

## APPLICATION NOTE 391

# NRZ Applications

*Abstract: This application note covers how to decouple a framer from the line interface unit (LIU) so that the user can connect the LIU/framer to a Bipolar or NRZ mode device.*

This application note applies to following single-chip transceivers: (T1) DS21352, DS21552, DS21Q352, and DS21Q552; (E1) DS21354, DS21554, DS21Q354, and DS21Q554; and (combination) DS2155, DS2156, DS21Q55, and DS21Q56.

## Overview

The line interface unit (LIU) can be completely decoupled from the framer/formatter to interface to optical, HDSL, or other devices with an NRZ interface. It can then be used to corrupt data, insert framing errors, or insert CRC errors, etc.

The framer/formatter can generate/detect either bipolar or NRZ data format (determined by the ODF bit). **Table 1** shows the register settings for the output data format. **Figures 1** and **2** show how to interface the framer/formatter to devices with bipolar or NRZ data modes.

When the LIU receive side is interfaced to a device with NRZ data format, an OR-gate must be added to convert the bipolar data format into NRZ. See **Figures 3** and **4** for both data mode applications.

### Table 1. Output data format (ODF) register settings

#### DS21352/552/Q352/Q552

CCR1: Common Control Register 1 (Address = 37 Hex)

TESE	ODF	RSOA	TSCLKM	RSCLKM	RESE	PLB	FLB	FUNCTION
X	0	X	X	X	X	X	X	Bipolar data
X	1	X	X	X	X	X	X	NRZ data

#### DS21354/554/Q354/Q554

TCR1: Transmit Control Register 1 (Address = 12 Hex)

ODF	TFPT	T16S	TUA1	TSiS	TSA1	TSM	TSIO	FUNCTION
0	X	X	X	X	X	X	X	Bipolar data
1	X	X	X	X	X	X	X	NRZ data

#### DS2155/56/Q55/Q56

IOCR1: I/O Configuration Register 1 (Address = 01 Hex)

RSMS	RSMS2	RSMS1	RSIO	TSDW	TSM	TSIO	ODF	FUNCTION
X	X	X	X	X	X	X	0	Bipolar data
X	X	X	X	X	X	X	1	NRZ data

The DS2155/56 provides a software control bit to separate or connect the LIU/framer when the LIUC pin is

hardwired high. If the LIUC pin is connected low, then the LIUC bit has no effect (**Table 2**).

**DS2155/56/Q55/Q56**

**LBCR: Loopback Control Register (Address = 4A Hex)**

--	--	--	LIUC	LLB	RLB	PLB	FLB	FUNCTION
X	X	X	0	X	X	X	0	LIUC control

**Table 2. LIU mux control**

LIUC PIN	LIUC BIT	FUNCTION
0	0	LIU and framer separated
0	1	LIU and framer separated
1	0	LIU and framer connected
1	1	LIU and framer separated

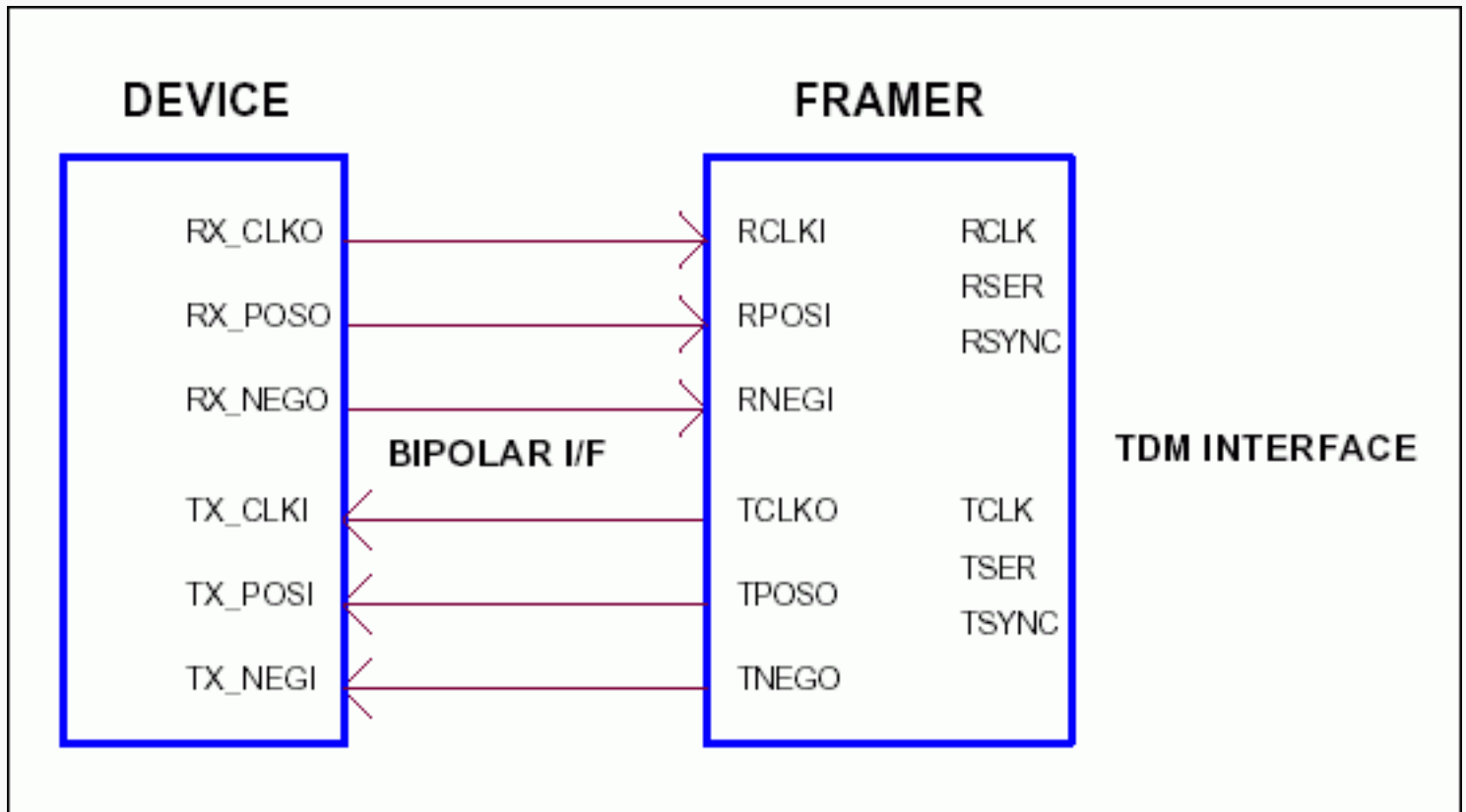


Figure 1. Framer connection to bipolar mode device.

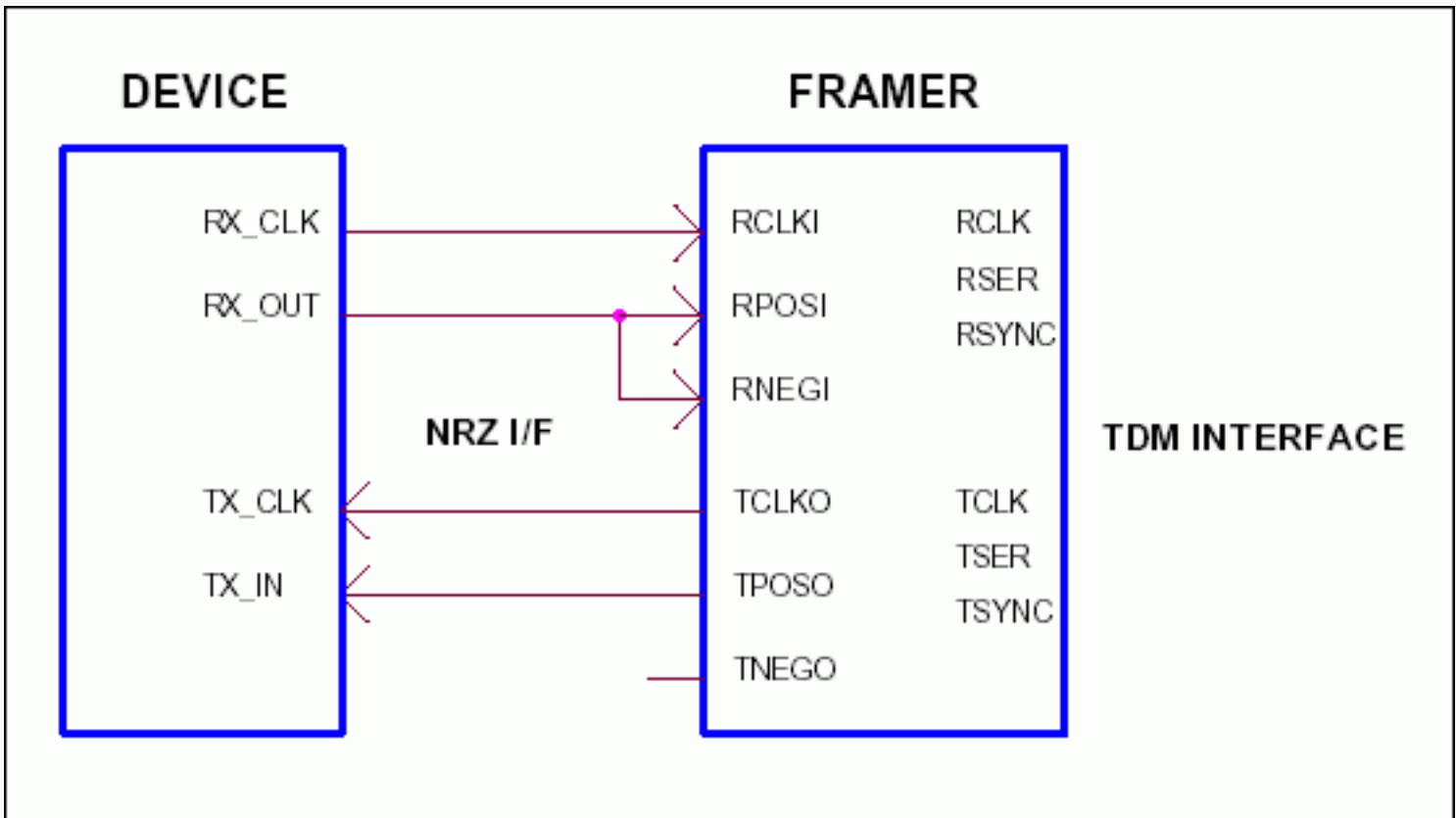


Figure 2. Framer connection to NRZ mode device.

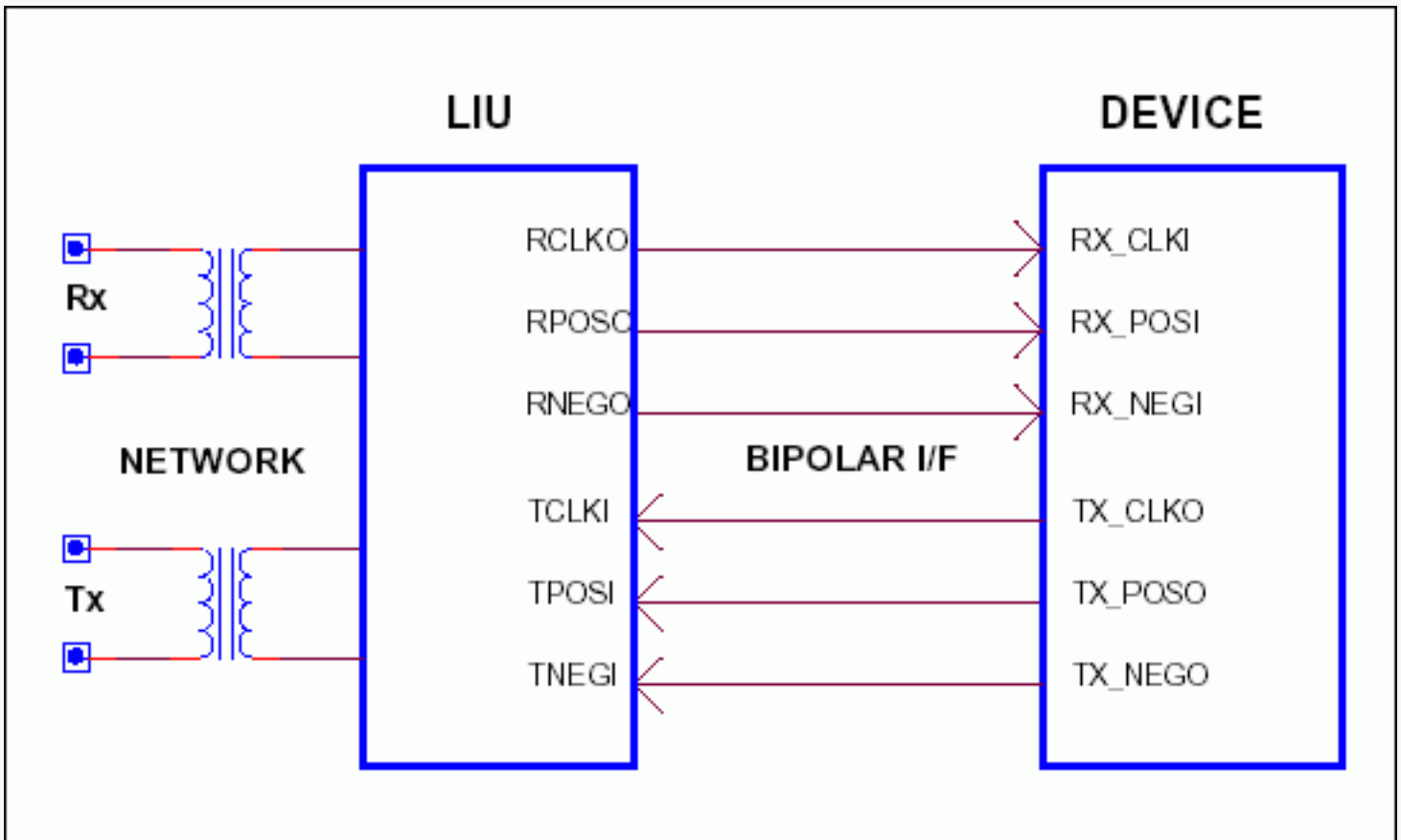


Figure 3. LIU connection to bipolar device.

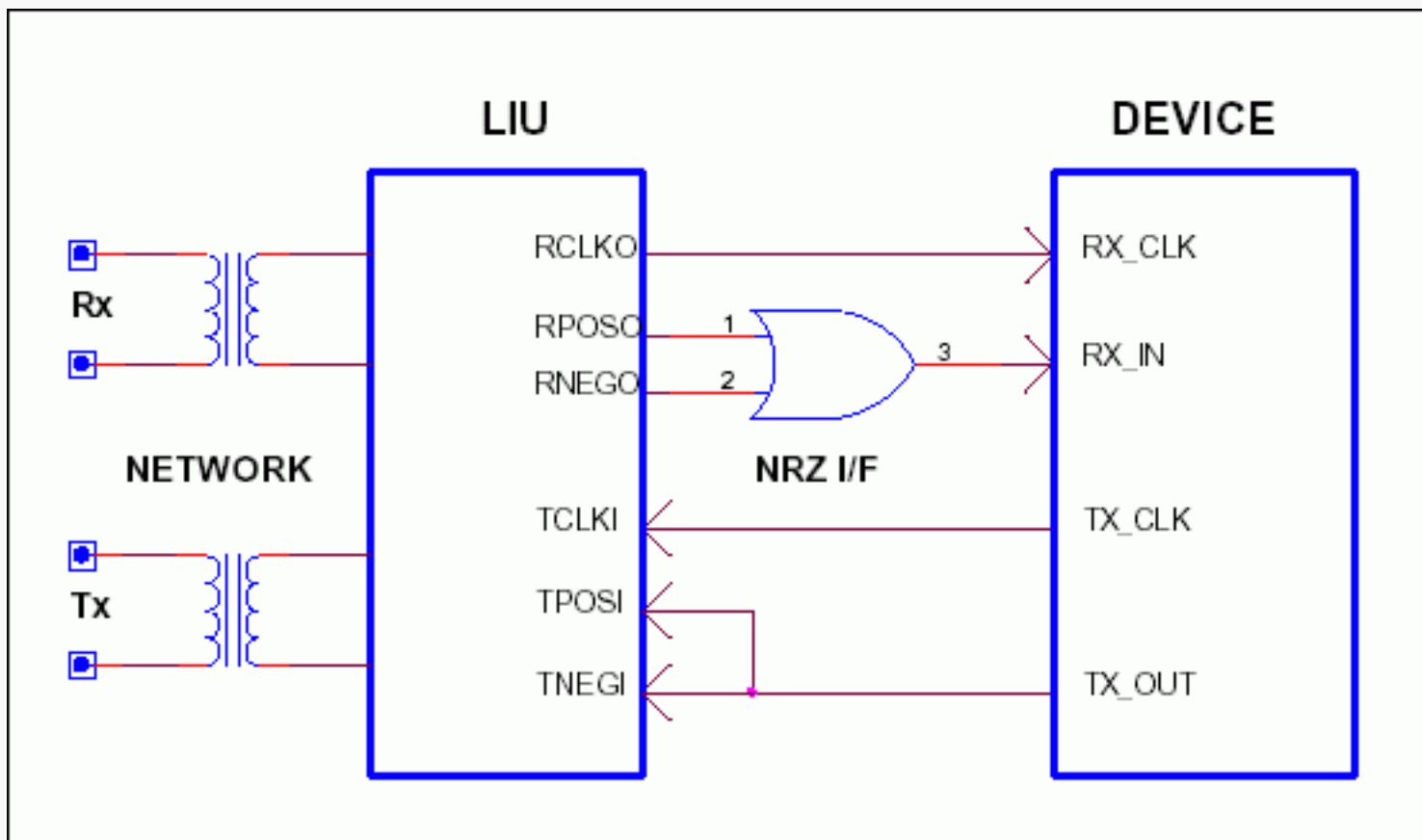


Figure 4. LIU connection to NRZ mode device.

#### Related Parts

- DS21352: [QuickView](#) -- [Full \(PDF\) Data Sheet](#) -- [Free Samples](#)
- DS21354: [QuickView](#) -- [Full \(PDF\) Data Sheet](#) -- [Free Samples](#)
- DS2155: [QuickView](#) -- [Full \(PDF\) Data Sheet](#) -- [Free Samples](#)
- DS21552: [QuickView](#) -- [Full \(PDF\) Data Sheet](#) -- [Free Samples](#)
- DS21554: [QuickView](#) -- [Full \(PDF\) Data Sheet](#) -- [Free Samples](#)
- DS2156: [QuickView](#) -- [Full \(PDF\) Data Sheet](#) -- [Free Samples](#)
- DS21Q352: [QuickView](#) -- [Full \(PDF\) Data Sheet](#) -- [Free Samples](#)
- DS21Q354: [QuickView](#) -- [Full \(PDF\) Data Sheet](#) -- [Free Samples](#)
- DS21Q55: [QuickView](#) -- [Full \(PDF\) Data Sheet](#)
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