# DS100BR410EVK-4 User Guide: 4 Channels SMA Evaluation Kit

# User's Guide

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# DS100BR410EVK-4 User Guide: 4 Channels SMA Evaluation Kit

The DS100BR410EVK-4 is a 4 channel SMA evaluation kit. It provides a complete high bandwidth platform to evaluate the signal integrity and signal conditioning features of the Texas Instruments DS100BR410SQ – Quad Channel Repeater Equalization and De-Emphasis.

**Topic** **Page**

# 1 Features

- Quad Channel Repeater for up to 10.3215 Gbps
- Low Power Consumption, with Option to Power Down Unused Channels
- Adjustable Receive Equalization
- Adjustable Transmit De-emphasis
- Adjustable Transmit VOD (up to 1200 mVp-p)
- IDLE Detection — Squelch Function Auto-Mutes the Output
- Less than 0.22 UI of Residual DJ at 10.3125 Gbps with 12 Meters Cable
- Programmable via Pin Selection or SMBus Interface
- Single Supply Operation at 2.5 V ±5%
- –40°C to +85°C Operation
- Greater than 7 kV HBM ESD Rating
- High Speed Signal Flow–Thru Pinout Package: 48-pin LLP(7 mm x 7 mm, 0.5 mm pitch)

# 2 Applications

- High-Speed Active Copper Cable Modules
- FR-4 Backplanes
- 10GE, 8GFC, 10GFC, 10G SONET, SAS, SATA, and InfiniBand

# 3 DS100BR410EVK-4 Demo Kit Contents

- End User License Agreement
- DS100BR410EVK-4 User Guide Rev 1.6
- DS100BR410EVK-4 Board

# 4 Ordering Information

**Table 1. DS100BR410EVK-4 Ordering Information**

| DEVICE | QTY |
|---|---|
| DS100BR410SQE | 250 |
| DS100BR410SQ | 1000 |
| DS100BR410SQX | 2500 |
| **SMA Evaluation Kit:** DS100BR410EVK-4 | |

# 5 DS100BR410EVK-4 Evaluation Board Images

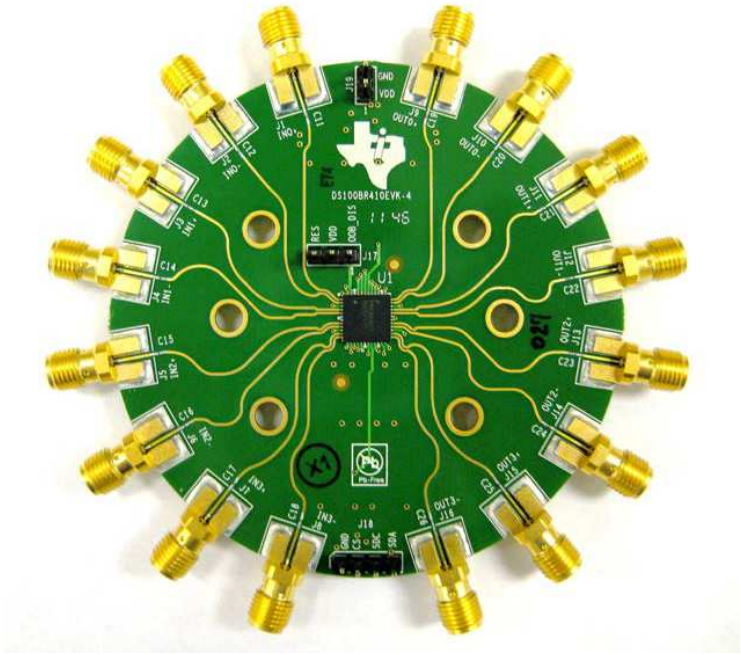


**Figure 1. DS100BR410EVK-4 Evaluation Board (Top View)**

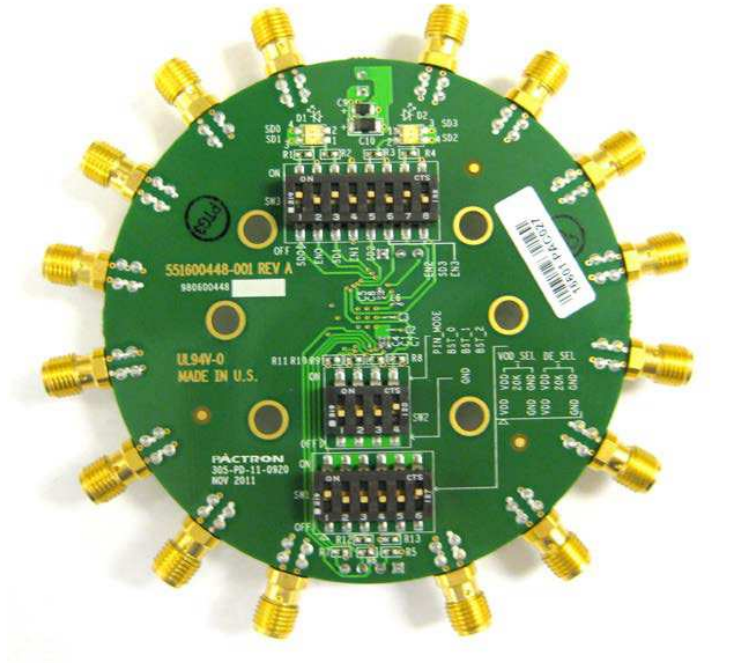


**Figure 2. DS100BR410EVK-4 Evaluation Board (Bottom View)**

## 6 Quick Start User Guide

1. **Connect J19 – VDD = 2.5 V and GND.**
2. **Connect 50 Ω SMA cables to the board.**
   - The input signals J1 to J8 can be connected from a pattern generator.
   - The output signals J9 to J16 can be connected to a scope.
3. **Set the input equalization level.**
   - **For external pin control for the equalization level:**
     - Set PIN_MODE = H by using the switch - SW2, pin 1 to the “OFF” position
     - Set BST_[2:0]= 111 (maximum level) by using the switch - SW2, pin 2,3,4 to the “OFF” position.
     - Note, this will set the level on all 4 channels (global setting).
   - **For SMBUS control for the equalization level:**
     - Set PIN_MODE = L (SMBUS mode) by using the switch - SW2, pin 1 to the “ON” position.
     - Please refer to datasheet for register map for equalization.
4. **Set the output DE – de-emphasis level**.
   - **For external pin control for the de-emphasis level:**
     - Set PIN_MODE = H by using the switch – SW2, pin 1 to the “OFF” position.
     - Set DE_SEL = open (-6dB) by using the switch – SW1, pin 4,5,6 to the “OFF” position.
     - Note, this will set the level on all 4 channels (global setting).
     - Also the switch provides the ability to set this pin to OPEN or VDD or 20k to GND or GND.
   - **Only 1 switch to the “ON” position is allowed.**
     - Do not have both VDD and GND to the “ON” position or there will be a VDD to GND short.
   - **For SMBUS control for the equalization level:**
     - Set PIN_MODE = L (SMBUS mode) by using the switch – SW2, pin 1 to the “ON” position.
     - Write to Reg_08-bit 3,2 to set the VOD level.
5. **Set the VOD – output differential voltage level.**
   - **For external pin control for the de-emphasis level:**
     - Set PIN_MODE = H by using the switch – SW2, pin 1 to the “OFF” position.
     - Note, this will set the level on all 4 channels (global setting).
     - Also, the switch provides the ability to set this pin to OPEN or VDD or 20k to GND or GND.
   - **Only 1 switch to the “ON” position is allowed.**
     - Do not have both VDD and GND to the “ON” position or there will be a VDD to GND short.
   - **For SMBUS control for the equalization level:**
     - Set PIN_MODE = L (SMBUS mode) by using the switch – SW2, pin 1 to the “ON” position.
     - Write to Reg_08-bit 3,2 to set the VOD level.

**Table 2. Connection and Control Description**

| Component | Name | Function |
|---|---|---|
| J1 to J8 | IN0+, IN0-, IN1+, IN1-, IN2+, IN2-, IN3+, IN3- | High speed differential inputs. |
| J9 to J16 | OUT0+, OUT0-, OUT1+, OUT1, OUT2+, OUT2-, OUT3+, OUT3- | High speed differential outputs. |
| J19 | VDD/GND | DC Power – VIN direct to DS100BR410SQ |
| J18 | GND, CS, SCL, SDA | Optional SMBUS access pins.<br>See the datasheet for additional information on SMBUS. |
| J17 | OOB_DIS, RES | OOB_DIS = L (internal pull-down: OOB support is enabled).<br>When OOB_DIS = H, the OOB squelch function is disabled.<br>NOTE: The silkscreen text is incorrect for RES and OOB_DIS, the RES is the OOB_DIS. |
| SW1 | VOD_SEL, DE_SEL | Switch to set VOD and DE level when PIN_MODE = H (SW=OFF) |
| SW2 | PIN_MODE, BST_[2:0] | PIN_MODE or SMBUS MODE.<br>Pin control for BST_[2:0], VOD_SEL, DE_SEL when PIN_MODE = H (SW=OFF). SMBUS control when PIN_MODE = L (SW=ON). |
| SW3 | SD1, EN1, SD2, EN2, SD1, EN1, SD2, EN2 | Signal Detect for CH0 to CH3 and enable pin control for CH0 to CH3. |

# 7 DS100BR410EVK-4 Schematic

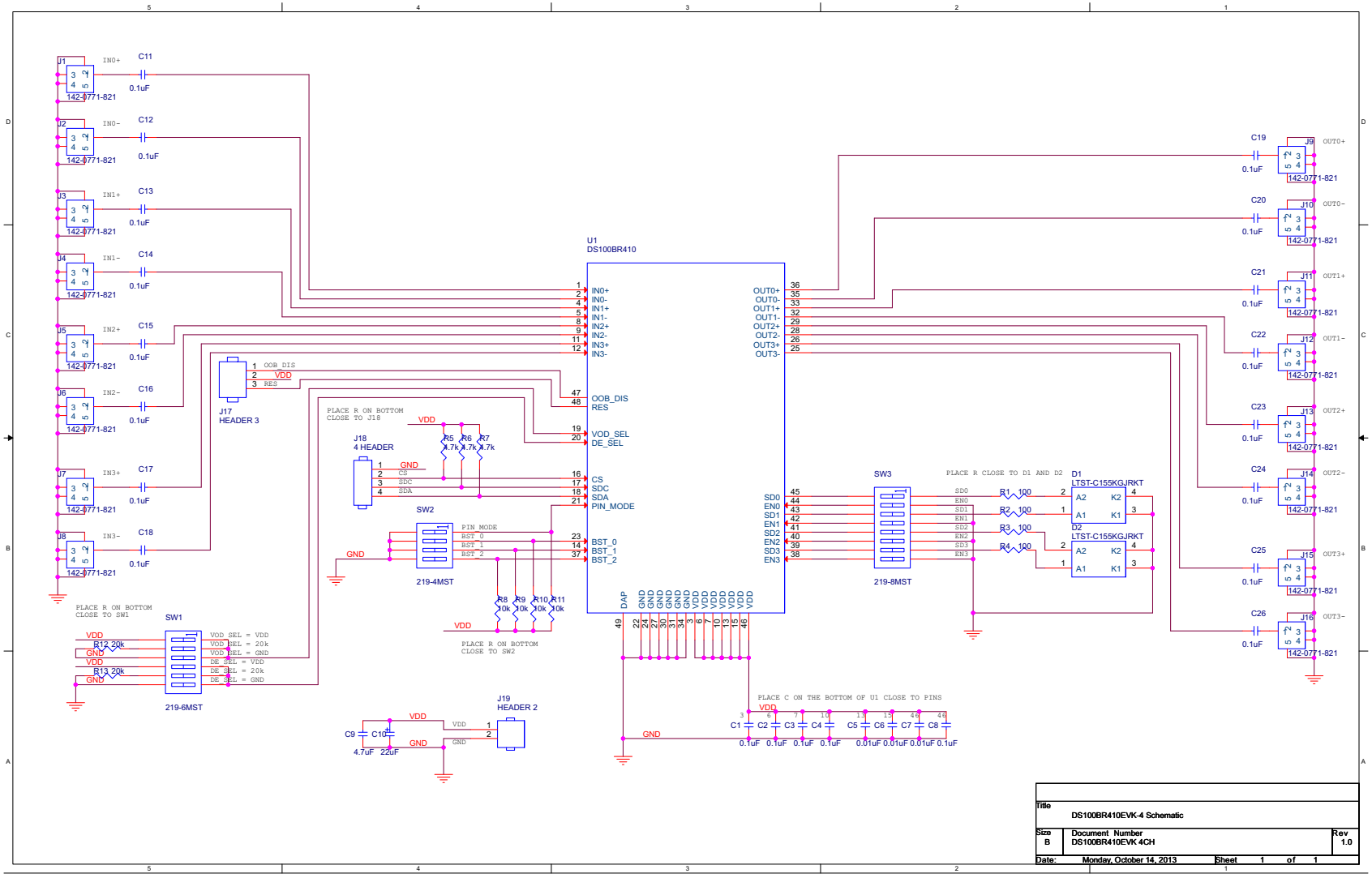


**Figure 3. DS100BR410EVK-4 Schematic**

# 8 Bill of Materials

| Item | Qty | Reference | Digikey PN | Manufacture PN | Descriptions |
|---|---|---|---|---|---|
| 1 | 21 | C1,C2,C3,C4,C8,C11, C12,C13,C14,C15,C16, C17,C18,C19,C20,C21, C22,C23,C24,C25,C26, | PCC2336CT-ND | ECJ-ZEB0J104M | CAP CERAMIC .1 UF 6.3 V X5R 0201 |
| 2 | 3 | C5,C6,C7 | PCC2381CT-ND | ECJ-ZEB1A103K | CAP CERAMIC .0 1UF 10 V X5R 0201 |
| 3 | 1 | C9 | 511-1443-1-ND | TCP0J475M8R | CAP TANT 4.7 UF 6.3 V SMD 0805 |
| 4 | 1 | C10 | 511-1502-1-ND | TCTAL1C226M8R | CAP TANTALUM 22 UF 16 V SMD 1206 |
| 5 | 2 | D1,D2 | 160-1409-1-ND | LTST-C155KGJRKT | LED GREEN/RED BICOLOR 1210 SMD |
| 6 | 16 | J1,J2,J3,J4,J5,J6,J7,J8, J9,J10,J11,J12,J13, J14,J15,J16 | J807-ND | 142-0771-821 | CONN JACK SMA 50 Ω PC MOUNT |
| 7 | 1 | J19 | WM6502-ND | 22-28-4023 | CONN HEADER 2POS .100 VERT GOLD |
| 8 | 1 | J17 | WM6503-ND | 22-28-4033 | CONN HEADER 2POS .100 VERT GOLD |
| 9 | 1 | J18 | WM6504-ND | 22-28-4043 | CONN HEADER 4POS .100 VERT GOLD |
| 10 | 4 | R1,R2,R3,R4 | RHM100LCT-ND | MCR01MZPF1000 | RES 100 OHM 1/16 W 1% 0402 SMD |
| 11 | 4 | R8,R9,R10,R11, | RHM10.0KLCT-ND | MCR01MZPF1002 | RES 10.0K Ω 1/16 W 1% 0402 SMD |
| 12 | 3 | R5,R6,R7 | RHM4.7KJCT-ND | MCR01MZPF1002 | RES 4.7K Ω 1/16 W 5% 0402 SMD |
| 13 | 2 | R12,R13 | RHM20.0KLCT-ND | MCR01MZPF2002 | RES 20.0K Ω 1/16 W 1% 0402 SMD |
| 14 | 1 | SW1 | CT2196MST-ND | 219-6MST | SWITCH TAPE SEAL 6 POS SMD |
| 15 | 1 | SW2 | CT2194MST-ND | 219-4MST | SWITCH TAPE SEAL 4 POS SMD |
| 16 | 1 | SW3 | CT2198MST-ND | 219-8MST | SWITCH TAPE SEAL 8 POS SMD |
| 17 | 1 | U1 | NA | DS100BR410SQ | QUAD CHANNEL REPEATER |

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**General Statement for EVMs including a radio**

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**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.

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**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.

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

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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.

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