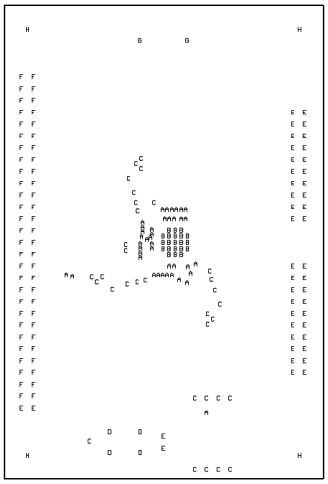
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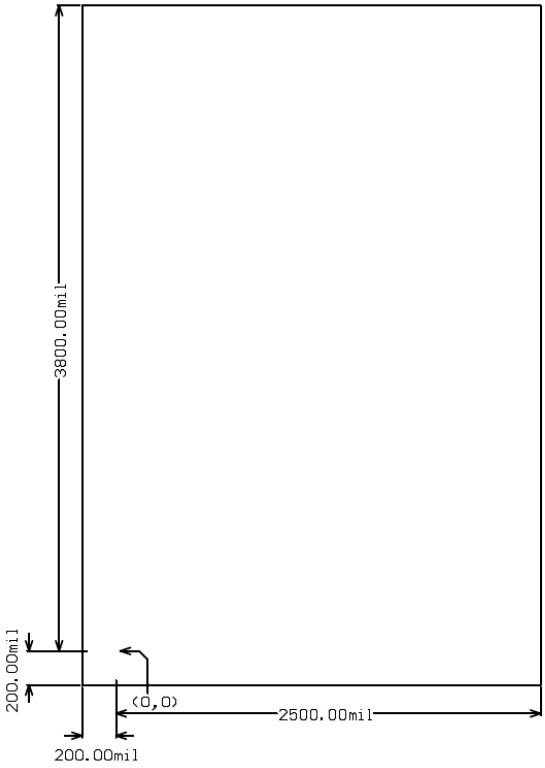


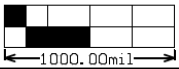
DRILL TABLE:

Symbol	Count	Hole Size	Plated	Hole Type	Tolerance (mils)	Mask Tenting
A	40	8.00mil (0.203mm)	PTH	Round	+0/-8	Both sides
B	21	8.10mil (0.206mm)	PTH	Round	+0/-8.1	Bottom only
C	33	15.00mil (0.381mm)	PTH	Round	+0/-15	Both sides
D	4	39.37mil (1.000mm)	PTH	Round		
E	44	40.00mil (1.016mm)	PTH	Round	+/-3	
F	56	40.16mil (1.020mm)	PTH	Round		
G	2	98.43mil (2.500mm)	PTH	Round		
H	4	125.98mil (3.200mm)	PTH	Round		
	204 Total					

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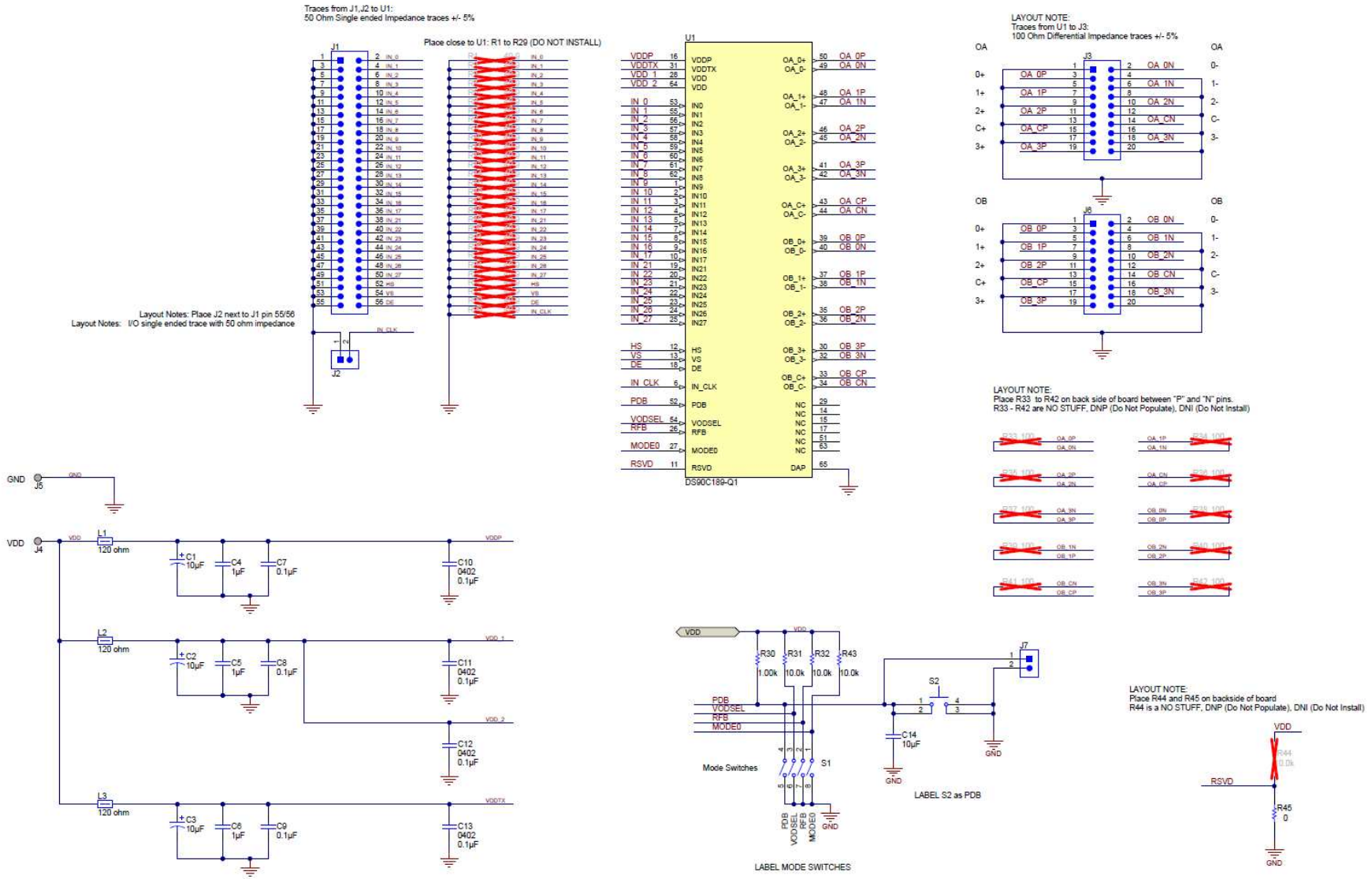




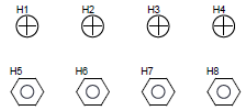
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6 Schematic and Bill of Materials



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PCB Number: HSDC023
PCB Rev: E1

PCB
LOGO
Texas Instruments

PCB
LOGO
FCC disclaimer

PCB
LOGO
Logo2

LBL1
PCB Label
Size: 0.65" x 0.20"

ZZ1
Label Assembly Note
This Assembly Note is for PCB labels only

ZZ2
Assembly Note
These assemblies are ESD sensitive, ESD precautions shall be observed.

ZZ3
Assembly Note
These assemblies must be clean and free from flux and all contaminants. Use of no clean flux is not acceptable.

ZZ4
Assembly Note
These assemblies must comply with workmanship standards IPC-A-610 Class 2, unless otherwise specified.

Variant/Label Table	
Variant	Label Text
001	DS90C189-Q1EVM

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Table 2. Bill of Materials

ITEM	DESIGNATOR	DESCRIPTION	MANUFACTURER	PART NUMBER	QTY
1	!PCB	Printed Circuit Board	Any	HSDC023	1
2	C1, C2, C3	CAP, TA, 10 µF, 16 V, +/- 20%, 2 ohm, SMD	Vishay-Sprague	293D106X0016B2TE3	3
3	C4, C5, C6	CAP, CERM, 1 µF, 16 V, +/- 10%, X7R, 0805	TDK	C2012X7R1C105K	3
4	C7, C8, C9	CAP, CERM, 0.1 µF, 16 V, +/- 5%, X7R, 0603	AVX	0603YC104JAT2A	3
5	C10, C11, C12, C13	CAP, CERM, 0.1 µF, 16 V, +/- 10%, X5R, 0402	MuRata	GRM155R61C104KA88D	4
6	C14	CAP, CERM, 10 µF, 10 V,+/- 10%, X7R, 0805	TDK	C2012X7R1A106K125AC	1
7	H1, H2, H3, H4	Machine Screw, Round, #4-40 x 1/4, Nylon, Philips panhead	B F Fastener Supply	NY PMS 440 0025 PH	4
8	H5, H6, H7, H8	Standoff, Hex, 0.5"L #4-40 Nylon	Keystone	1902C	4
9	J1	Header, 2.54 mm, 28x2, Gold, TH	Samtec	TSW-128-07-S-D	1
10	J2, J7	Header, 100mil, 2x1, Gold, TH	Samtec	TSW-102-07-G-S	2
11	J3, J6	Header, 100mil, 10x2, Gold, TH	Samtec	TSW-110-07-G-D	2
12	J4, J5	Terminal, Turret, TH, Double	Keystone	1502-2	2
13	L1, L2, L3	Ferrite Bead, 120 ohm @ 100 MHz, 3 A, 0603	MuRata	BLM18SG121TN1D	3
14	LBL1	Thermal Transfer Printable Labels, 0.650" W x 0.200" H - 10,000 per roll	Brady	THT-14-423-10	1
15	R30	RES, 1.00 k, 1%, 0.1 W, 0402	Panasonic	ERJ-2RKF1001X	1
16	R31, R32, R43	RES, 10.0 k, 1%, 0.063 W, 0402	Vishay-Dale	CRCW040210K0FKED	3
17	R45	RES, 0, 5%, 0.063 W, 0402	Panasonic	ERJ-2GE0R00X	1
18	S1	DIP Switch, 4 position slide actuator, SPST, SMD	Omron Electronic Components	A6S-4104-H	1
19	S2	SWITCH TACTILE SPST-NO 0.02A 15V, TH	Panasonic	EVQ-PAD04M	1
20	U1	Low Power 1.8V Dual Pixel FPD-Link (LVDS) Serializer, RTD0064F (VQFNP-64)	Texas Instruments	DS90C189-Q1	1
21	R1, R2, R3, R4, R5, R6, R7, R8, R9, R10, R11, R12, R13, R14, R15, R16, R17, R18, R19, R20, R21, R22, R23, R24, R25, R26, R27, R28, R29	RES, 49.9, 1%, 0.05 W, 0201	Vishay-Dale	CRCW020149R9FKED	0
22	R33, R34, R35, R36, R37, R38, R39, R40, R41, R42	RES, 100, 1%, 0.063 W, 0402	Vishay-Dale	CRCW0402100RFKED	0
23	R44	RES, 10.0 k, 1%, 0.063 W, 0402	Vishay-Dale	CRCW040210K0FKED	0

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   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。
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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2. 実験局の免許を取得後ご使用いただく。
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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.

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.

5. *Accuracy of Information:* To the extent TI provides information on the availability and function of EVMs, TI attempts to be as accurate as possible. However, TI does not warrant the accuracy of EVM descriptions, EVM availability or other information on its websites as accurate, complete, reliable, current, or error-free.

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