

Application Note

SOC PLUS DUAL SWITCHED 10/100 MB ETHERNET USING THE CS89712 AND KENDIN KS8993.

The Cirrus Logic CS89712 is a highly integrated system on a chip (SoC) with a 10BaseT MAC and PHY. For applications requiring 10/100, it can be paired with the Kendin Communications KS8993 Single Chip Switch. This provides an SoC with a fully switched dual 10/100 Ethernet. The Kendin device provides the 10/100 MACs, PHYs switching logic and frame buffer.

In its default mode, the KS8993 is a three port switch with auto-negotiation on all ports. No additional software is required in the CS89712 to operate the KS8993 in the default mode.

The KS8993 has an address lookup engine which performs Learning, Migration, Aging and Forwarding. It intercepts error packets, pause frames, and local packets. It has a low latency switching engine which operates in store and forward mode. It supports Quality of Service (QoS)

by providing two priority queues, with the priority determined by the port, or using 802.1p based priority. These capabilities are not available in non-switched devices.

This solution is ideal for a VoIP terminal in an office, where both a PC and a terminal must be connected to the LAN, but the PC has only one Ethernet port, and the wall jack is only wired for one LAN connection. If the VoIP terminal has two Ethernet connections, one port would connect to the LAN, and the second port would go to the PC. This creates a potential bottleneck, since all messages between the LAN and the PC go through the VoIP terminal. The KS8993 solves this problem by off loading the switching function from the ARM processor in the CS89712.

A block diagram of the circuit is shown in Figure 1.

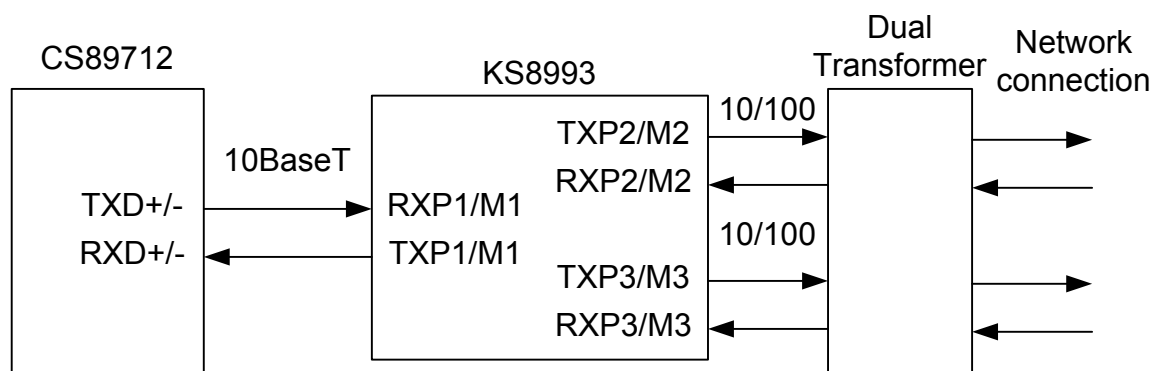


Figure 1. Block Diagram of CS89712 Circuit with Dual 10/100 Connection

1. APPLICATION CIRCUIT

The connection between the CS89712 and the KS8993 is made through capacitive coupling instead of using an extra set of transformers on the 10BaseT side. Transformers are not necessary if the CS89712 and the KS8993 share the same power and ground; i.e., they are on the same board or chassis, or if there is a short distance between them with low loss power and ground connections. With no transformers in the circuit, the two functions of the transformers must be replicated:

1. The loading on the transmitter must be 100 ohms.
2. The DC component on the received signal must be minimized.

Figure 2 shows the circuit to connect the two devices. On the CS89712 transmitter, the four 25 Ω resistors from TXDP to TXDN add up to the required 100 Ω termination. The two series capacitors block the DC component of the transmitted signal (if any). The value of 0.1 μF is a

nominal value that gives adequate margin for the resulting high pass filter. The value of these capacitors is not critical, since there is no common mode voltage on the CS89712 output during idle periods (see discussion of receiver circuit below). The 0.1 μF capacitor to ground provides an A.C. ground for the KS8993 receiver.

The KS8993 transmit circuit has a 100 Ω resistor for impedance matching, and 100 pF capacitors to block the common mode voltage on the transmitter. If there were a change in the common mode voltage between the idle and transmit conditions, the resulting transient would discharge through the 100 pF capacitors, distorting the shape of the transmitted pulses, so proper reception wouldn't be guaranteed until the common mode voltage returned to approximately VDD/2. (This isn't a concern in a standard application, because a transformer is normally used to block the common mode DC. Because the transformer doesn't store up charge, there is no transient when the DC voltage goes away.) The common mode voltage of the

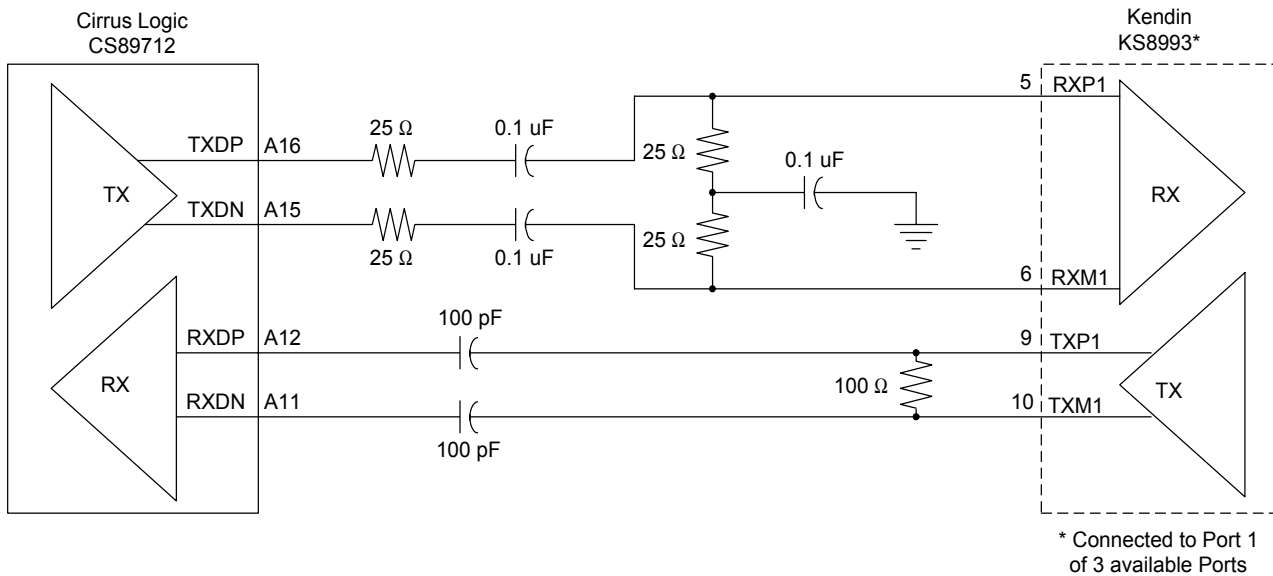


Figure 2. Connection between the CS89712 and the KS8993

KS8993 doesn't change between the idle and common mode conditions the capacitors are used as a precaution. Figure 3 shows the transmit data out of the KS8993, measured before the 100 pF capacitors - that is, across the 100 Ω resistor.

If there were any shift in the common mode voltage, then the DC blocking capacitors would

have to be small enough to allow the common mode voltage to return to normal during the preamble of the Ethernet frame, but large enough to not cause droop on the signal during transmission. The value of 100 pF was determined using the equivalent common mode and differential circuits

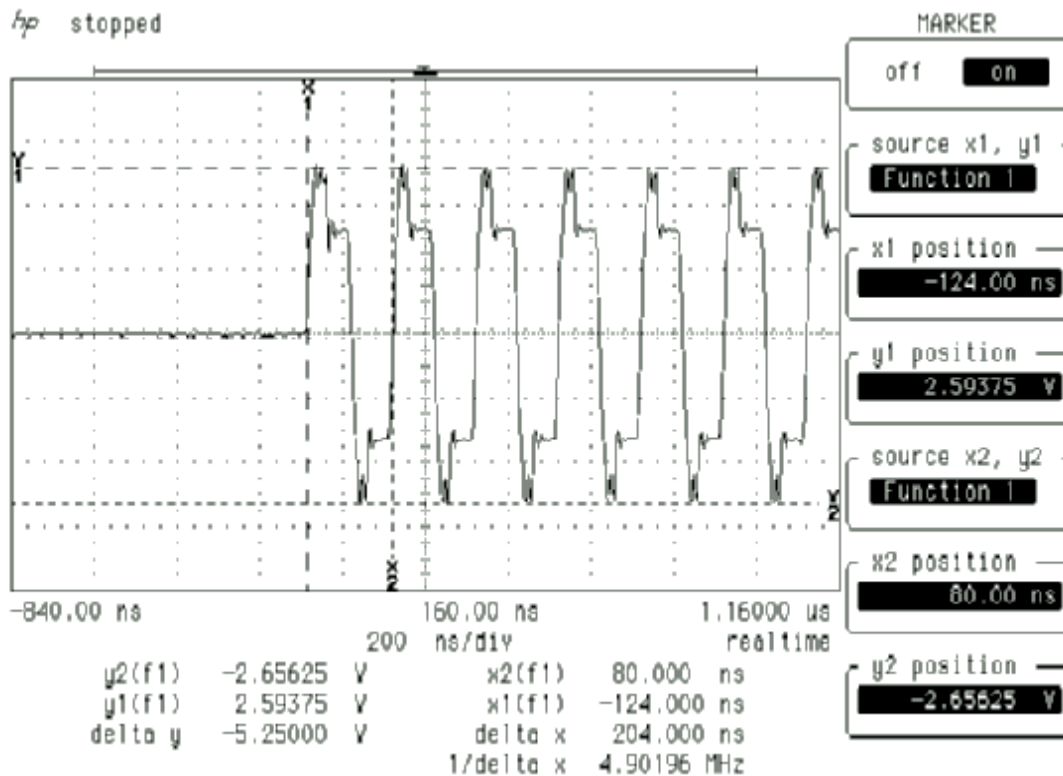


Figure 3. Transmit Output of KS8993

for the input of the CS89712 receiver. (Figure 4.) The RC time constant of the common mode circuit is:

$$\tau = 100 \text{ pF} \times (2.5 \text{ k}\Omega + 5 \text{ k}\Omega + 11.4 \text{ k}\Omega)$$

which comes out to about 1.9 μ sec, or about 19 bit intervals.

The effect of the RC time constant on the data pulses is calculated using the differential circuit. In this case the RC time constant is:

$$\tau = 100 \text{ pF} \times 5 \text{ k}\Omega$$

which is 500 nsec, or 5 bit times. This is long enough to prevent significant droop on the output during data transmission.

2. CONCLUSION

In a VoIP terminal, Quality of Service (QoS) is maintained by the efficient packet processing of the CS89712, and by the high performance switch engine in the KS8993. This circuit can also be used in a residential firewall or home gateway.

In addition to the KS8993, other Kendin switched devices may be used to provide additional 10/100 ports using the same method of capacitive coupling. The Kendin parts automatically detect a link on each port and power down ports with no link.

A datasheet as well as other information for the CS89712 is available on the Cirrus Logic website: <http://www.cirrus.com> (under the Communications link). The Kendin KS8993 datasheet is available on the Kendin Communications website: <http://www.kendin.com>.

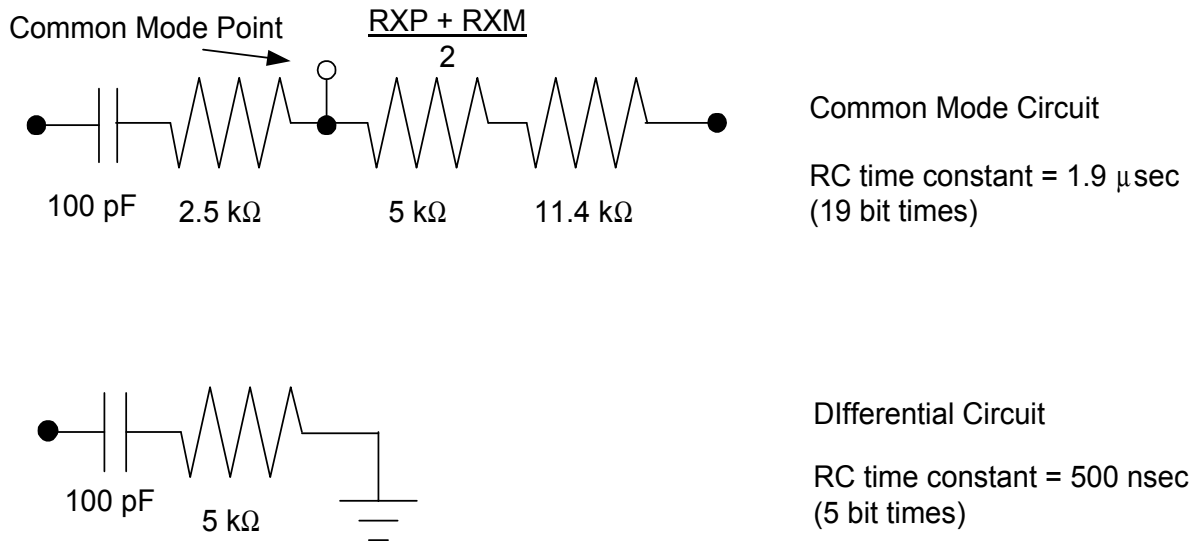


Figure 4. Equivalent Circuits for CS89712 Receive Inputs

• **Notes** •

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