DS64BR111EVK SMA Evaluation Kit

User's Guide

Literature Number: SNLU181A
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DS64BR111EVK User's Guide SMA Evaluation Kit

The DS64BR111EVK – SMA evaluation kit provides a complete high bandwidth platform to evaluate the SAS/SATA signal conditioning features of the Texas Instruments DS64BR111 Repeater. The DS64BR111EVK can be used for standard compliance testing, performance evaluation, and initial system prototyping. The SMA edge launch connectors used for the DS64BR111EVK 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.

1 Features

- Two Channel Repeater up to 6.4 Gbps Rate
  - DS64BR111: 1x Bidirectional Lane
- Low 65 mW/channel Power Consumption, with Option to Power Down Unused Channels
- Advanced Signal Conditioning Features
  - 4-Stage Equalization
  - Transmit De-Emphasis
  - Transmit VOD Control
  - < 0.2 UI of Residual DJ at 6.4 Gbps
- 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 LLP (4 mm x 4 mm)
- Industrial –40 to 85°C Operating Temperature Range

2 Applications

- High-Speed Active Copper Cable Modules and FR-4 Backplanes in Communication Systems
- FC, SAS, SATA 3/6 Gbps (with OOB detection), Infiniband, CPRI, OBSAI, RXAUI, and many others

3 Demo Kit Contents

- DS64BR111EVK Board

4 Ordering Information

Table 1. DS64BR111EVK Ordering Information

DEVICE	QUANTITY
DS64BR111SQ/NOPB	1000
DS64BR111SQE/NOPB	250
SMA Evaluation Kit: DS64BR111EVK/NOPB	

5 Evaluation Board

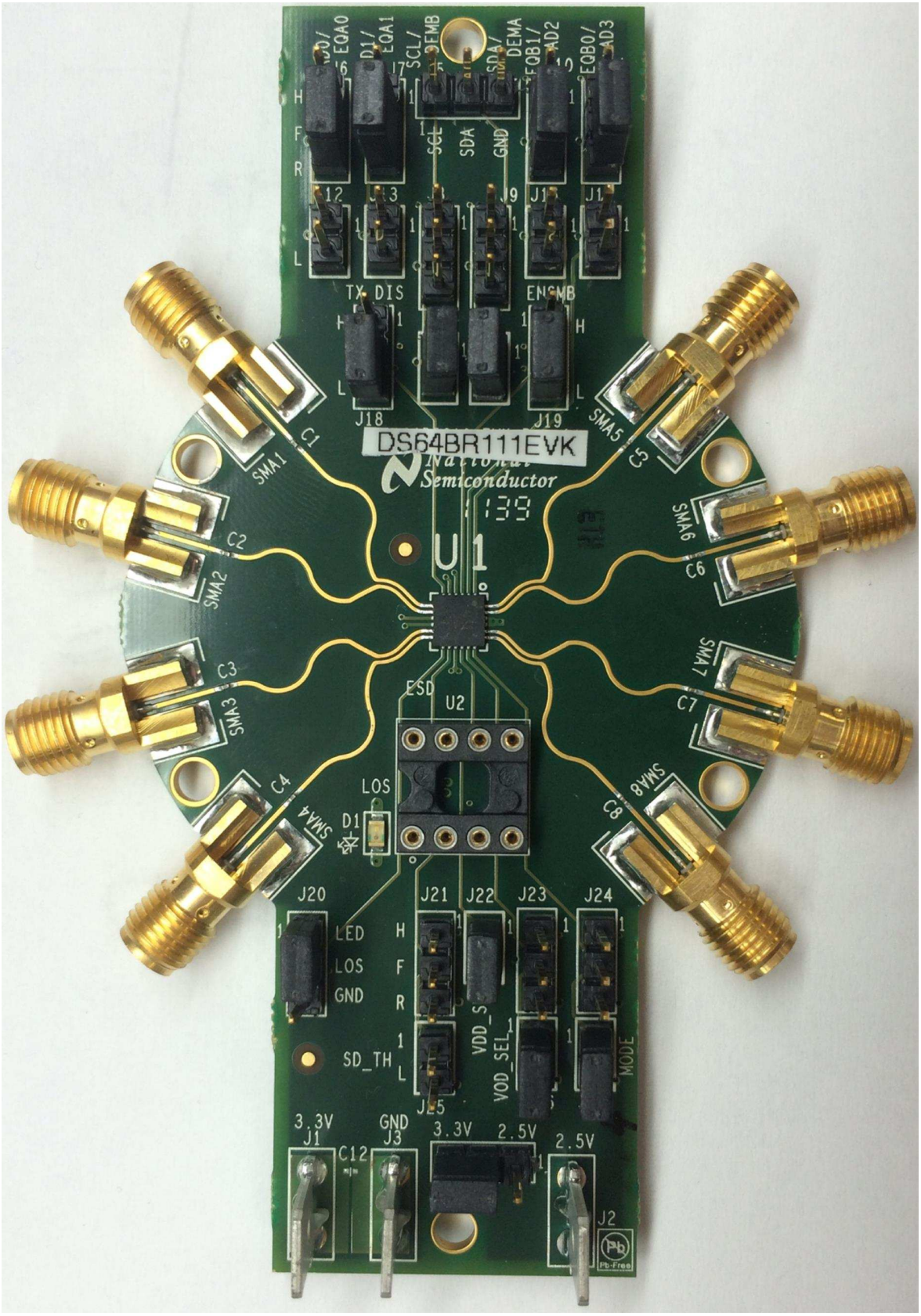

Figure 1. DS64BR111EVK Evaluation Board

6 Setup

The DS64BR111EVK – 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 DS64BR111 devices on system power-up when a SMBus master (microcontroller or similar) is unavailable in the design.

6.1 DS64BR111 Pin Control

Uses the external control pins on the DS64BR111 to configure the signal integrity and control settings of the device. In this mode only a subset of the equalization and de-emphasis levels are available. 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, DE, and VOD control with fewer physical pins.

The 4 levels are defined as:

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

The EVK 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.

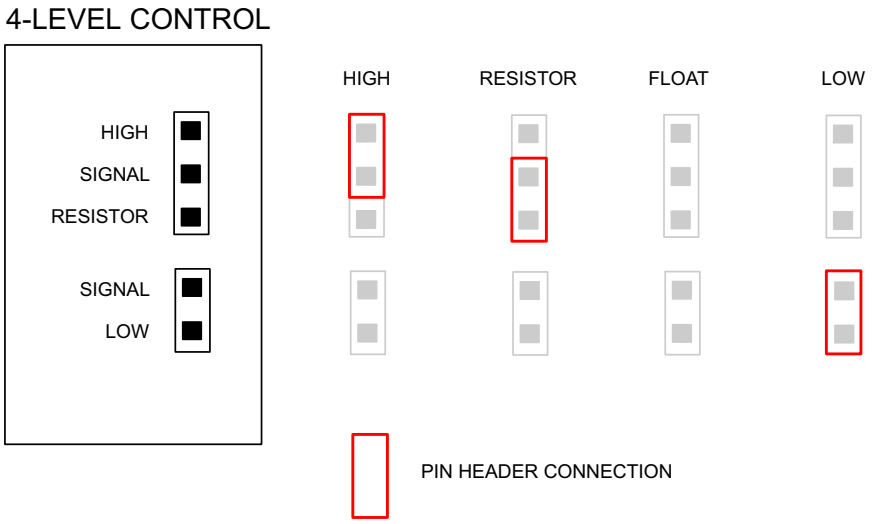

Figure 2. 4-Level IO Control on EVK

The DS64BR111EVK is shipped ready to use in pin control configuration. As delivered, the EVK will have the following installed jumpers.

1. J4 – 3.3-V operation: Use the J1 and J3 connectors to supply 3.3-V power to the EVK.
2. J18 – TX-DIS = LOW: Device is enabled.
3. J19 – ENSMB = LOW: PIN CONTROL configuration mode.
4. J20 – LED – LOS: The LOS output is connected to the onboard LED. The LED will glow green in the presence of a valid signal on CH A input.
5. J22 – VDD_SEL = LOW: Use DS64BR111 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.
6. VOD_SEL = Float: Default output amplitude settings for CH A and CH B.

6.2 SMBus Mode

The SMBus can also be used to control the DS64BR111 devices. This method has the advantage of independent control and finer signal conditioning granularity.

Table 2. Typical DS64BR111 Register Writes

Register Address	Function	Description
Register 0x0F	CHA EQ	Write EQ setting to 1B'h
Register 0x11	CHA DEM	Write DE setting for bits [2:0] = 000'b
Register 0x23	CHA VOD	Write VOD setting for bits [4:2] = 101'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 DS64BR111 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 DS64BR111. 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 full active cable application, it is generally expected that the DS64BR111 driving the cable will use a VOD setting of 1000 mVpp or greater and no output De-Emphasis (DE). The DS64BR111 receiving the signal will utilize a Continuous Time Linear Equalizer (CTLE) to recover the attenuated signal and redrive it into the local system.

SETUP: PRBS7 Generator → DS64BR111 (A) → 10-m 30AWG cable → DS64BR111 (B) → Scope

DS64BR111 (A) Transmit Settings

1. Output Voltage Amplitude = 1000 mVpp or greater
2. De-Emphasis = 0 dB
3. EQ = 00'h (Minimal EQ)

DS64BR111 (B) Receive Settings

1. Output Voltage Amplitude = 700 mVpp or greater
2. De-Emphasis = 0 dB
3. EQ = 2F'h (Default)

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

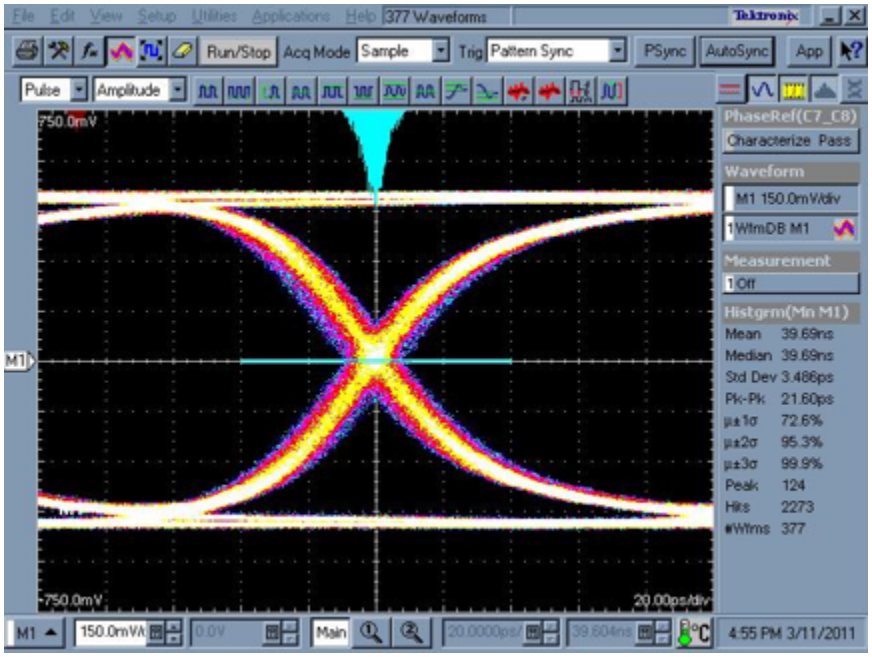

Figure 3. 6 Gbps Eye Diagram at SCOPE in SETUP

8 Schematic

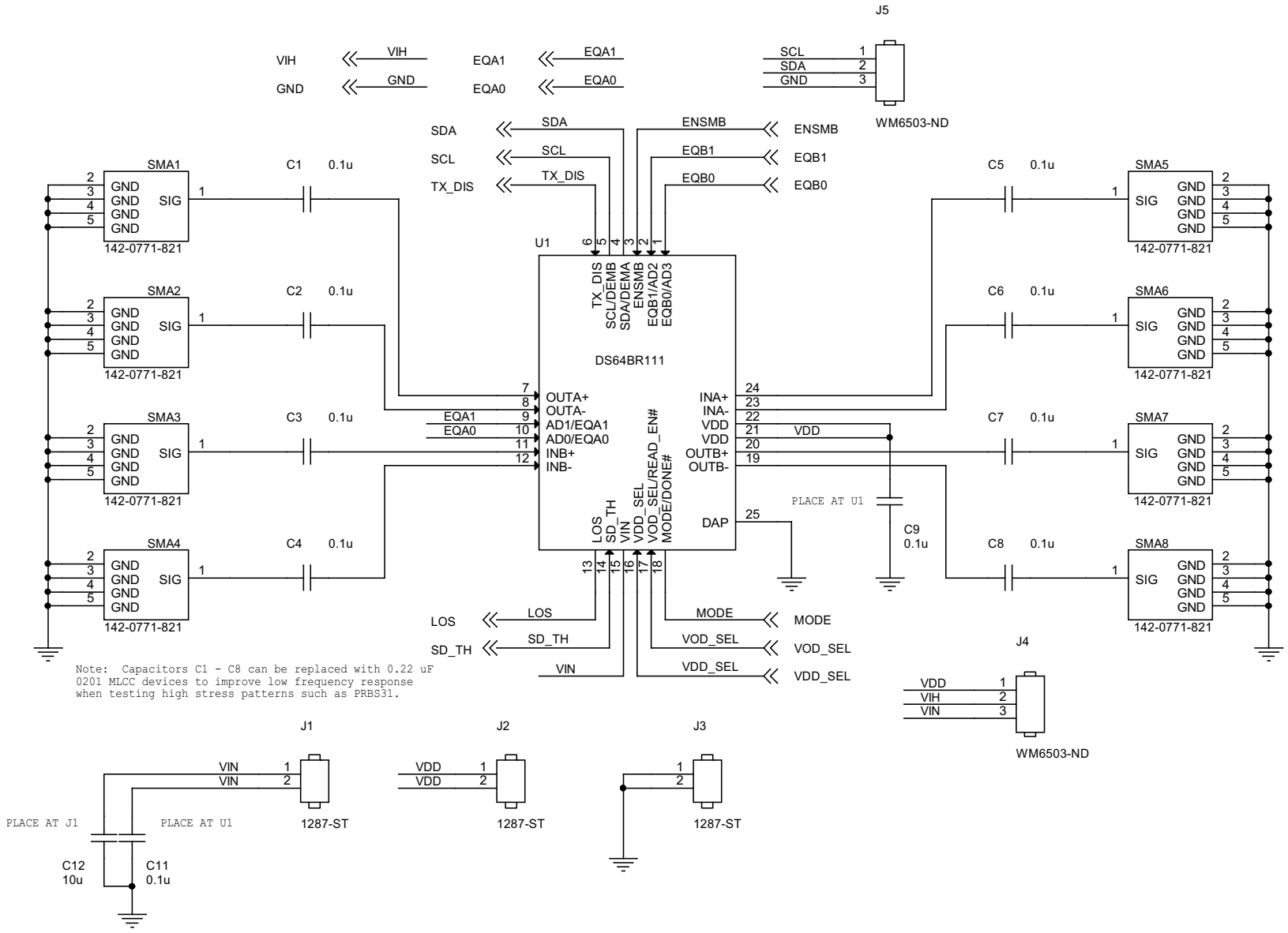

Figure 4. DS64BR111EVK Schematic

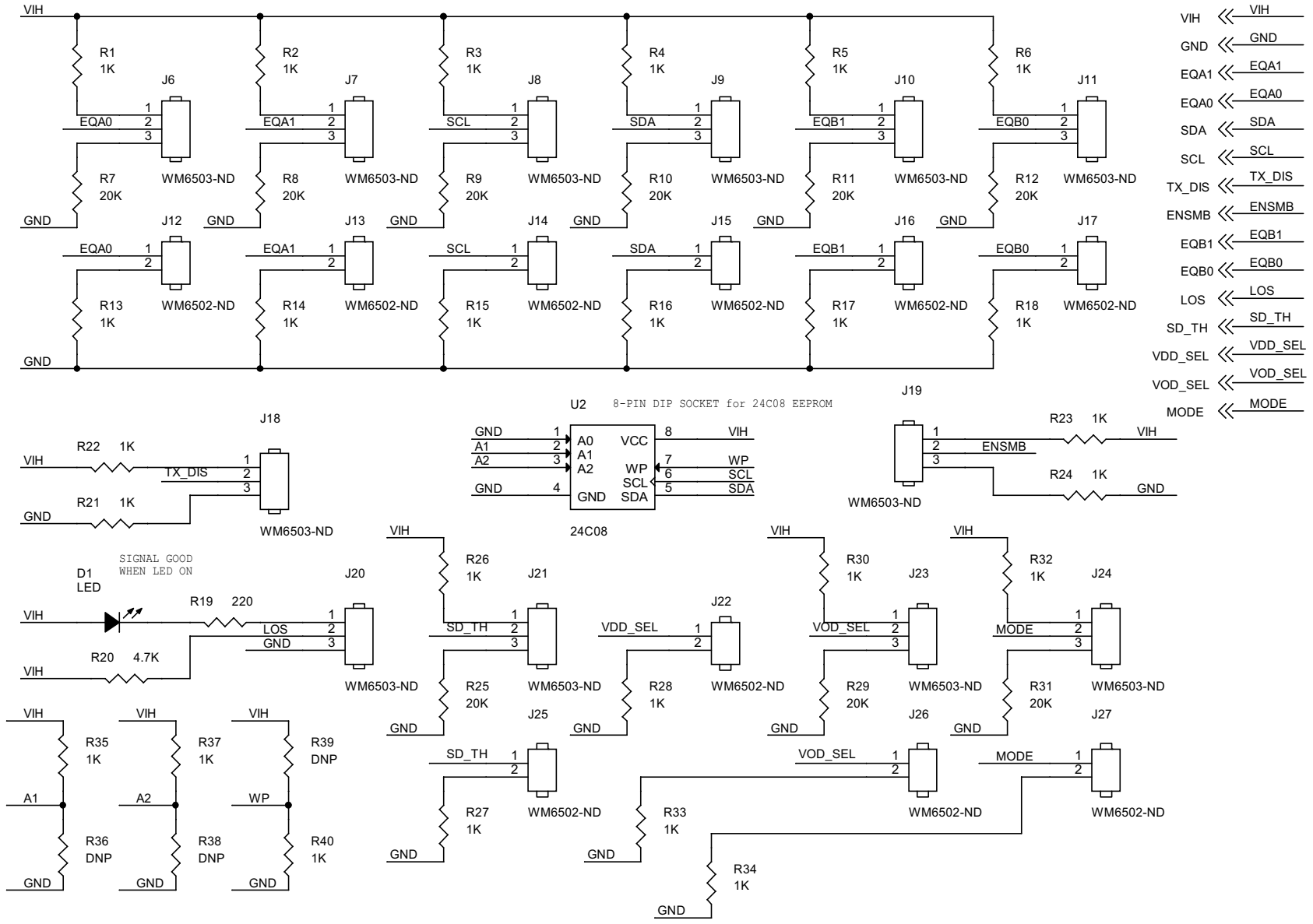

Figure 5. DS64BR111EVK Schematic

9 Bill of Materials

Item	Quantity	Reference	Digikey PN	Manufacture PN	Description
1	10	C1,C2,C3,C4,C5, C6,C7, C8,C9,C11	445-1796-1-ND	C0603X5R0J104K	CAP CERAMIC .1UF 6.3 V X5R 0201
2	1	C12	511-1502-1-ND	TCTAL1C226M8R	CAP TANT 22UF 16 V 20% SMD 1206
3	1	D1	160-1409-1-ND	LTST-C139KGKT	LED GREEN 0603 SMD
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	26	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	RHM1.0KJCT-ND	MCR01MZPJ102	RES 1.0K Ω 1/16W 5% 0402 SMD
8	9	R7,R8,R9, R10,R11,R12, R25, R29,R31	RHM20.0KLCT-ND	MCR01MZPF2002	RES 20.0K Ω 1/16W 1% 0402 SMD
9	1	R19	RHM220JCT-ND	MCR01MZPJ221	RES 220 Ω 1/16W 5% 0402 SMD
10	1	R20	RHM4.7KJCT-ND	MCR01MZPJ472	RES 4.7K Ω 1/16W 5% 0402 SMD
11	1	R41,R42	RHM0.0JCT-ND	MCR01MZPJ472	RES 0.0 Ω 1/16W 5% 0402 SMD
12	1	U1	NA	Texas Instruments	DS64BR111SQ/NOPB (24LLP - 4x4mm)
13	1	U2	ED90197-ND	115-43-308-41-001000	IC SOCKET 8PIN DIP
14	3	R36,R38,R39	DNP	DNP	DNP

Revision History

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

Changes from Original (August 2015) to A Revision	Page
• Changed voltage amplitude units to clarify mVpp instead of mV	8
• Changed DS64BR111EVK schematic to correct INA and OUTA pin locations	9

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

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      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

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FCC Interference Statement for Class B EVM devices

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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.*

3.2 *Canada*

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

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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

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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
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