

## HXC44400

Quad Channel 56G CDR/Retimer

The HXC44400 is a uni-directional quad-channel PAM4 CDR/retimer. The chip can support both data rates of 56Gbps PAM4 and 28Gbps NRZ. The HXC44400 can be used in 200G QSFP56 and 400G QSFP-DD modules. The chip is optimized for Ethernet applications. It is in full compliance with OIF CEI-56G-VSR. The power consumption is typically 380mW per channel.

The HXC44400 has built-in programmable and adaptive equalization in both the receiver and transmitter paths to compensate for transmission line losses and inter-symbol interference.

Auto DC-offset calibration is implemented with auto phase calibration and the unique CDR/retimer architecture enables independent receive and transmit CDR loop bandwidth optimization for increased Jitter tolerance and reduced Jitter transfer performance.

The device has a built-in, single 14GHz master voltage-controlled oscillator (VCO) providing the oscillator output for each channel. In addition, the self-test functions such as a PRBS generator/checker, jitter tolerance (JTOL), and eye-opening monitor (EOM) provide users with module-level diagnostics and function tests.

The HXC44400 also integrates a microcontroller unit (MCU) for programmable control, which could reduce BOM cost and enable better module design. The I2C interface is used to control the built-in MCU.

### Features

- Quad CDR/retimer for transmitter or receiver channels
- Supports 56Gbps PAM4 and 28Gbps NRZ
- 750mVpp typical output swing with 7-bit resolution for output amplitude control
- Auto-adaptive CTLE and DFE in input receiver equalization
- Programmable 3-tap de-emphasis at the output transmitter
- Linearity compensation for the output through a look-up table
- Independent, adaptive bandwidth control in RX CDR for optimum jitter tolerance
- Internal and automatic DC and phase offset calibrations
- Reference-less and reference clock operation
- On-chip testability: EOM, JTOL, PRBS generator/checker, user-defined pattern generator
- Embedded CPU with RAM/ROM and downloadable firmware
- I2C control interface (16-bit address and data): standard and fast modes
- CEI-56G-VSR-PAM4 compliance

### Applications

- 200G QSFP-based Ethernet Transceivers and Active optical cables (AOCs)
- 4 x 50G PAM4 Ethernet CDR/Retimer

### Ordering Information

Part Number	Package	Temperature
HXC44400-BFI	4.8 x 4 mm 81-FCCSP 11 x 9 grid, 0.4mm pitch	-40°C to +85°
HXC44400-EVB	Evaluation Board	Room Temperature

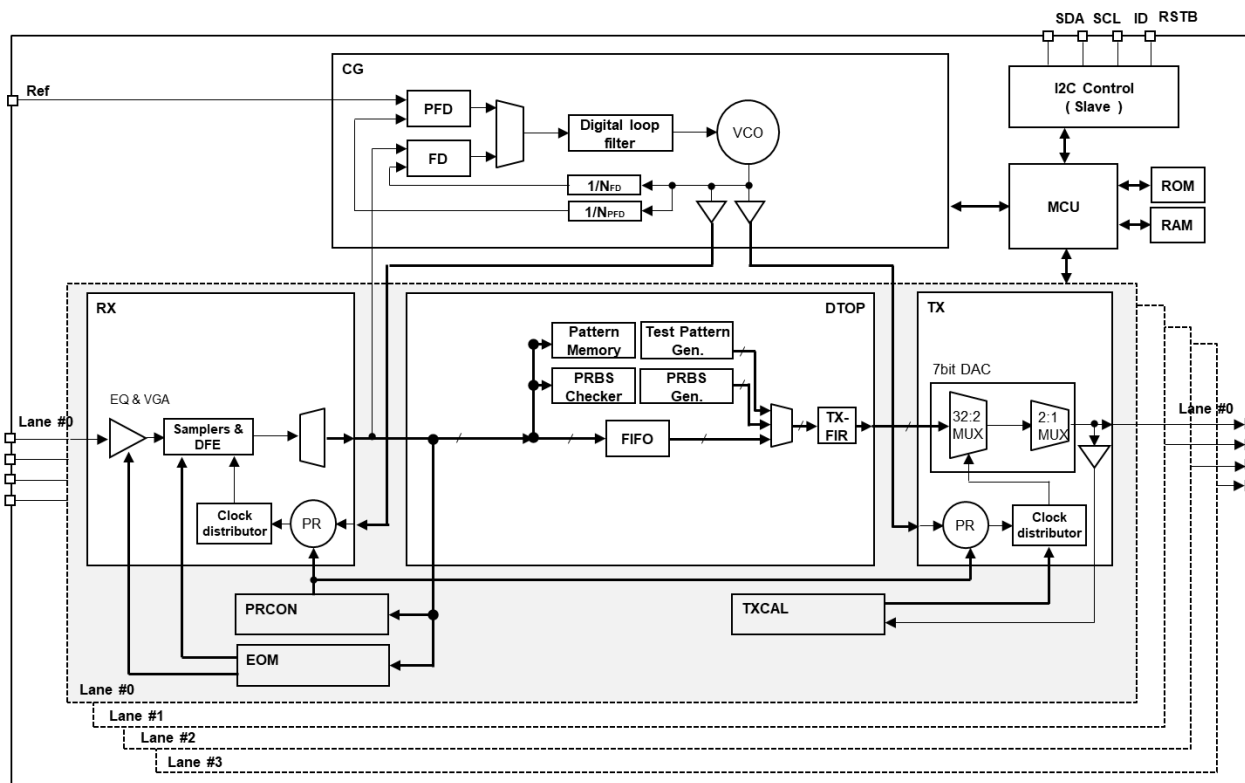


Figure 1. Block Diagram

## IMPORTANT NOTICE AND DISCLAIMER

RENESAS ELECTRONICS CORPORATION AND ITS SUBSIDIARIES (“RENESAS”) PROVIDES TECHNICAL SPECIFICATIONS AND RELIABILITY DATA (INCLUDING DATASHEETS), DESIGN RESOURCES (INCLUDING REFERENCE DESIGNS), APPLICATION OR OTHER DESIGN ADVICE, WEB TOOLS, SAFETY INFORMATION, AND OTHER RESOURCES “AS IS” AND WITH ALL FAULTS, AND DISCLAIMS ALL WARRANTIES, EXPRESS OR IMPLIED, INCLUDING, WITHOUT LIMITATION, ANY IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE, OR NON-INFRINGEMENT OF THIRD PARTY INTELLECTUAL PROPERTY RIGHTS.

These resources are intended for developers skilled in the art designing with Renesas products. You are solely responsible for (1) selecting the appropriate products for your application, (2) designing, validating, and testing your application, and (3) ensuring your application meets applicable standards, and any other safety, security, or other requirements. These resources are subject to change without notice. Renesas grants you permission to use these resources only for development of an application that uses Renesas products. Other reproduction or use of these resources is strictly prohibited. No license is granted to any other Renesas intellectual property or to any third party intellectual property. Renesas disclaims responsibility for, and you will fully indemnify Renesas and its representatives against, any claims, damages, costs, losses, or liabilities arising out of your use of these resources. Renesas' products are provided only subject to Renesas' Terms and Conditions of Sale or other applicable terms agreed to in writing. No use of any Renesas resources expands or otherwise alters any applicable warranties or warranty disclaimers for these products.

(Rev.1.0 Mar 2020)

### Corporate Headquarters

TOYOSU FORESIA, 3-2-24 Toyosu,  
Koto-ku, Tokyo 135-0061, Japan  
[www.renesas.com](http://www.renesas.com)

### Contact Information

For further information on a product, technology, the most up-to-date version of a document, or your nearest sales office, please visit:  
[www.renesas.com/contact/](http://www.renesas.com/contact/)

### Trademarks

Renesas and the Renesas logo are trademarks of Renesas Electronics Corporation. All trademarks and registered trademarks are the property of their respective owners.

## IMPORTANT NOTICE AND DISCLAIMER

RENESAS ELECTRONICS CORPORATION AND ITS SUBSIDIARIES (“RENESAS”) PROVIDES TECHNICAL SPECIFICATIONS AND RELIABILITY DATA (INCLUDING DATASHEETS), DESIGN RESOURCES (INCLUDING REFERENCE DESIGNS), APPLICATION OR OTHER DESIGN ADVICE, WEB TOOLS, SAFETY INFORMATION, AND OTHER RESOURCES “AS IS” AND WITH ALL FAULTS, AND DISCLAIMS ALL WARRANTIES, EXPRESS OR IMPLIED, INCLUDING, WITHOUT LIMITATION, ANY IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE, OR NON-INFRINGEMENT OF THIRD PARTY INTELLECTUAL PROPERTY RIGHTS.

These resources are intended for developers skilled in the art designing with Renesas products. You are solely responsible for (1) selecting the appropriate products for your application, (2) designing, validating, and testing your application, and (3) ensuring your application meets applicable standards, and any other safety, security, or other requirements. These resources are subject to change without notice. Renesas grants you permission to use these resources only for development of an application that uses Renesas products. Other reproduction or use of these resources is strictly prohibited. No license is granted to any other Renesas intellectual property or to any third party intellectual property. Renesas disclaims responsibility for, and you will fully indemnify Renesas and its representatives against, any claims, damages, costs, losses, or liabilities arising out of your use of these resources. Renesas' products are provided only subject to Renesas' Terms and Conditions of Sale or other applicable terms agreed to in writing. No use of any Renesas resources expands or otherwise alters any applicable warranties or warranty disclaimers for these products.

(Rev.1.0 Mar 2020)

### Corporate Headquarters

TOYOSU FORESIA, 3-2-24 Toyosu,  
Koto-ku, Tokyo 135-0061, Japan  
[www.renesas.com](http://www.renesas.com)

### Contact Information

For further information on a product, technology, the most up-to-date version of a document, or your nearest sales office, please visit:  
[www.renesas.com/contact/](http://www.renesas.com/contact/)

### Trademarks

Renesas and the Renesas logo are trademarks of Renesas Electronics Corporation. All trademarks and registered trademarks are the property of their respective owners.