



AN065: Reference Design Recommendation

How to Design Kinetic Technologies AS1602 for use with Voltage-Mode PHYs

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Version 2.0

Preliminary Information subjected to future revision and changes

Overview

This document provides an overview of a reference design using the Kinetic AS1602 device with a voltage-mode PHY; the specific design example in this document shows the AS1602 used with the Broadcom BCM54610 PHY. The AS1602 is a Dual Channel Active EMI suppressor for Ethernet Applications for both Power over Ethernet (PoE) and traditional non-PoE Ethernet systems, where compliance to tougher EMI Emissions (Class B), EMI Immunity standards (Level 2/3 or higher) and / or ESD ($\pm 25\text{kV}$ Air Discharge / $\pm 12\text{kV}$ CDE) is required.

There are various voltage-mode PHYs in the market, ranging from standalone to embedded in IP processors. As such, the presented method of use applies to a general category, and some fine tuning may be necessary for other part numbers or manufacturers.

This document is to be used in conjunction with relevant parts datasheets and application notes that provide generic design guidelines for the AS1602 part.

Design Notes

For a more detailed description of the AS1602 technology and applications, please refer to additional reference material along with these design notes.

Line Transformer Powering

Designing the Kinetic AS1602 with Broadcom's BCM54610 (voltage mode PHY) requires some minimal circuit modifications in order to have the AS1602 and BCM54610 voltage-mode PHY compatible. The following changes have been tested, and the combined circuit is Ethernet compliant.

The BCM54610 Ethernet transceiver is a voltage-mode device that provides its own common mode voltage to the transformer, rather than an off chip supply as is usual in a current-mode design. The common mode voltage for the BCM54610 Ethernet transceiver in 10, 100, and 1000Base-T mode is nominally at 1.65V. The AS1602 shall be connected in parallel to the Broadcom PHY, and the center-tap of the transformer shall source a voltage close to 1.65V. This voltage to the center tap current shall be supplied from the PHY_VDD (2.5V) supply through a 16 ohm resistor (R1) to the center tap of the transformer (C12). The 16 ohm resistor is calculated based on the following equation:

$$R = [\text{PHY_VDD} - 1.7\text{V}] / 50\text{mA}$$

$$\text{PHY_VDD} = 2.5\text{V}$$

Two AS1602 will draw 50mA current

1.7V Common Mode voltage of BCM54610

$$([2.5\text{V} - 1.70\text{V}] / 50\text{mA} = 16\Omega).$$

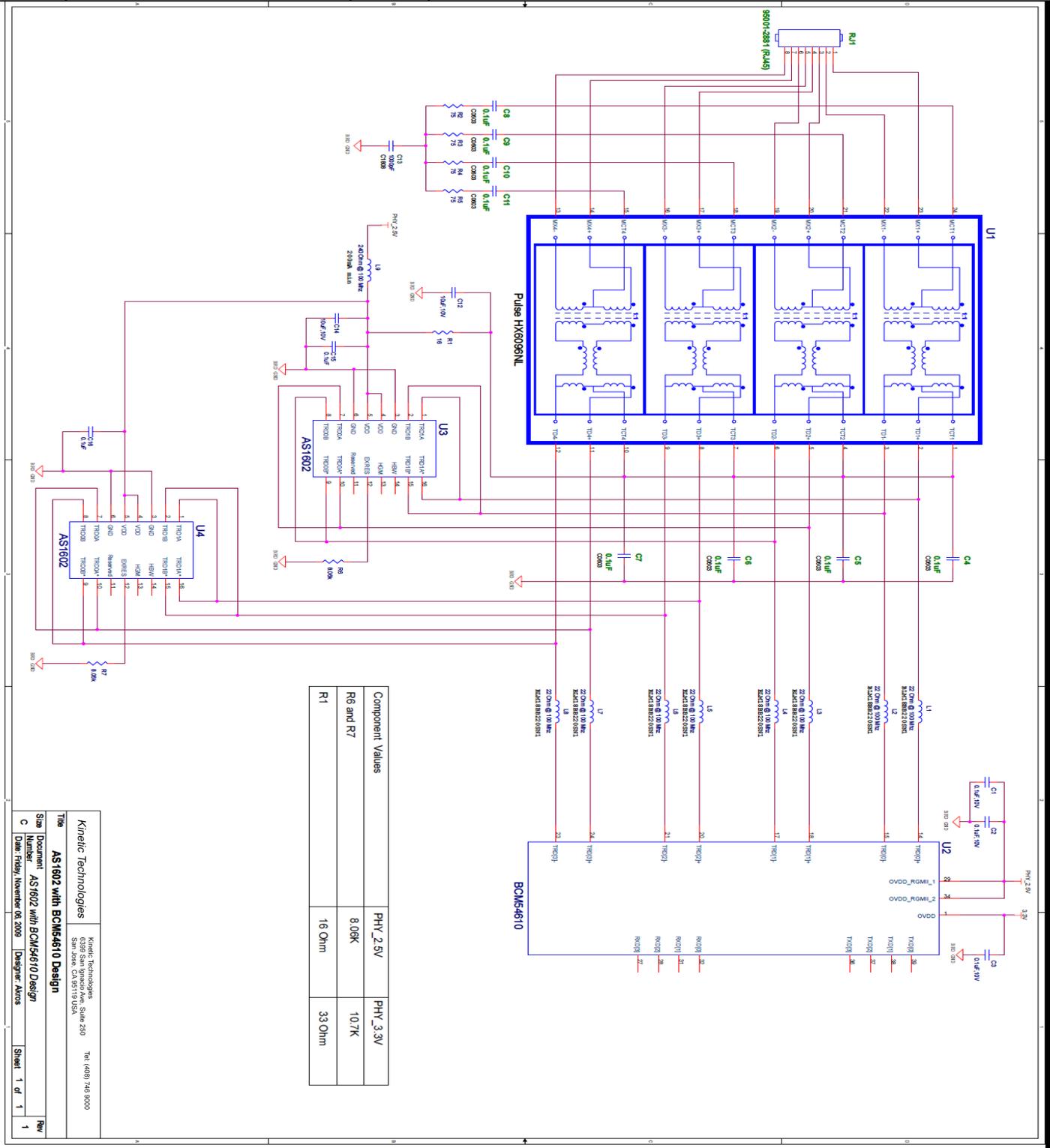
When using two AS1602 in the case of a 1000Base_T application, both AS1602 will draw 50ma combined; therefore, using a 16 ohm resistor will provide adequate current for the two AS1602 devices.

It is also important to note that in order to meet return loss, 22 ohm ferrite beads (22Ω@100khz, 500mA; M18BA220SN1D) are added in series with the PHY to achieve the required return loss performance.

If the design uses a current-mode PHY, then the center tap voltage of the transformer can be set to PHY_VDD. In this case, the resistor R1 should be set to 0 ohm.

Design Schematics

Schematics and BOM are embedded here for reference only. For high quality images, please see separate PDF and XLS files respectively.

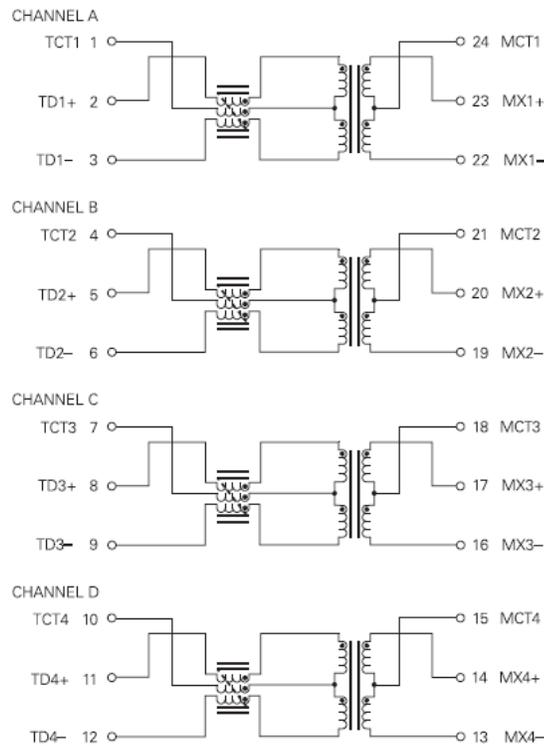


Transformer Schematic
PoE* Plus
Gigabit Transformer Modules
 *Power over Ethernet



Schematic

H6096NL, HX6096NL



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