

TLK100 Implementation

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Executive Summary

We are living in the Age of the Internet, and with that comes the greater necessity for usable, reliable internet connections. Over 85% of all LAN connected workstations use Ethernet. Texas Instrument's TLK100 is a physical-layer Ethernet device used to communicate with a MAC-layer device in order to run integrity checks over an Ethernet line. The TLK100 will help in providing critical information on numerous types of cable faults, as well as give an accurate location of these faults.

Introduction

Ethernet first came into use in the late 70s, thanks to two Xerox researchers: Robert Metcalfe and David Boggs. Ethernet is a “multipoint data communication system with collision detection” [2]. It is a physical connection between machines. It is made up of 4 pairs of twisted wires. Two of these pairs are used for data transmission, while the other two are used for power. Many different faults can develop along an Ethernet line, some of these faults may include opens and shorts, cable impedance mismatches, bad connectors, termination mismatches, water damage, as well as other discontinuities. The TLK100 has the resources to test for these various faults and also be able to return its location in relation to the TLK100.

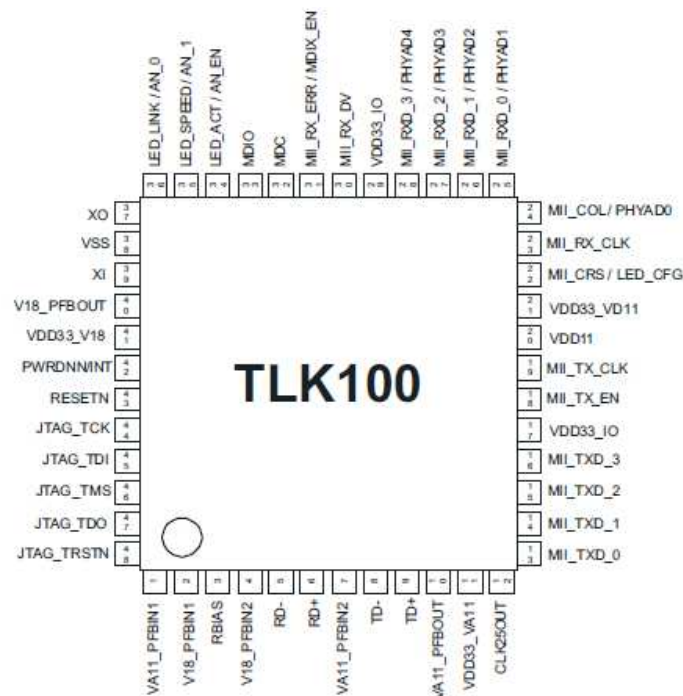


Figure 1. TLK100 Pin Diagram [5]

Objective

This application note is intended to provide readers with the knowledge required to properly connect the TLK100 to the Stellaris® LM3S9B96 Development Board which provides power and a MAC layer to the TLK100.

Media Independent Interface (MII)

The TLK100 is connected to the Development Board using a Media Independent Interface or MII. MII is a PHY to MAC layer connection that provides both data and power. Below is a description of the MII pins.

Ethernet MII Pin Out		
Pin No.	Name Signal	Description
1	Power	+5 Vdc/ 3.3 Vdc
2	MDIO	MII Data Input/Output
3	MDC	MII Data Clock
4	RxD 3	Receive Data 3
5	RxD 2	Receive Data 2
6	RxD 1	Receive Data 1
7	RxD 0	Receive Data 0
8	Rx_DV	Rx Data Valid
9	Rx_CLK	Rx Clock
10	Rx_ER	Rx Error
11	Tx_ER	Tx Error
12	Tx_CLK	Tx Clock
13	Tx_EN	Tx Enable
14	TxD 0	Transmit Data 0
15	TxD 1	Transmit Data 1
16	TxD 2	Transmit Data 2

17	TxD 3	Transmit Data 3
18	COL	Collision
19	CRS	Carrier Sense
20	Power	+5 Vdc/ +3.3 Vdc
21	Power	+5 Vdc/ +3.3 Vdc
22-39	GND	Signal Ground
40	Power	+5 Vdc/ +3.3 Vdc

Table 1. MII Pin Descriptions

MII is in the form of a 40-pin Mini-D Ribbon size connection, having both a male and female part (Below).

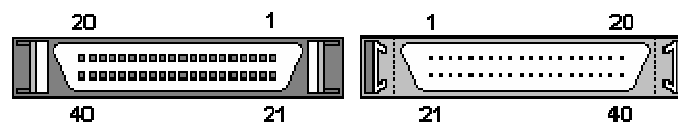


Figure 2. MII Connectors [4]

40 PIN HI-DENSITY D-SUB FEMALE at the network device (Left).
40 PIN HI-DENSITY D-SUB MALE at the transceiver (Right).

Mapping the TLK100 to Development Board via MII

In order to use MII to connect the TLK100 to the LM3S9B96

Development Board, each must be mapped to appropriate MII ports.

In order to connect the MII to the Development board we need to use an MII compatible breakout board which we can then connect to the Development board's EPIs (External Peripheral Interface).

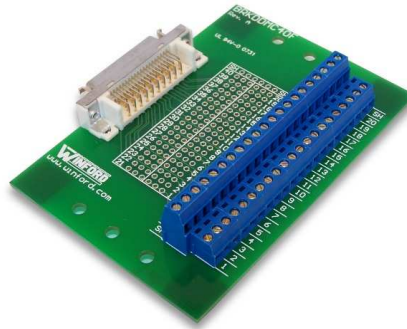


Figure 3. MII Compatible Breakout [7]

The EPIs, as shown below in Figure 4, are 36 pins mapped to the Development Kits ARM Cortex M3 microcontroller. With this microcontroller the TLK100 can be controlled.

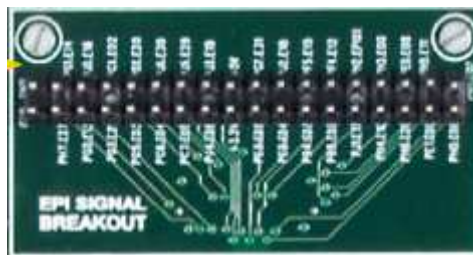


Figure 4. EPI Breakout Pins [6]

This EPI breakout pin adapter is used in place of the Development Board's SDRAM chip. Each port on the microcontroller that had been mapped to the SDRAM is now mapped to its corresponding breakout pin. These pins are now free to be used by the TLK100.

The TLK100 is wired to a MII male connector. This connector should then plug into the MII breakout board. The MII is then mapped to the necessary EPIs by using the MII compatible breakout board.

MII Pin	Signal	Breakout Board Pin	EPI Pin	Microcontroller port	TLK100 Pin*
1	Power	21	17	3.3V	†
2	MDIO	22	32	PE0	33
3	MDC	23	33	PE1	32
4	RX_D3	24	30	PH3	28
5	RX_D2	25	28	PH2	27
6	RX_D1	26	36	PH1	26
7	RX_D0	27	35	PH0	25
8	RX_DV	28	34	PH5	30
9	RX_CLK	29	31	PH6	23
10	RX_ER	30	3	PH7	31
11	TX_ER	31	15	PJ4	Not needed
12	TX_CLK	32	12	PJ6	19
13	TX_EN	33	14	PJ5	18
14	TX_D0	34	6	PJ0	13
15	TX_D1	35	27	PJ1	14
16	TX_D2	36	22	PJ2	15
17	TX_D3	37	16	PJ3	16
18	COL	38	29	PH4	24
19	CRS	39	5	PG0	22
20	Power	40	17	3.3V	†
21	Power	1	17	3.3V	†
22--39	GND	2--19	1,2	GND	38
40	Power	20	17	3.3V	†

Table 2. Full Pin Mapping Table

* Determined from Figure 1

† See Figure 5

Mappings from the Breakout Board to the Development Board are connected using a 36-pin ribbon. The ribbon connector fits over the EPI breakouts, while the other end should be spliced and attached to the individual breakout board slots. All these mappings and connections can be done using Table 2. It is important to note that all power sources and grounds should be shorted together.

Wiring the TLK100 for Power

The TLK100 has the ability to use 3.3V, or a combination of 3.3V, 1.8V, and 1.1V supplies. However, when using the LM3S9B96 Development Board it is easiest to use the 3.3V option because the Development Board has a 3.3V breakout pin. This option can then be implemented using the MII connections, which are also compatible with 3.3V.

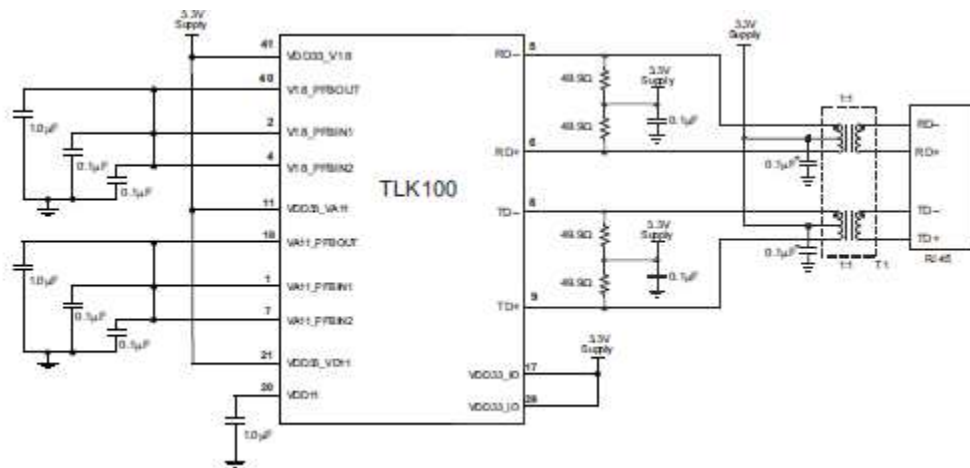


Figure 5. TLK100 Power Setup [5]

In the above diagram each of the shown power pins on the TLK100 are mapped to MII pins 1, 20, 21, and 40. These MII pins supply the necessary 3.3V to power the TLK100.

Wiring Clock and LEDs

After all the MII and power wirings are completed, the final task is to attach a clock. The clock should be a 25MHz crystal oscillator with one terminal wired to XI and the other to XO (pins 39 and 37). Capacitors

should be placed from each of these pins to ground and a resistor between XO and the clock (all rated based on the crystal oscillator). This clock will act as a reference clock for the TLK100.

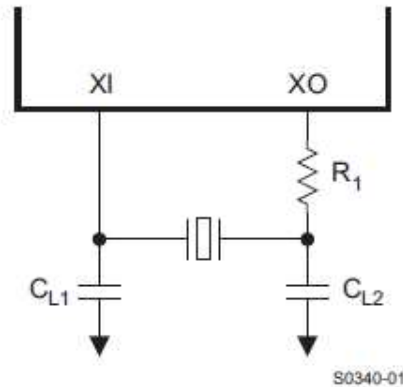


Figure 6. Crystal Oscillator Clock Setup [5]

Three LEDs can be configured into three different modes when attached to the TLK100. The TLK100 supports: Link, Speed, and Activity functions for the LEDs. These LEDs are an option that can be used in addition to the color-touch screen supplied by the Development Board. Figure 7 shows how these LEDs should be attached to the TLK100.

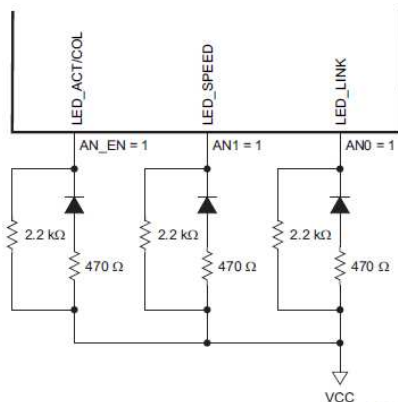


Figure 7. TLK100 LED Setup [5]

Possible Issues

If the MII compatible breakout board does not come with the right female MII connector, it may need to be replaced. Simply desolder the wrong connector and solder a correct connector into the board in its place.

Conclusion

Once the TLK100 is connected to the Development Board via MII, we can begin to communicate with the TLK100 using the Development Board's color-touch screen. With this we can tell the TLK100 to perform Time Domain Reflectometry, Active Link Cable Diagnostics, and Digital Spectrum Analysis in order to find faults along the Ethernet line. With this design we can rest easy that with the growing use of Ethernet we can keep up with troubleshooting our cables.

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