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Tel: +86-755-8981 8866 Fax: +86-755-8427 6832
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Address: A1208, Overseas Decoration Building, #122 Zhenhua RD., Futian, Shenzhen, China

XRT73LC04A

4 CHANNEL DS3/E3/STS-1 LINE INTERFACE UNIT

SEPTEMBER 2008 *REV. 1.0.2*

GENERAL DESCRIPTION

The XRT73LC04A, 4-Channel, DS3/E3/STS-1 Line Interface Unit is a low power CMOS version of the XRT73L04A and consists of four independent line transmitters and receivers integrated on a single chip designed for DS3, E3 or SONET STS-1 applications.

Each channel of the XRT73LC04A can be configured to support the E3 (34.368 Mbps), DS3 (44.736 Mbps) or the SONET STS-1 (51.84 Mbps) rates. Each channel can be configured to operate in a mode/data rate that is independent of the other channels.

In the transmit direction, each channel encodes input data to either B3ZS (DS3/STS-1) or HDB3 (E3) format and converts the data into the appropriate pulse shapes for transmission over coaxial cable via a 1:1 transformer.

In the receive direction, the XRT73LC04A performs equalization on incoming signals, performs Clock Recovery, decodes data from either B3ZS or HDB3 format, converts the receive data into TTL/CMOS format, checks for LOS or LOL conditions and detects and declares the occurrence of Line Code Violations.

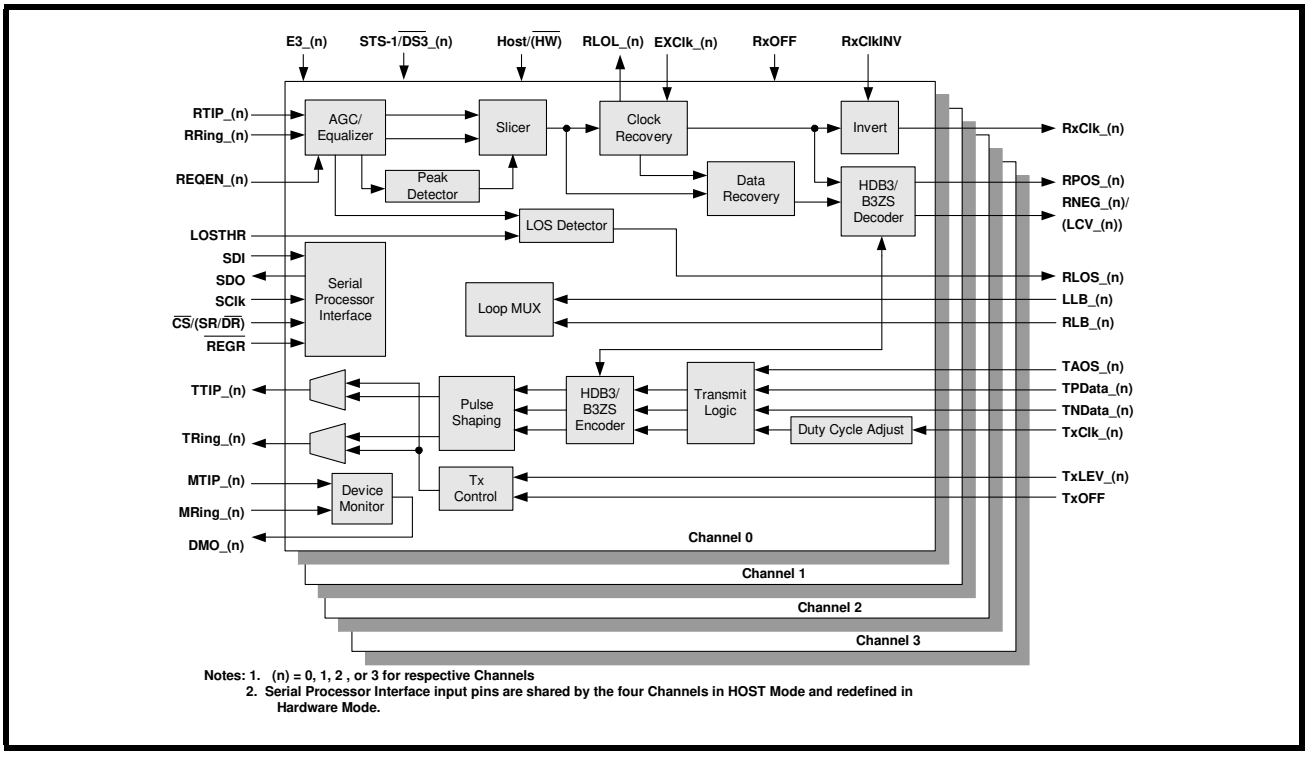
FEATURES

- Incorporates an improved Timing Recovery circuit and is pin and functional compatible to XRT73L04A
- Meets E3/DS3/STS-1 Jitter Tolerance Requirements
- Contains a 4-Wire Microprocessor Serial Interface
- Full Loop-Back Capability
- Transmit and Receive Power Down Modes
- Full Redundancy Support
- Uses Minimum External components
- Single +3.3V Power Supply
- Low Power CMOS design
- 5V tolerant I/O
- -40℃ to +85℃ Operating Temperature Range
- Available in a Thermally Enhanced 144 pin LQFP package

APPLICATIONS

- Digital Cross Connect Systems
- CSU/DSU Equipment
- Routers
- Fiber Optic Terminals
- Multiplexers
- ATM Switches

FIGURE 1. XRT73LC04A BLOCK DIAGRAM



Notes: 1. (n) = 0, 1, 2 , or 3 for respective Channels
2. Serial Processor Interface input pins are shared by the four Channels in HOST Mode and redefined in Hardware Mode.

TYPICAL APPLICATIONS

FIGURE 2. MULTICHANNEL ATM APPLICATION

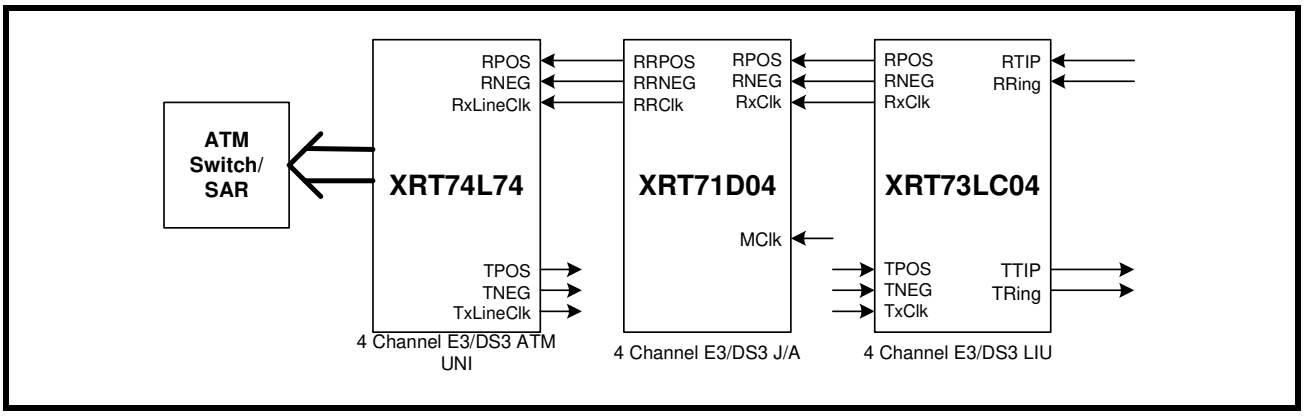
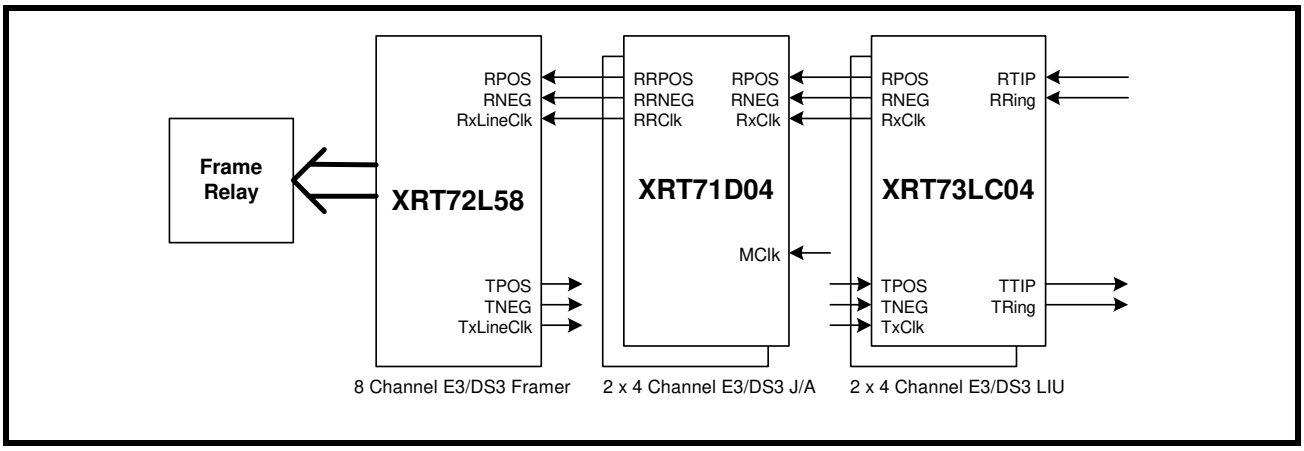


FIGURE 3. MULTISERVICE - FRAME RELAY APPLICATION



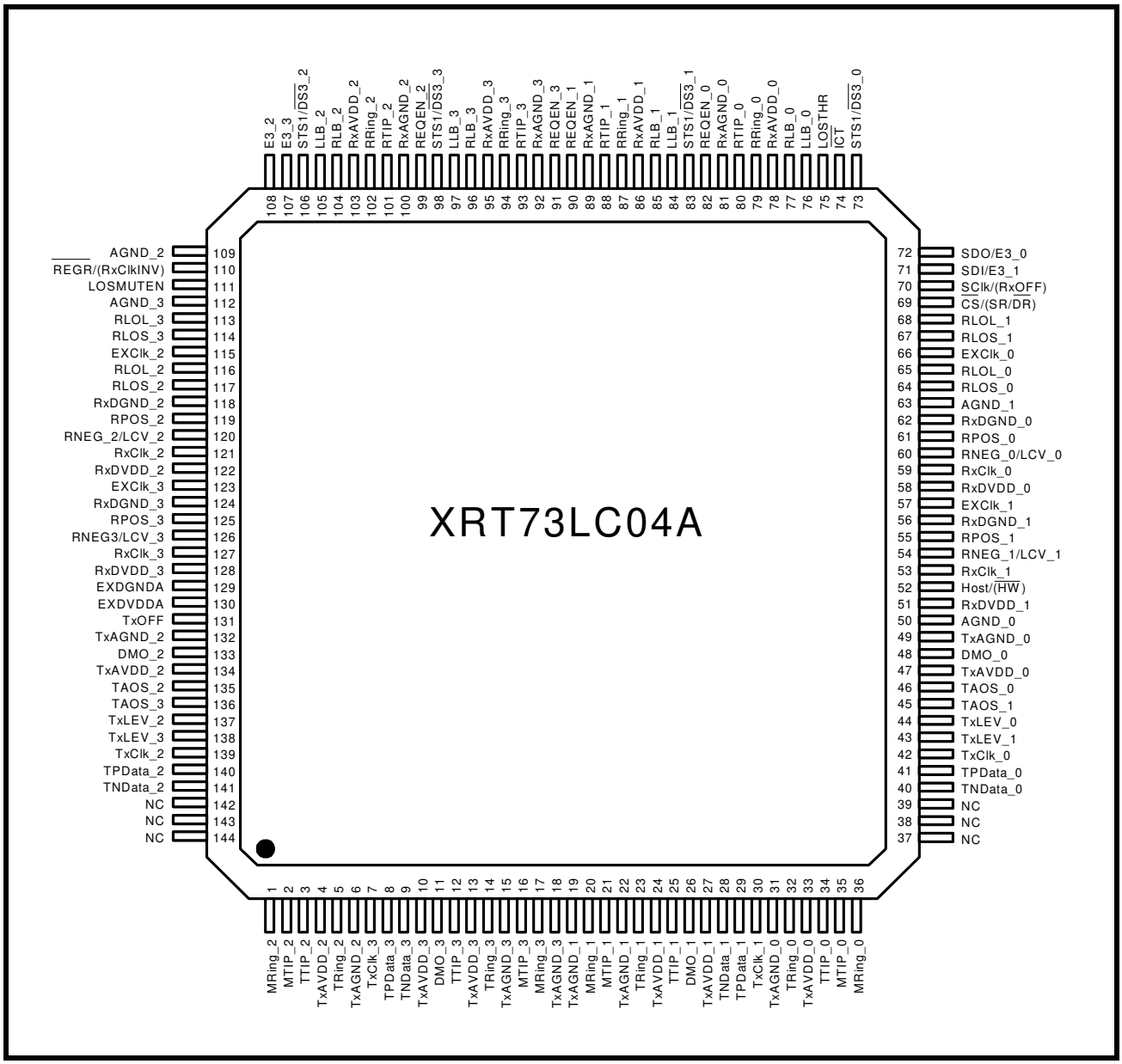
TRANSMIT INTERFACE CHARACTERISTICS:

- Accepts either Single-Rail or Dual-Rail data from Terminal Equipment and generates a bipolar signal from the line
- Integrated Pulse Shaping Circuit
- Built-in B3ZS/HDB3 Encoder (which can be disabled)
- Contains Transmit Clock Duty Cycle Correction Circuit on-chip
- Generates pulses that comply with the ITU-T G.703 pulse template (E3 applications)
- Generates pulses that comply with the DSX-3 pulse template as specified in Bellcore GR-499-CORE and ANSI T1.102_1993
- Generates pulses that comply with the STSX-1 pulse template as specified in Bellcore GR-253-CORE
- Transmitter can be turned off in order to support redundancy designs

RECEIVE INTERFACE CHARACTERISTICS:

- Integrated Adaptive Receive Equalization (optional) and Timing Recovery
- Declares and Clears the LOS defect per ITU-T G.775 requirements (E3 and DS3 applications)
- Meets Jitter Tolerance Requirements as specified in ITU-T G.823_1993 (E3 Applications)
- Meets Jitter Tolerance Requirements as specified in Bellcore GR-499-CORE (DS3 Applications)
- Declares Loss of Signal (LOS) and Loss of Lock (LOL) Alarms
- Built-in B3ZS/HDB3 Decoder (which can be disabled)
- Recovered Data can be muted while the LOS Condition is declared
- Outputs either Single-Rail or Dual-Rail data to the Terminal Equipment
- Receiver can be powered down in order to conserve power in redundancy designs

FIGURE 4. PIN OUT OF THE XRT73LC04A IN THE 144 PIN TQFP PACKAGE



ORDERING INFORMATION

PART #	PACKAGE	OPERATING TEMPERATURE RANGE
XRT73LC04AIV	144 Pin LQFP 20 X 20 X 1.4 mm	-40°C to +85°C

TABLE OF CONTENTS

PIN DESCRIPTIONS (BY FUNCTION)

TRANSMIT INTERFACE

PIN #	NAME	TYPE	DESCRIPTION
34 25 3 12	TTIP_0 TTIP_1 TTIP_2 TTIP_3	O	**Transmit TTIP Output - Channel (n):** The XRT73LC04A uses this pin along with TRing_(n) to transmit a bipolar line signal via a 1:1 transformer.
32 23 5 14	TRing_0 TRing_1 TRing_2 TRing_3	O	**Transmit Ring Output - Channel (n):** The XRT73LC04A uses this pin along with TTIP_(n) to transmit a bipolar line signal via a 1:1 transformer.
42 30 139 7	TxClk_0 TxClk_1 TxClk_2 TxClk_3	I	**Transmit Clock Input for TPData and TNData - Channel (n):** This input pin must be driven at 34.368 MHz (for E3 applications), 44.736 MHz (for DS3 applications), or 51.84 MHz (for SONET STS-1 applications). The XRT73LC04A uses this signal to sample the TPData_(n) and TNData_(n) input pins. By default, the XRT73LC04A is configured to sample these two pins on the falling edge of this signal. ***NOTE:*** *If the XRT73LC04A is operating in the HOST Mode, then the device can be configured to sample the TPData_(n) and TNData_(n) input pins on either the rising or falling edge of TxClk_(n).*
41 29 140 8	TPData_0 TPData_1 TPData_2 TPData_3	I	**Transmit Positive Data Input - Channel (n)**: The XRT73LC04A samples this pin on the falling edge of TxClk_(n). If the device samples a "1", then it generates and transmits a positive polarity pulse to the line. The data should be applied to this input pin if the Transmit Section is configured to accept Single-Rail data from the Terminal Equipment. ***NOTE:*** *If the XRT73LC04A is operating in the HOST Mode, then the XRT73LC04A can be configured to sample the TPData_(n) pin on either the rising or falling edge of TxClk_(n).*
40 28 141 9	TNData_0 TNData_1 TNData_2 TNData_3	I	**Transmit Negative Data Input - Channel (n):** The XRT73LC04A samples this pin on the falling edge of TxClk_(n). If the device samples a "1", then it generates and transmits a negative polarity pulse to the line. In Single-Rail Mode, this pin must be tied to GND to enable the HDB3/B3ZS Encoder and Decoder, (internally pulled-down). In Dual-Rail Mode this input is the N-Rail Data input. ***NOTE:*** *If the XRT73LC04A is operating in the HOST Mode, then the XRT73LC04A can be configured to sample the TNData_(n) pin on either the rising or falling edge of TxClk_(n).*

TRANSMIT INTERFACE

PIN #	NAME	TYPE	DESCRIPTION
44 43 137 138	TxLEV_0 TxLEV_1 TxLEV_2 TxLEV_3	I	**Transmit Line Build-Out Enable/Disable Select - Channel (n):** This input pin permits the Transmit Line Build-Out circuit, within Channel (n), to be enabled or disabled. In E3 mode, this pin has no effect on the transmit pulse shape. Setting this pin to "High" disables the Line Build-Out circuit. In this mode, Channel (n) outputs partially-shaped pulses onto the line via the TTIP_(n) and TRing_(n) output pins. Setting this pin to "Low" enables the Line Build-Out circuit within Channel (n). In this mode, Channel (n) outputs shaped pulses onto the line via the TTIP_(n) and TRing_(n) output pins. To comply with the Isolated DSX-3/STSX-1 Pulse Template Requirements per Bellcore GR-499-CORE or Bellcore GR-253-CORE: 1. Set this input pin to "1" if the cable length between the Cross-Connect and the transmit output of Channel (n) is greater than 225 feet. 2. Set this input pin to "0" if the cable length between the Cross-Connect and the transmit output of Channel (n) is less than 225 feet. This pin is active only if the following two conditions are true: a. The XRT73LC04A is configured to operate in either the DS3 or SONET STS-1 Modes. b. The XRT73LC04A is configured to operate in the Hardware Mode. ***NOTE:*** *This pin to should be tied to GND if the XRT73LC04A is going to be operating in the HOST Mode, (internally pulled-down).*
131	TxOFF	I	**Transmitter OFF Input:** Setting this input pin "High" turns off all of the Transmitter Sections. In this mode the TTIP and TRing outputs are tri-stated. ***NOTES:*** 1. *This input pin controls the TTIP and TRing outputs even when the XRT73LC04A is operating in the HOST Mode.* 2. *For HOST Mode Operation, this pin is tied to GND if the Transmitter is intended to be turned off via the Microprocessor Serial Interface.*

RECEIVE INTERFACE

PIN #	NAME	TYPE	DESCRIPTION
59 53 121 127	RxClk_0 RxClk_1 RxClk_2 RxClk_3	O	**Receive Clock Output - Channel (n):** This output pin is the Recovered Clock signal from the incoming line signal for Channel (n). The Receive Section of Channel (n) outputs data via the RPOS_(n) and RNEG_(n) output pins on the rising edge of this clock signal. Configure the Receive Section of Channel (n) to update the data on the RPOS_(n) and RNEG_(n) output pins on the falling edge of RxClk_(n) by doing one of the following: **a. Operating in the Hardware Mode** Pull the RxClkINV pin to "High". **b. Operating in the HOST Mode** Write a "1" into the RxClkINV bit-field within the Command Register.
60 54 120 126	RNEG_0/LCV_0 RNEG_1/LCV_1 RNEG_2/LCV_2 RNEG_3/LCV_3	O	**Receive Negative Data Output - Channel (n):** The function of this pin is dependent on whether the 73L04A is in the Hardware or HOST Mode (HOST/$\overline{HW}$) and the condition of $\overline{CS}$/(SR/$\overline{DR}$). **a. Operating in the Hardware Mode** **Receive Negative Data:** Setting the $\overline{CS}$/(SR/$\overline{DR}$) pin "Low", (Dual-Rail operation) this output pin pulses "High" whenever Channel (n) has received a Negative Polarity pulse in the incoming line signal at the RTIP_(n) and RRing_(n) inputs. **Line Code Violation:** When $\overline{CS}$/(SR/$\overline{DR}$) is set "High", (Single-Rail operation), the B3ZS/HDB3 Encoder/Decoder is activated and the Line Code Violation signal is output on this pin. **b. Operating in the HOST Mode** **Receive Negative Data:** Writing a "0" to the (SR/$\overline{DR}$)_(n) bit in the command register configures channel(n) in the Dual-Rail Mode and activates RNEG_(n). Writing a "1" to (SR/$\overline{DR}$)_(n) bit of the Command Register configures the Single-Rail Mode and activates LCV_(n). *If the B3ZS/HDB3 Decoder is enabled then the zero suppression patterns in the incoming line signal (such as: "00V", "000V", "B0V", "B00V") is not reflected at this output.*
61 55 119 125	RPOS_0 RPOS_1 RPOS_2 RPOS_3	O	**Receive Positive Data Output - Channel (n):** The function of this pin is dependent on the setting of the $\overline{CS}$/(SR/$\overline{DR}$) pin. **Receive Positive Data** If $\overline{CS}$/(SR/$\overline{DR}$) is set "Low" (Dual-Rail Mode), this output pin pulses "High" whenever Channel (n) has received a Positive Polarity pulse in the incoming line signal at the RTIP_(n)/RRing_(n) inputs. **Data Output** If $\overline{CS}$/(SR/$\overline{DR}$) is set "High" (Single-Rail Mode), data is output on this pin. *If the B3ZS/HDB3 Decoder is enabled then the zero suppression patterns in the incoming line signal (such as: "00V", "000V", "B0V", "B00V") is not reflected at this output.*
79 87 102 94	RRing_0 RRing_1 RRing_2 RRing_3	I	**Receive Ring Input - Channel (n):** This input pin along with RTIP_(n) is used to receive the bipolar line signal from the Remote DS3/E3/STS-1 Terminal.

RECEIVE INTERFACE

PIN #	NAME	TYPE	DESCRIPTION
80 88 101 93	RTIP_0 RTIP_1 RTIP_2 RTIP_3	I	**Receive TIP Input - Channel (n):** This input pin along with RRing_(n) is used to receive the bipolar line signal from the Remote DS3/E3/STS-1 Terminal.
82 90 99 91	REQEN_0 REQEN_1 REQEN_2 REQEN_3	I	**Receive Equalization Enable Input - Channel (n):** Setting this input pin "High" enables the Internal Receive Equalizer within Channel (n). Setting this pin "Low" disables the Internal Receive Equalizer. The guidelines for enabling and disabling the Receive Equalizer are described in Section 3.2. ***NOTE:*** *This pin is ignored and should be tied to GND if the XRT73LC04A is going to be operating in the HOST Mode, (internally pulled-down).*
110	RxClkINV	I	**Invert RxClk_(n) Output - Select:** The function of this pin depends upon the mode of operation. **Hardware Mode - Invert RxClk Output Select:** Setting this input pin "High" configures the Receive Section of all Channels to invert their RxClk_(n) clock output signals. Setting this pin "Low" configures Channel(n) to output the recovered data via the RPOS_(n) and RNEG_(n) output pins on the rising edge of RxClk_(n). Setting this input pin "High" configures Channel (n) to output the recovered data via the RPOS_(n) and RNEG_(n) output pins on the falling edge of RxClk_(n). ***NOTE:*** *This pin is internally pulled "High".*

CLOCK INTERFACE

PIN #	NAME	TYPE	DESCRIPTION
66 57 115 123	EXClk_0 EXClk_1 EXClk_2 EXClk_3	I	**External Reference Clock Input - Channel (n):** Apply a 34.368 MHz clock signal for E3 applications, a 44.736 MHz clock signal for DS3 applications or a 51.84 MHz clock signal for SONET STS-1 applications. The Channel (n) Clock Recovery PLL uses this signal as a Reference Signal for Declaring and Clearing the Receive Loss of Lock Alarm. The Clock recovery PLL also generates the exact clock for the LIU. It is permissible to use the same clock that drives the TxClk_(n) input pin. It is permissible to operate the four Channels at different data rates.

OPERATING MODE SELECT

PIN #	NAME	TYPE	DESCRIPTION
69	SR/$\overline{DR}$/$\overline{CS}$	I	**Microprocessor Serial Interface - Chip Select Input/Encoder-Decoder Disable Input:** The function of this pin depends upon whether the XRT73LC04A is operating in the HOST Mode or in the Hardware Mode. ***NOTE:*** *This pin is internally pulled "High".* **Hardware Mode - Receive Output Single-Rail/Dual-Rail Select:** In Hardware Mode, setting this pin "High" configures each of the four channels to operate in the Single-Rail Mode. When each of the four channels are configured to operate in the Single-Rail Mode, then the Receive Section of each channel will output data via the RPOS_(n) output pin. ***NOTE:*** *Tie the TNData_(n) input to GND to enable HDB3/B3ZS Encoding and Decoding.* Setting this pin "Low" configures each of the four channels to operate in the Dual-Rail Mode. When each of the four channels are configured to operate in the Dual-Rail Mode, then the Receive Section of each channel will output data via both the RPOS_(n) and RNEG_(n) output pins. ***NOTE:*** *This input pin functions as the $\overline{CS}$ input pin, if the XRT73LC04A device has been configured to operate in the HOST Mode.*
72 71 108 107	E3_0/SDO E3_1/SDI E3_2 E3_3	I/O I I I	**E3_Mode Select - Channel 0:** This pin has a dual function. In HOST mode, this pin functions as SDO. **E3_Mode Select - Channel 1** This pin has a dual function. In HOST mode,this pin functions as SDI. **E3_Mode Select - Channel 2** **E3_Mode Select - Channel 3** **Hardware Mode Operation - E3 Mode Select - Channel (n):** This input pin is used to configure Channel (n) of the XRT73LC04A to operate in the E3 or STS-1/DS3 Modes. Setting this input pin to "High" configures Channel (n) to operate in the E3 Mode. Setting it "Low" configures Channel (n) to operate in either the DS3 or STS-1 Modes, depending upon the state of the STS-1/$\overline{DS3}$_(n) input pin. ***NOTE:*** *This pin is internally pulled "Low" when XRT73LC04A is in the Hardware Mode.*
73 83 106 98	STS1/$\overline{DS3}$_0 STS1/$\overline{DS3}$_1 STS1/$\overline{DS3}$_2 STS1/$\overline{DS3}$_3	I	**STS-1/DS3 Select Input - Channel (n):** "High" for STS-1 and "Low" for DS3 Operation. The XRT73LC04A ignores this pin if the E3_(n) pin is set to "1". This input pin is ignored if the XRT73LC04A is operating in the HOST Mode. ***NOTE:*** *This pin should be tied to GND if the XRT73LC04A is going to be operating in the HOST Mode, (internally pulled-down).*

OPERATING MODE SELECT

PIN #	NAME	TYPE	DESCRIPTION
52	HOST/($\overline{HW}$)	I	**HOST-Hardware Mode Select:** This input pin is used to enable or disable the Microprocessor Serial Interface (e.g., consisting of the SDI, SDO, SClk, and $\overline{CS}$ pins). Setting this input pin "High" enables the Microprocessor Serial Interface (e.g. configures the XRT73LC04A to operate in the HOST Mode). In this mode, configure the XRT73LC04A via the Microprocessor Serial Interface. When the XRT73LC04A is operating in the HOST Mode, then it ignores the states of many of the discrete input pins. Setting this input pin "Low" disables the Microprocessor Serial Interface (e.g., configures the XRT73LC04A to operate in the Hardware Mode). In this mode, many of the external input control pins are functional. (Internally Pulled-up)

CONTROL AND ALARM INTERFACE

PIN #	NAME	TYPE	DESCRIPTION
36 20 1 17	MRing_0 MRing_1 MRing_2 MRing_3	I	**Monitor Ring Input - Channel (n):** The bipolar line output signal from TRing_(n) can be connected to this pin via a 270-ohm resistor in order to check for line driver failure. This pin is internally pulled "High".
35 21 2 16	MTIP_0 MTIP_1 MTIP_2 MTIP_3	I	**Monitor Tip Input - Channel (n):** The bipolar line output signal from TTIP_(n) can be connected to this pin via a 270-ohm resistor in order to check for line driver failure. This pin is internally pulled "High".
48 26 133 11	DMO_0 DMO_1 DMO_2 DMO_3	O	**Drive Monitor Output - Channel (n):** If no transmitted AMI signal is present on MTIP_(n) and MRing_(n) input pins for 128±32 TxClk periods, then DMO_(n) toggles and remains "High" until the next AMI signal is detected.
46 45 135 136	TAOS_0 TAOS_1 TAOS_2 TAOS_3	I	**Transmit All Ones Select - Channel (n):** A "High" on this pin causes the Transmit Section, within Channel (n), to generate and transmit a continuous AMI all “1’s" pattern onto the line. The frequency of this "1’s" pattern is determined by TxClk_(n). This input pin is ignored if the XRT73LC04A is operating in the HOST Mode. ***NOTE:*** *This pin should be tied to GND if the XRT73LC04A is going to be operating in the HOST Mode, (internally pulled-down).*
64 67 117 114	RLOS_0 RLOS_1 RLOS_2 RLOS_3	O	**Receive Loss of Signal Output Indicator - Channel (n):** This output pin toggles "High" if Channel (n) has detected a Loss of Signal Condition in the incoming line signal. The criteria that the XRT73LC04A uses to declare an LOS Condition depends upon whether the device is operating in the E3 or STS-1/DS3 Mode.
65 68 116 113	RLOL_0 RLOL_1 RLOL_2 RLOL_3	O	**Receive Loss of Lock Output Indicator - Channel (n):** This output pin toggles "High" if Channel (n) has detected a Loss of Lock Condition. Channel (n) declares an LOL (Loss of Lock) condition if the recovered clock frequency deviates from the Reference Clock frequency (available at the EXClk_(n) input pin) by more than 0.5%.

CONTROL AND ALARM INTERFACE

PIN #	NAME	TYPE	DESCRIPTION
60 54 120 126	RNEG_0/(LCV_0) RNEG_1/(LCV_1) RNEG_2/(LCV_2) RNEG_3/(LCV_3)	O	**Line Code Violation - Channel (n):** The function of this pin is dependent on whether the XRT73LC04A is in the Hardware or HOST Mode (HOST/$\overline{HW}$) and if $\overline{CS}$/(SR/$\overline{DR}$) is set "High". **Hardware Mode** **Line Code Violation:** When $\overline{CS}$/(SR/$\overline{DR}$) is set "High", (Single-Rail operation), the B3ZS/HDB3 Encoder/Decoder is activated and the Line Code Violation signal is output on this pin. **HOST Mode** **Receive Negative Data:** Writing a "1" to (SR/$\overline{DR}$)_(n) bit of the Command Register configures the Single-Rail Mode and activates LCV_(n). *If the B3ZS/HDB3 Decoder is enabled then the zero suppression patterns in the incoming line signal (such as: "00V", "000V", "B0V", "B00V") is not reflected at this output.*
74	$\overline{ICT}$	I	**In-Circuit Test Input**: Setting this pin "Low" causes all digital and analog outputs to go into a high-impedance state to allow for in-circuit testing. This pin should be set to "High" for normal operation. This pin is internally pulled "High".
75	LOSTHR	I	**Loss of Signal Threshold Control**: Forcing the LOSTHR pin to GND or VDD provides two settings. This pin must be set to a "High" or "Low" level upon power up and should not be changed during operation. This pin is only applicable during DS3 or STS-1 operations.
76 84 105 97	LLB_0 LLB_1 LLB_2 LLB_3	I	**Local Loop-back - Channel (n)**: This input pin along with RLB_(n) dictates which Loop-Back mode Channel (n) is operating in. A "High" on this pin with RLB_(n) set to "Low" configures Channel (n) to operate in the Analog Local Loop-Back Mode. A "High" on this pin with RLB_(n) also being set to "High" configures Channel (n) to operate in the Digital Local Loop-Back Mode. ***NOTE:*** *This pin is ignored and should be tied to GND if the XRT73LC04A is going to be operating in the HOST Mode.*
77 85 104 96	RLB_0 RLB_1 RLB_2 RLB_3	I	**Remote Loop-Back - Channel (n):** This input pin in conjunction with LLB_(n) dictates which Loop-Back mode Channel (n) is operating in. A "High" on this pin with LLB_(n) being set to "Low" configures Channel (n) to operate in the Remote Loop-Back Mode. A "High" on this pin with LLB_(n) also being set to "High" configures Channel (n) to operate in the Digital Local Loop-Back Mode. ***NOTE:*** *This pin is ignored and should be tied to GND if the XRT73LC04A is going to be operating in the HOST Mode.*

CONTROL AND ALARM INTERFACE

PIN #	NAME	TYPE	DESCRIPTION
111	LOSMUTEN	I	**MUTE-upon-LOS Enable Input (Hardware Mode):** This input pin is use to configure the XRT73LC04A, while it is operating in the Hardware Mode, to MUTE the recovered data via the RPOS_(n), RNEG_(n) output pins whenever one of the Channels declares an LOS conditions. Setting this input pin “High" configures all Channels to automatically pull the RPOS_(n) and RNEG_(n) output pins “Low” whenever it is declaring an LOS condition, thereby MUTing the data being output to the Terminal Equipment. Setting this input pin "Low" configures all Channels to NOT automatically MUTE the recovered data whenever an LOS condition is declared. ***NOTES:*** 1. *This pin is ignored and should be tied to GND if the XRT73LC04A is going to be operating in the HOST Mode.* 2. *This pin is internally pulled "Low".*

MICROPROCESSOR INTERFACE

PIN #	NAME	TYPE	DESCRIPTION
69	$\overline{CS}$/ SR/$\overline{DR}$	I	**Microprocessor Serial Interface - Chip Select Input/Encoder-Decoder Disable Input:** The function of this pin depends upon whether the XRT73LC04A is operating in the HOST Mode or in the Hardware Mode. **HOST Mode Operation - Chip Select Input:** The Local Microprocessor must assert this pin to "0" in order to enable communication with the XRT73LC04A via the Microprocessor Serial Interface. ***NOTE:*** *This pin is internally pulled "High".*
70	SClk/(RxOFF)	I	**Microprocessor Serial Interface Clock Signal/Receiver Shut OFF Input:** The function of this pin depends upon: **HOST Mode - Microprocessor Serial Interface Clock Signal:** This signal is used to sample the data on the SDI pin on the rising edge of this signal. During Read operations the Microprocessor Serial Interface updates the SDO output on the falling edge of this signal. **Hardware Mode - Receiver Shut OFF input:** Setting this input pin "High" shuts off all of the Receiver Sections. Setting this input pin "Low" enables all of the Receive Sections for full operation.
71	SDI/E3_1	I	**Serial Data Input for the Microprocessor Serial Interface** This pin has a dual function. **HOST Mode:** To read or write data into the Command Registers over the Microprocessor Serial Interface, apply the Read/Write bit, the Address Values of the Command Registers and Data Value to be written during Write Operations to this pin. This input is sampled on the rising edge of the SClk pin.

MICROPROCESSOR INTERFACE

PIN #	NAME	TYPE	DESCRIPTION
72	SDO/E3_0	O	**Serial Data Output from the Microprocessor Serial Interface** The function of this pin depends upon the mode of operation. **HOST Mode Operation:** This pin serially outputs the contents of the specified Command Register during Read Operations. The data on this pin is updated on the falling edge of the SClk input signal. This pin is tri-stated upon completion of data transfer.
110	$\overline{\text{REGR}}$/ RxClkINV	I	**Register Reset Input (Invert RxClk_(n) Output - Select):** The function of this pin depends upon the mode of operation.In Hardware mode, this pin functions as RxClkINV. **HOST Mode - Register Reset Input:** Setting this input pin "Low" causes the XRT73LC04A to reset the contents of the Command Registers to their default settings and to its default operating configuration. ***NOTE:*** *This pin is internally pulled "High".*

POWER AND GROUND PINS

PIN #	NAME	TYPE	DESCRIPTION
4	TxAVDD_2	****	**Transmitter Analog Supply, 3.3V ± 5% - Channel(n)**
6	TxAGND_2	****	**Transmitter Analog Ground - Channel(n)**
10	TxAVDD_3	****	**Transmitter Analog Supply, 3.3V ± 5% - Channel(n)**
13	TxAVDD_3	****	**Transmitter Analog Supply, 3.3V ± 5% - Channel(n)**
15	TxAGND_3	****	**Transmitter Analog Ground - Channel(n)**
18	TxAGND_3	****	**Transmitter Analog Ground - Channel(n)**
19	TxAGND_1	****	**Transmitter Analog Ground - Channel(n)**
22	TxAGND_1	****	**Transmitter Analog Ground - Channel(n)**
24	TxAVDD_1	****	**Transmitter Analog Supply, 3.3V ± 5% - Channel(n)**
27	TxAVDD_1	****	**Transmitter Analog Supply, 3.3V ± 5% - Channel(n)**
31	TxAGND_0	****	**Transmitter Analog Ground - Channel(n)**
33	TxAVDD_0	****	**Transmitter Analog Supply, 3.3V ± 5% - Channel(n)**
47	TxAVDD_0	****	**Transmitter Analog Supply, 3.3V ± 5% - Channel(n)**
49	TxAGND_0	****	**Transmitter Analog Ground - Channel (n)**
50	AGND_0	****	**Analog Ground Pin - Channel (n)**
51	RxDVDD_1	****	**Receiver Digital Supply 3.3V ± 5% Channel (n)**
56	RxDGND_1	****	**Receiver Digital Ground - Channel(n)**
58	RxDVDD_0	****	**Receiver Digital Supply 3.3V ± 5% Channel (n)**
62	RxDGND_0	****	**Receiver Digital Ground - Channel(n)**
63	AGND_1	****	**Analog Ground Pin - Channel(n)**
78	RxAVDD_0	****	**Receiver Analog Supply 3.3V ± 5% - Channel (n)**
81	RxAGND_0	****	**Receiver Analog Ground - Channel (n)**
86	RxAVDD_1	****	**Receiver Analog Supply 3.3V ± 5% - Channel (n)**
89	RxAGND_1	****	**Receiver Analog Ground - Channel (n)**
92	RxAGND_3	****	**Receiver Analog Ground - Channel (n)**
95	RxAVDD_3	****	**Receiver Analog Supply 3.3V ± 5% - Channel (n)**
100	RxAGND_2	****	**Receiver Analog Ground - Channel (n)**
103	RxAVDD_2	****	**Receiver Analog Supply 3.3V ± 5% - Channel (n)**
109	AGND_2	****	**Analog Ground Pin - Channel (n)**
112	AGND_3	****	**Analog Ground Pin - Channel (n)**
118	RxDGND_2	****	**Receiver Digital Ground - Channel(n)**
122	RxDVDD_2	****	**Receiver Digital Supply 3.3V ± 5% - Channel (n)**

POWER AND GROUND PINS

PIN #	NAME	TYPE	DESCRIPTION
124	RxDGND_3	****	**Receiver Digital Ground - Channel(n)**
128	RxDVDD_3	****	**Receiver Digital Supply 3.3V ± 5% - Channel (n)**
129	EXDGNDA	****	**External Clock Digital Ground**
130	EXDVDDA	****	**External Clock Digital Supply**
132	TxAGND_2	****	**Transmitter Analog Ground - Channel (n)**
134	TxAVDD_2	****	**Transmitter Analog Supply 3.3V ± 5% - Channel(n)**

NO CONNECTION PINS

PIN #	NAME	TYPE	DESCRIPTION
37	NC		No connection
38	NC		No connection
39	NC		No connection
142	NC		No connection
143	NC		No connection
144	NC		No connection

ELECTRICAL CHARACTERISTICS

ABSOLUTE MAXIMUM RATINGS

Storage Temperature	- 65℃ to + 150℃
Operating Temperature	- 40℃ to + 85℃
Supply Voltage Range	-0.5V to +3.465V
Theta-JA	24°C/W
Theta-JC	5.5°C/W

NOTE: *The XRT73LC04A is assembled in a thermally enhanced package with an integral Copper Heat Slug. The Heat Slug is solder plated and is exposed on the bottom of the package and is electrically connected to the internal Ground connections of the device. This Heat Slug can be soldered to the mounting board if desired, but must be electrically isolated from any V_{DD} connections.*

ELECTRICAL CHARACTERISTICS (T_A = 25°C, V_{DD} = 3.3V ± 5%, UNLESS OTHERWISE SPECIFIED)

SYMBOL	PARAMETER	MIN.	TYP.	MAX.	UNITS
DC Electrical Characteristics					
DV_{DD}	Digital DC Supply Voltage	3.135	3.3	3.465	V
AV_{DD}	Analog DC Supply Voltage	3.135	3.3	3.465	V
I_{CC}	Supply Current (Measured while Transmitting and Receiving all "1's")			500	mA
V_{IL}	Input Low Voltage *			0.8	V
V_{IH}	Input High Voltage *	2.0		5.0	V
V_{OL}	Output Low Voltage, IOUT = -4.0mA *			0.4	V
V_{OH}	Output High Voltage, IOUT = 4.0mA *	2.8			V
I_L	Input Leakage Current *			±10	µA

NOTE: ** Not applicable to pins with pull-up or pull-down resistors.*

ELECTRICAL CHARACTERISTICS (CONTINUED) (T_A = 25°C, V_{DD} = 3.3V ± 5%, UNLESS OTHERWISE SPECIFIED)

AC ELECTRICAL CHARACTERISTICS (SEE FIGURE 5)

TERMINAL SIDE TIMING PARAMETERS (SEE FIGURE 6 AND FIGURE 7) -- {(n) = 0, 1, 2 OR 3 }

SYMBOL	PARAMETER	MIN.	TYP.	MAX.	UNITS
	TxClk_(n) Clock Duty Cycle (STS-1/DS3)	30	50	70	%
	TxClk_(n) Clock Duty Cycle (E3)	30	50	70	%
	TxClk_(n) Frequency (SONET STS-1)		51.84		MHz
	TxClk_(n) Frequency (DS3)		44.736		MHz
	TxClk_(n) Frequency (E3)		34.368		MHz
t_{RTX}	TxClk_(n) Clock Rise Time (10% to 90%)		3	5	ns
t_{FTX}	TxClk_(n) Clock Fall Time (90% to 10%)		3	5	ns
t_{TSU}	TPData_(n)/TNData_(n) to TxClk_(n) Falling Set up time	3	1.5		ns
t_{THO}	TPData_(n)/TNData_(n) to TxClk_(n) Falling Hold time	3	1.5		ns
t_{LCVO}	RxClk_(n) to rising edge of LCV_(n) output delay		2.5		ns
t_{TDY}	TTIP_(n)/TRing_(n) to TxClk_(n) Rising Propagation Delay time		8		ns
	RxClk_(n) Clock Duty Cycle		50		%
	RxClk_(n) Frequency (SONET STS-1)		51.84		MHz
	RxClk_(n) Frequency (DS3)		44.736		MHz
	RxClk_(n) Frequency (E3)		34.368		MHz
t_{CO}	RxClk_(n) to RPOS_(n)/RNEG_(n) Delay Time	0	2.5		ns
t_{RRX}	RxClk_(n) Clock Rise Time (10% to 90%)		1.5		ns
t_{FRX}	RxClk_(n) Clock Fall Time (10% to 90%)		1.5		ns
C_I	Input Capacitance			10	pF
C_L	Load Capacitance			10	pF

NOTES:

1. *All XRT73LC04A digital inputs are designed to be TTL 5V compliant.*
2. *All XRT73LC04A digital outputs are also TTL 5V compliant. However, these outputs will not drive to 5V nor will they accept external 5V pull-ups.*

FIGURE 5. TRANSMIT PULSE AMPLITUDE TEST CIRCUIT FOR E3, DS3 AND STS-1 RATES (TYPICAL CHANNEL)

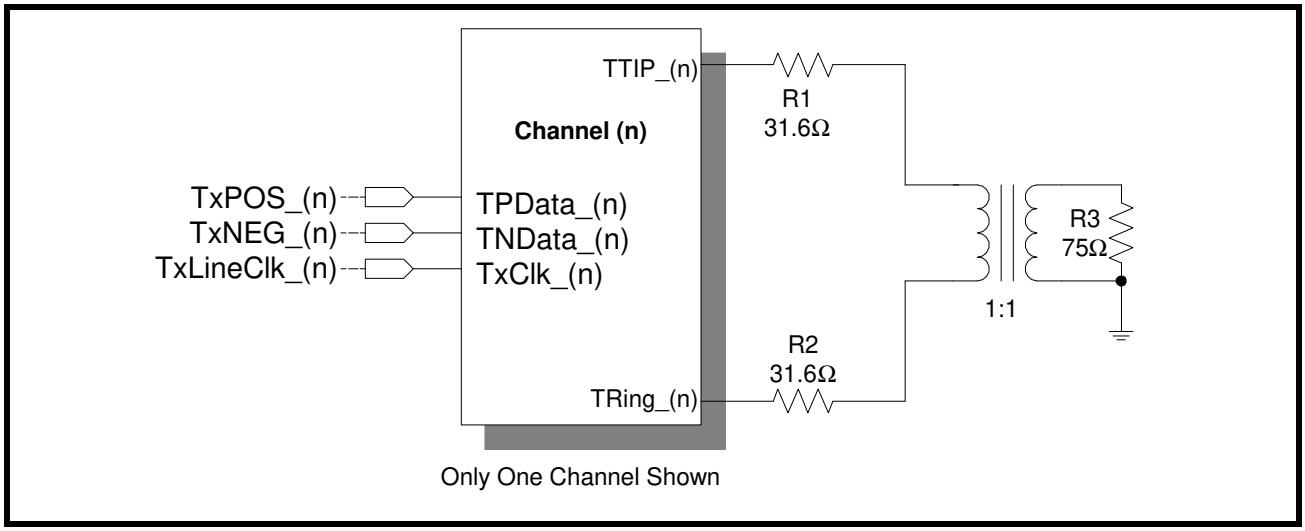


FIGURE 6. TIMING DIAGRAM OF THE TRANSMIT TERMINAL INPUT INTERFACE

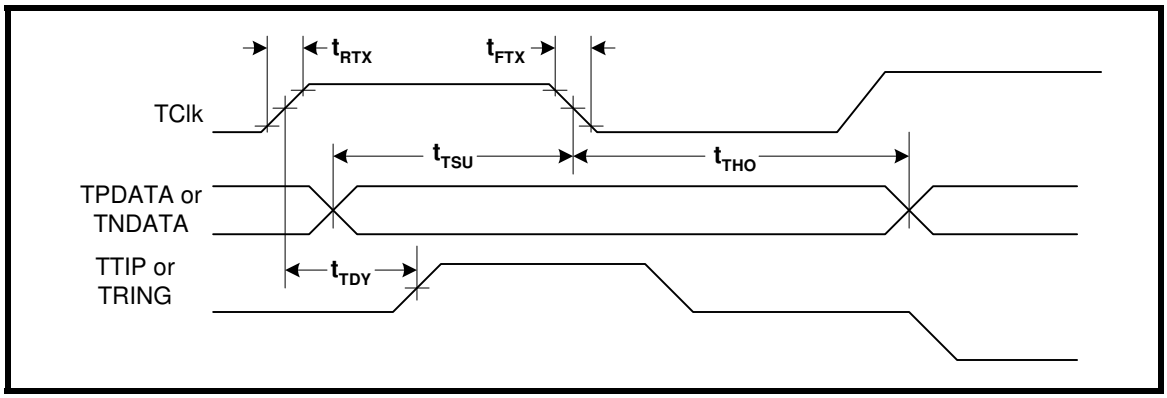
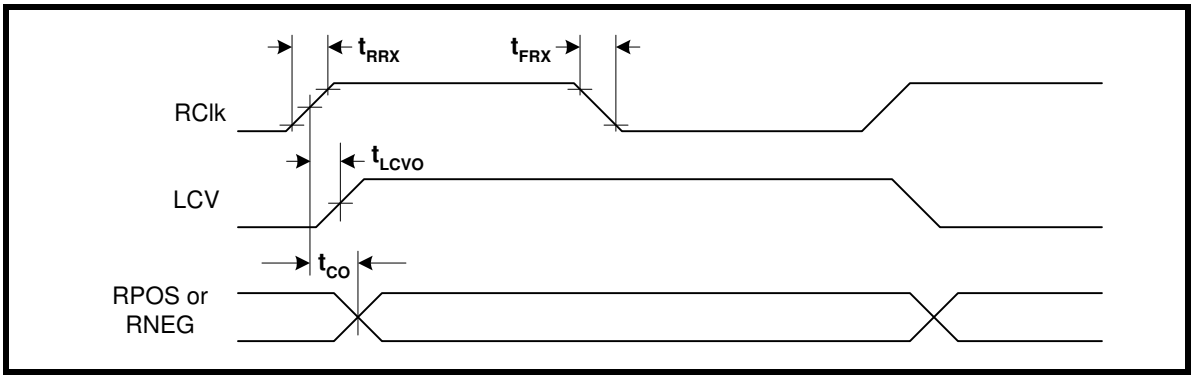


FIGURE 7. TIMING DIAGRAM OF THE RECEIVE TERMINAL OUTPUT INTERFACE



ELECTRICAL CHARACTERISTICS (CONTINUED), (T_A = 25°C, V_{DD} = 3.3V ± 5%, UNLESS OTHERWISE SPECIFIED)

LINE SIDE PARAMETERS E3 APPLICATION					
TRANSMIT CHARACTERISTICS (SEE FIGURE 5)					
SYMBOL	**PARAMETER**	**MIN.**	**TYP.**	**MAX**	**UNITS**
	Transmit Output Pulse Amplitude (Measured at Secondary Output of Transformer)	0.90	1.00	1.10	Vpk
	Transmit Output Pulse Amplitude Ratio	0.95	1.00	1.05	
	Transmit Output Pulse Width	12.5	14.55	16.5	ns
	Transmit Output Pulse Width Ratio	0.95	1.00	1.05	
	Transmit Output Jitter with jitter-free input @ TxClk_(n)		0.02	0.05	UIpp
Receive Line Characteristics					
	Receive Sensitivity (Length of cable)	1200	1400		feet
	Interference Margin	-20	-15		dB
	Signal Level to Declare Loss of Signal			-35	dB
	Signal Level to Clear Loss of Signal	-15			dB
	Occurrence of LOS to LOS Declaration Time	10		255	UI
	Termination of LOS to LOS Clearance Time	10		255	UI
	Intrinsic Jitter (all “1’s” pattern)		0.02		UI
	Jitter Tolerance @ Jitter Frequency = 100Hz	64			UI
	Jitter Tolerance @ Jitter Frequency = 1kHz	30			UI
	Jitter Tolerance @ Jitter Frequency = 10kHz	4			UI
	Jitter Tolerance @ Jitter Frequency = 800kHz	0.15	0.20		UI

ELECTRICAL CHARACTERISTICS (CONTINUED), (T_A = 25°C, V_{DD} = 3.3V ± 5%, UNLESS OTHERWISE SPECIFIED)

LINE SIDE PARAMETERS SONET STS-1 APPLICATION					
TRANSMIT CHARACTERISTICS (SEE FIGURE 5)					
SYMBOL	**PARAMETER**	**MIN.**	**TYP.**	**MAX**	**UNITS**
	Transmit Output Pulse Amplitude (Measured with TxLEV=0)	0.65	0.75	0.90	Vpk
	Transmit Output Pulse Amplitude (Measured with TxLEV=1)	0.90	1.00	1.10	Vpk
	Transmit Output Pulse Width	8.6	9.65	10.6	ns
	Transmit Output Pulse Amplitude Ratio	0.90	1.00	1.10	
	Transmit Output Jitter with jitter-free input @ TxClk_(n)		0.02	0.05	UI
Receive Line Characteristics					
	Receive Sensitivity (Length of cable)	900	1100		feet
	Signal Level to Declare or Clear Loss of Signal (See Table 5)				mV
	Intrinsic Jitter (all “1’s” pattern)		0.02		UI
	Jitter Tolerance @ Jitter Frequency = 100Hz	64			UI
	Jitter Tolerance @ Jitter Frequency = 1kHz	64			UI
	Jitter Tolerance @ Jitter Frequency = 10kHz	5			UI
	Jitter Tolerance @ Jitter Frequency = 400kHz	0.15	0.35		UI

ELECTRICAL CHARACTERISTICS (CONTINUED), (T_A = 25°C, V_{DD} = 3.3V ± 5%, UNLESS OTHERWISE SPECIFIED)

LINE SIDE PARAMETERS DS3 APPLICATION					
TRANSMIT CHARACTERISTICS (SEE FIGURE 5)					
SYMBOL	**PARAMETER**	**MIN.**	**TYP.**	**MAX**	**UNITS**
	Transmit Output Pulse Amplitude (Measured at 0 feet, TxLEV=0)	0.65	0.75	0.85	Vpk
	Transmit Output Pulse Amplitude (Measured at 0 feet, TxLEV=1)	0.90	1.00	1.10	Vpk
	Transmit Output Pulse Width	10.10	11.18	12.28	ns
	Transmit Output Pulse Amplitude Ratio	0.90	1.00	1.10	
	Transmit Output Jitter with jitter-free input @ TxClk_(n)		0.02	0.05	UI
Receive Line Characteristics					
	Receive Sensitivity (Length of cable)	900	1100		feet
	Signal Level to Declare or Clear Loss of Signal (See Table 5)				mV
	Intrinsic Jitter (all “1’s” pattern)		0.02		UI
	Jitter Tolerance @ Jitter Frequency = 100Hz	64			UI
	Jitter Tolerance @ Jitter Frequency = 1kHz	64			UI
	Jitter Tolerance @ Jitter Frequency = 10kHz	5			UI
	Jitter Tolerance @ Jitter Frequency = 300kHz (Cat II)	0.35	0.45		UI

Figure 8, Figure 9 and Figure 10 present the Pulse Template requirements for the E3, DS3 and STS-1 Rates.

FIGURE 8. ITU-T G.703 TRANSMIT OUTPUT PULSE TEMPLATE FOR E3 APPLICATIONS

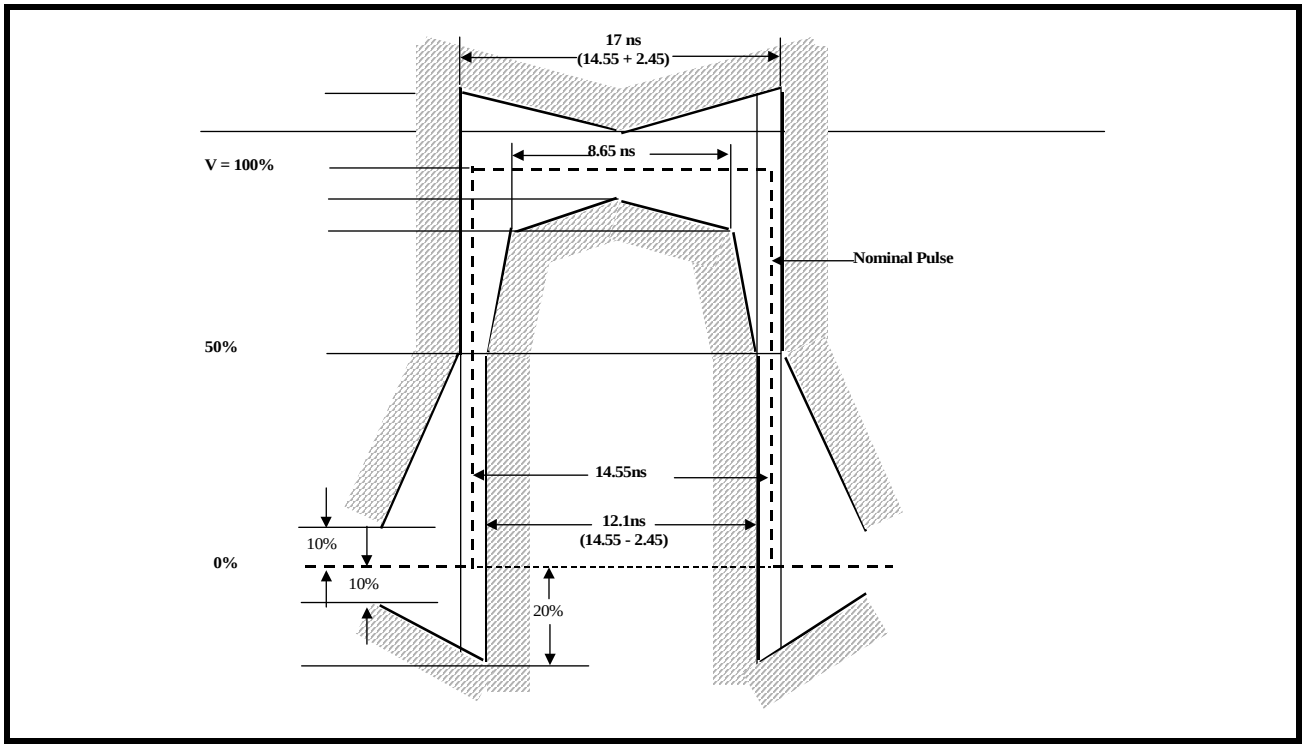


FIGURE 9. BELLCORE GR-499-CORE TRANSMIT OUTPUT PULSE TEMPLATE FOR DS3 APPLICATIONS