

DS125BR111EVM User's Guide SMA Evaluation Kit

User's Guide



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DS125BR111EVM User's Guide ***SMA Evaluation Kit***

The DS125BR111EVM – SMA evaluation kit provides a complete high bandwidth platform to evaluate the 10GbE, PCIe, and SAS/SATA signal conditioning features of the Texas Instruments DS125BR111 repeater/redriver. The DS125BR111EVM can be used for standard compliance testing, performance evaluation, and initial system prototyping. The SMA edge launch connectors used for the DS125BR111EVM will interface to multiple system connector types via commercially available breakout cables, adaptors, and boards (not included). This flexible connectivity enables integrated system level testing between TI repeaters and 3rd party ASIC/FPGA host boards.

| Topic | Page |
|-------------------------------------|-----------|
| 1 Features | 3 |
| 2 Applications | 3 |
| 3 Demo Kit Contents | 3 |
| 4 Ordering Information | 3 |
| 5 Evaluation Board | 4 |
| 6 Setup | 4 |
| 7 Expected Results | 7 |
| 8 Schematic | 8 |
| 9 Bill of Materials | 10 |

1 Features

- Two Channel Repeater up to 12 Gbps Rate
 - DS125BR111: 1x Bidirectional Lane
- Low 65mW/channel Power Consumption, with Option to Power Down Unused Channels
- Advanced Signal Conditioning Features
 - Linear Equalization (up to 10 dB @ 6 GHz)
 - Linear output drive
 - Output voltage range over 1200 mV
- Fully Programmable via Pin Selection or SMBus Interface
- Selectable Single Supply Operation
- 5 kV HBM ESD Rating
- 3.3 V LVCMOS Input Tolerant for SMBus Interface
- Flow-Thru Pinout Package: 24-Pin QFN (4 mm x 4 mm)
- Industrial –40 to 85°C Operating Temperature Range

2 Applications

- High-Speed Cables and Backplanes in Communication Systems
- PCIe, SAS I/II/III, SATA 3/6 Gbps (with OOB detection) and many others

3 Demo Kit Contents

- DS125BR111EVM Board

4 Ordering Information

Table 1. DS125BR111EVM Ordering Information

| DEVICE | QUANTITY |
|--|----------|
| DS125BR111RTWR | 1000 |
| DS125BR111RTWT | 250 |
| SMA Evaluation Kit: DS125BR111EVM | |

5 Evaluation Board

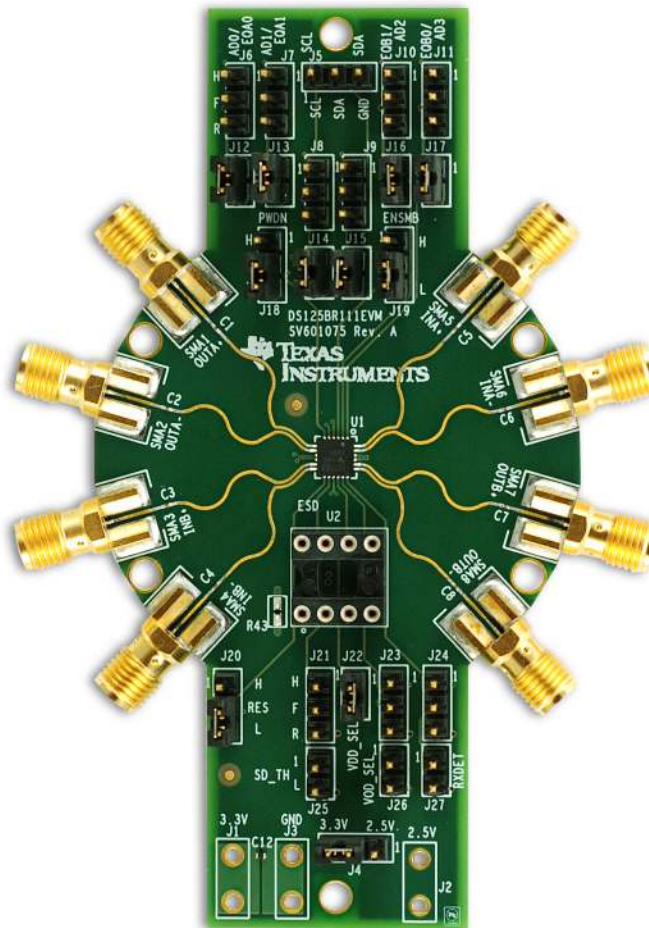


Figure 1. DS125BR111EVM Evaluation Board

6 Setup

The DS125BR111EVM – SMA evaluation kit can be used in three different modes:

1. **Pin Control** (provides access to selected signal integrity settings)
2. **SMBus Mode** (full access to signal integrity and control settings)
3. **EEPROM Mode** (full access to signal integrity and control settings)

The EEPROM mode is a convenient method of programming one or more DS125BRxxx devices on system power-up when a SMBus master (microcontroller or similar) is unavailable in the design. It is recommended to use a 1 MHz capable EEPROM. The EEPROM must be 8-kbits or smaller.

6.1 DS125BR111 Pin Control

Uses the external control pins on the DS125BR111 to configure the signal integrity and control settings of the device. Due to the limited number of control pins, a limited bandwidth 4-level input scheme has been implemented across the control pin interface. This allows for improved EQ and VOD control with fewer physical pins.

The 4 levels are defined as:

1. **Low:** 1 K Ω to GND
2. **Resistor:** 20 K Ω to GND
3. **Float:** No External Connection
4. **High:** 1 K Ω to VDD

The EVM interfaces to this 4-level IO using the setup below. Only one shunt connection is required to access any of the 4 levels. This methodology minimizes the risk of improper connections that could damage the board or board power supply.

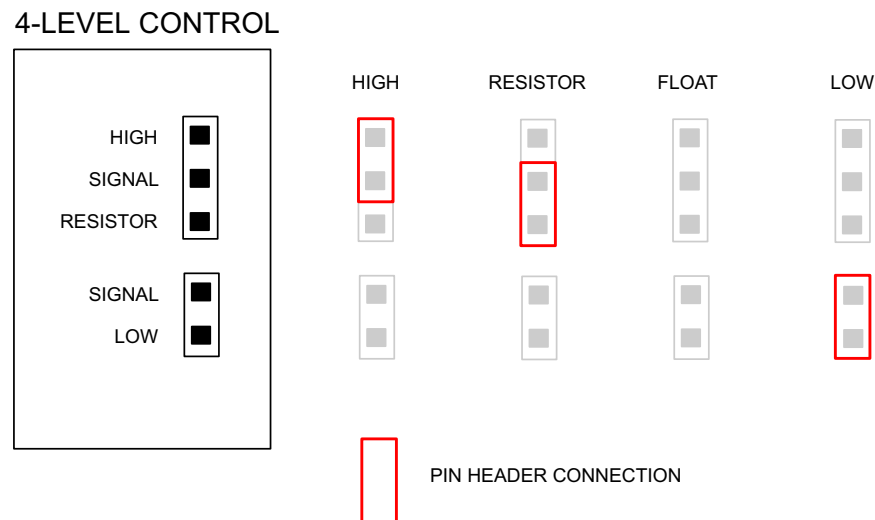


Figure 2. 4-Level IO Control on EVM

The DS125BR111EVM is quickly setup for use in pin control configuration. Jumpers listed below should be installed on the EVM for pin control.

1. J4 – 3.3 V operation: Use the J1 and J3 connectors to supply 3.3 V power to the EVM. The EVM power connections are designed to accommodate 1287-ST quick connect tabs or directly soldered to power leads for connection to a lab power supply.
2. J18 – PWDN = LOW: Device is enabled.
3. J19 – ENSMB = LOW: PIN CONTROL configuration mode.
4. J22 – VDD_SEL = LOW: Uses DS125BR111 internal regulator to convert 3.3 V supply to proper internal supply level of 2.5 V. Note: The 2.5 V level may be observed on the device VDD pins or the J2 connector.
5. VOD_SEL = 1: Recommended output amplitude settings for CH A and CH B in SAS/SATA and PCIe applications.

6.2 SMBus Mode

The SMBus can also be used to control the DS125BR111 devices. This method has the advantage of independent control and finer signal conditioning granularity.

Table 2. Typical DS125BR111 Register Writes

| Register Address | Function | Description |
|------------------|------------|--|
| Register 0x0F | CHA EQ | Write EQ setting 03'h |
| Register 0x11 | CHA VOD_DB | Write VOD_DB setting for bits [2:0] = 000'b |
| Register 0x23 | CHA VOD | Write VOD setting for bits [4:2] = 111'b |
| Register 0x06 | CRC DIS | Write bit [3] = 1'b send register updates directly to channel without any CRC check. |

6.3 EEPROM Mode

A serial EEPROM may also be used to configure one or more DS125BR111 devices. This configuration mode is accessed by setting the ENSMB 4-level input to FLOAT. For additional information please see the device datasheet.

7 Expected Results

This evaluation board has been designed to evaluate the cable and/or FR4 signal conditioning performance of the DS125BR111. Adding additional cables or adaptor boards into the signal path will have some impact on the optimal settings, but keeping the adaptor boards small and using short high-quality SMA cables will minimize this effect.

7.1 Performance

When used in a PCIe or SAS system, it is generally expected that the DS125BR111 will be receiving a signal with embedded TX FIR information. The DS125BR111 works to extend the reach possible by adding active linear equalization to the channel, boosting attenuated signals so that they can be more easily recovered at the SAS-3 Rx. The outputs are specially designed to be transparent to TX FIR signaling passing this information critical for optimal link training to the SAS-3 Rx. The typical device settings used in most SAS-3 environments are EQ = Level 4, VOD_DB = 0 and VOD_SEL = 1 in Pin mode or EQ = 03'h, VOD = 111'b, and VOD_DB = 000'b in SMBus mode.

SETUP1: PRBS7 Generator (no TX FIR) → 10" FR4 → DS125BR111EVM → Scope

DS125BR111 Settings

1. VOD_SEL = 1
2. VOD_DB = 0
3. EQ0 = 1

Additional documentation and device performance is available in the device datasheet.

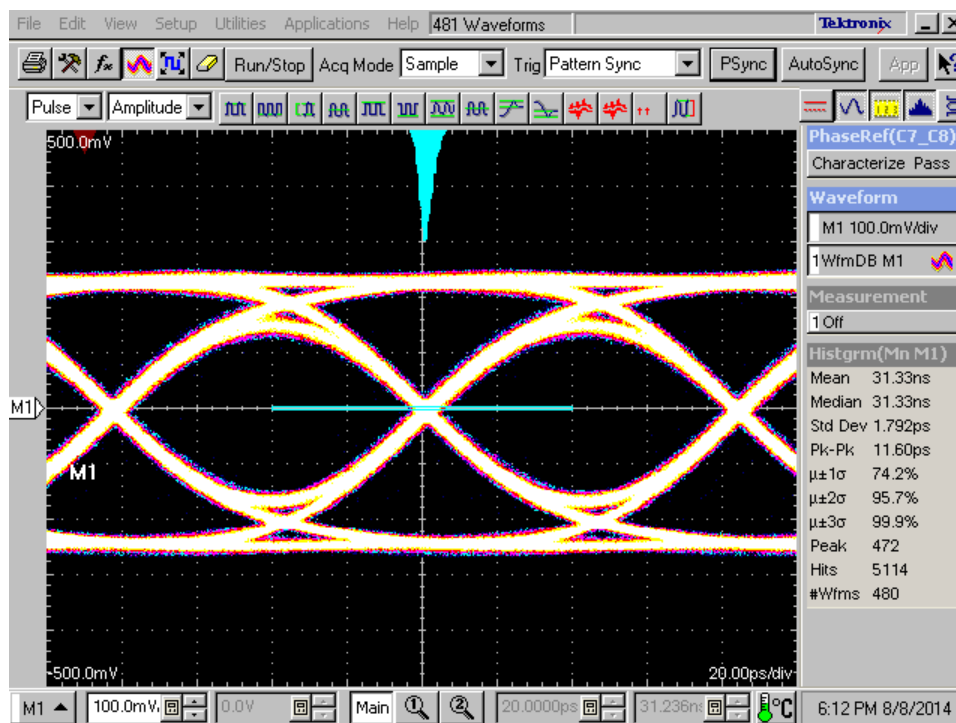


Figure 3. 12 Gbps Eye Diagram at SCOPE in SETUP1

8 Schematic

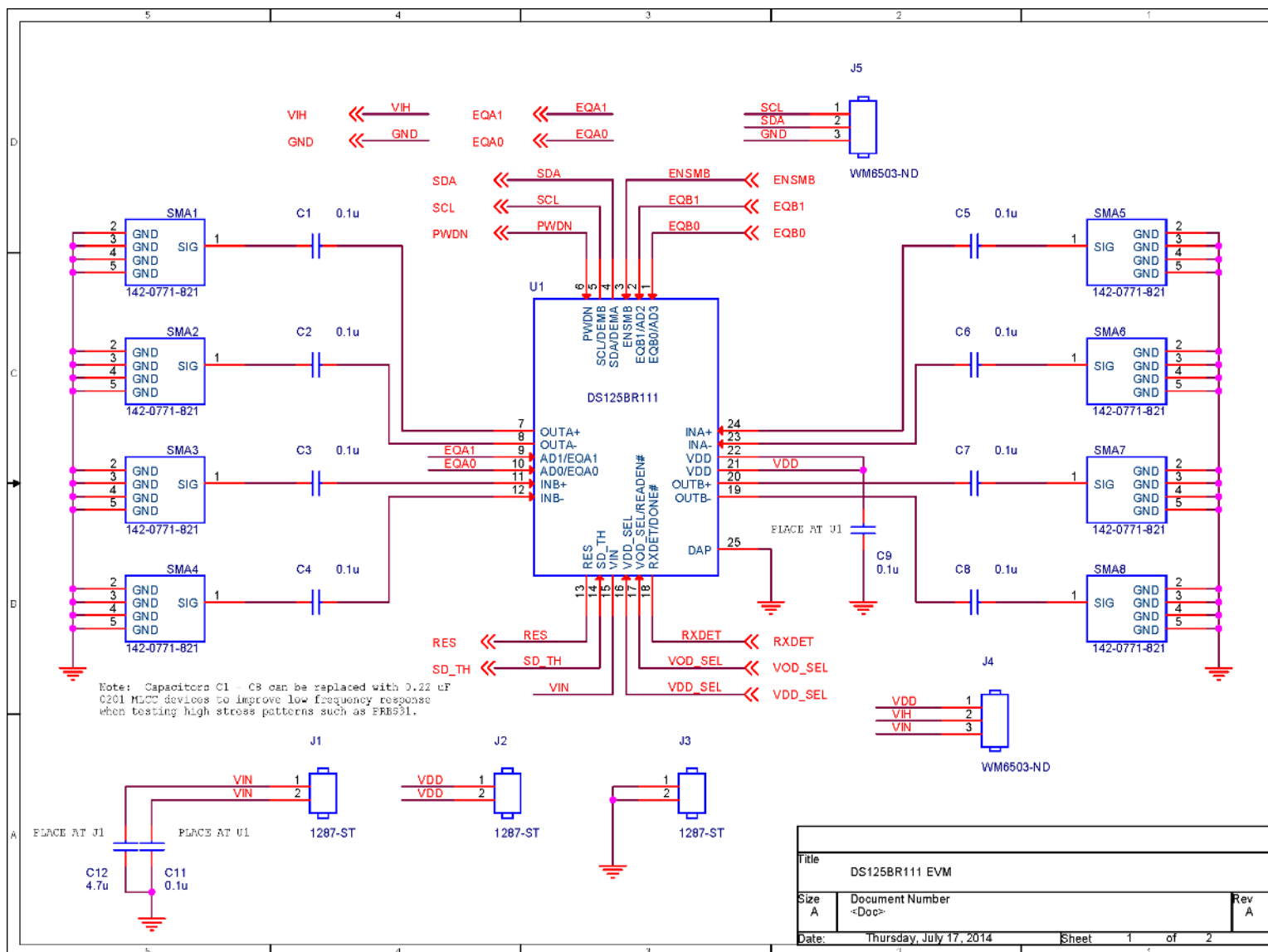


Figure 4. DS125BR111EVM Schematic

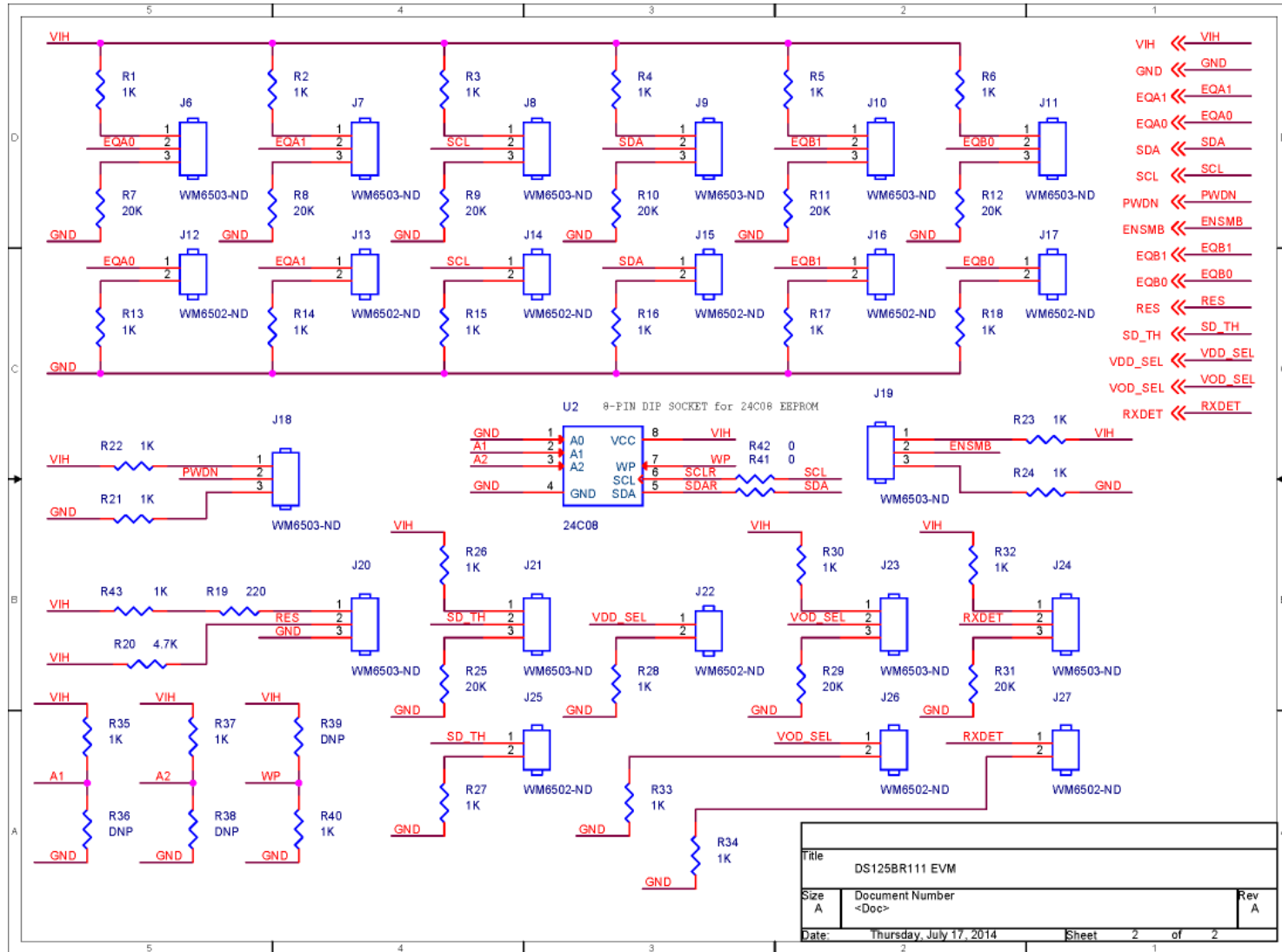


Figure 5. DS125BR111EVM Schematic

9 Bill of Materials

| Item | Quantity | Reference | Digikey PN | Manufacture PN | Descriptions |
|------|----------|---|----------------|--------------------------|---------------------------------|
| 1 | 1 | PCB | | SV601075 | DS125BR111EVM PCB ASSY |
| 2 | 10 | C1, C2, C3, C4, C5, C6, C7, C8, C9, C11 | 445-1796-1-ND | C0603X5R0J104K | CAP CERAMIC .1UF 6.3 V X5R 0201 |
| 3 | 1 | C12 | 1276-1482-1-ND | CL05A475MP5NRNC | CAP CER 4.7UF 10V 20% X5R 0402 |
| 4 | 10 | SMA1, SMA2, SMA3, SMA4, SMA5, SMA6, SMA7, SMA8, SMA9, SMA10, SMA11, SMA12 | J807-ND | 142-0771-821 | CONN JACK SMA 50 Ω PC MOUNT |
| 5 | 14 | J4, J5, J6, J7, J8, J9, J10, J11, J18, J19, J20, J21, J23, J24 | WM6503-ND | 22-28-4033 | CONN HEADER 3POS .100 VERT GOLD |
| 6 | 10 | J12, J13, J14, J15, J16, J17, J22, J25, J26, J27 | WM6502-ND | 22-28-4023 | CONN HEADER 2POS .100 VERT GOLD |
| 7 | 27 | R1, R2, R3, R4, R5, R6, R13, R14, R15, R16, R17, R18, R21, R22, R23, R24, R26, R27, R28, R30, R32, R33, R34, R35, R37, R40, R43 | P1.0KJCT-ND | ERJ-2GEJ102X | RES 1.0K Ω 1/10W 5% 0402 SMD |
| 8 | 9 | R7,R8,R9, R10,R11,R12, R25, R29,R31 | P20.0KLCT-ND | ERJ-2RKF2002X | RES 20.0K Ω 1/10W 1% 0402 SMD |
| 9 | 1 | R19 | P220JCT-ND | ERJ-2GEJ221X | RES 220 Ω 1/10W 5% 0402 SMD |
| 10 | 1 | R20 | P4.7KJCT-ND | ERJ-2GEJ472X | RES 4.7K Ω 1/10W 5% 0402 SMD |
| 11 | 1 | R41, R42 | P0.0JCT-ND | ERJ-2GE0R00X | RES 0.0 Ω 1/10W 5% 0402 SMD |
| 12 | 1 | U1 | | DS125BR111RTW | IC REPEATER 2CH 24-QFN (4x4mm) |
| 13 | 1 | U2 | ED90197-ND | 115-43-308-41- 001000 | IC SOCKET 8PIN DIP |
| 14 | 12 | J30, J31, J32, J33 J34, J35, J36, J37, J38, J39, J40, J41 | 3M9580-ND | 969102-0000-DA | SHUNT JUMPER .1" BLACK GOLD |
| 15 | 3 | J1, J2, J3 | 1287-STK-ND | 1287-ST | Connector TAB 0.250 Solder |
| 16 | 3 | R36, R38, R39 | DNP | DNP | DNP |

Revision History

Changes from Original (August 2014) to A Revision Page

- Changed EVM Photo..... 4
-

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

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- 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.

Industry Canada Compliance (English)

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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.

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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.

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Concernant les EVMs avec antennes détachables

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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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Products

| | |
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