FEATURES

- Operating rate
  - 1062 MHz (Fibre Channel) line rates
  - Half and full VCO output rates
- Functionally compliant X3T11 Fibre Channel Physical and Transmission Protocol Standard
- Transmitter incorporating phase-locked loop (PLL) clock synthesis from low speed reference
- Receiver PLL provides clock and data recovery
- 10 bit parallel TTL compatible interface
- Low-jitter serial LVPECL compatible interface
- Local loopback
- Continuous downstream clocking from receiver
- Drives 30m of twinax cable directly

APPLICATIONS

- Workstation
- Frame buffer
- Switched networks
- Data broadcast environment
- Proprietary extended backplanes

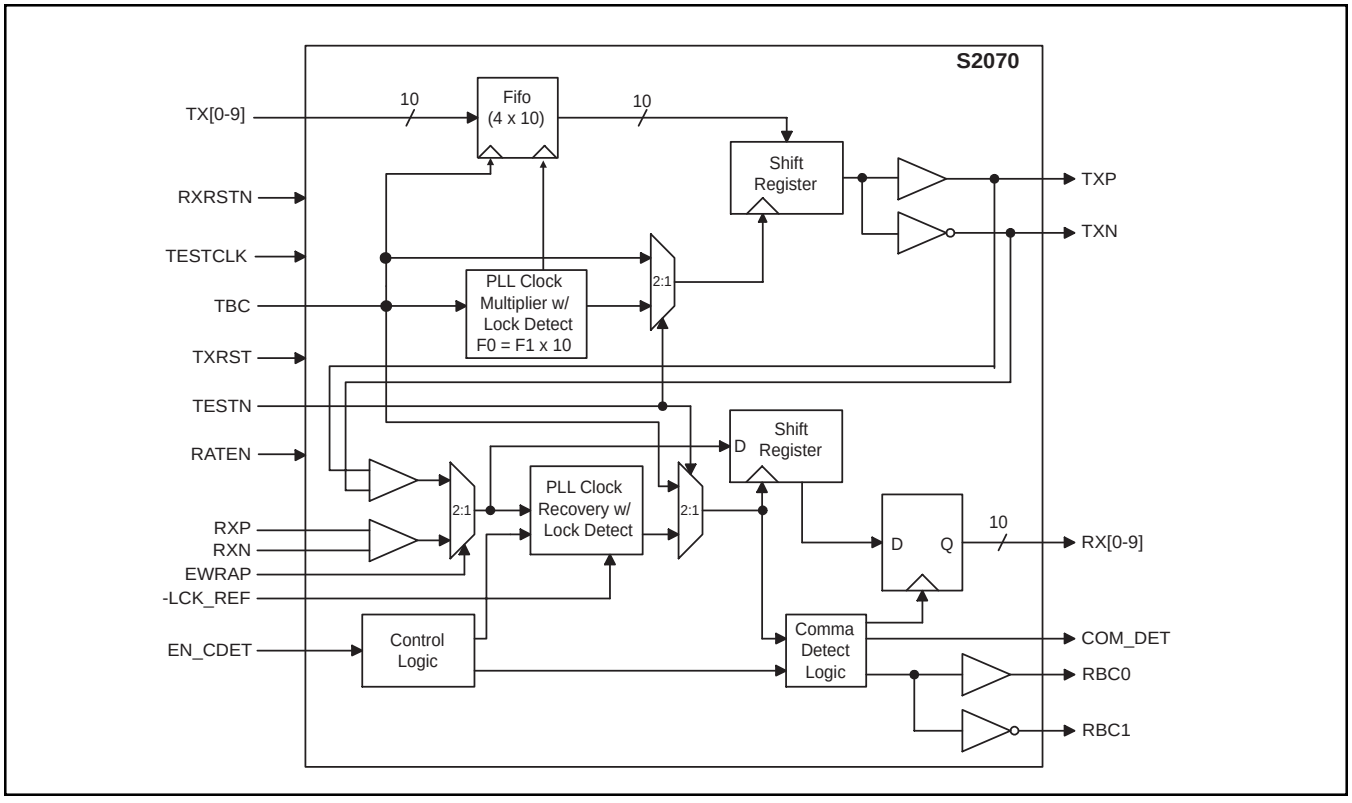
GENERAL DESCRIPTION

The S2070 transmitter and receiver chip facilitates high-speed serial transmission of data over fiber optic, coax, or twinax interfaces. The device conforms to the requirements of the X3T11 Fibre Channel Standard, and runs at 1.062 Mbps data rates with an associated 10-bit data word.

The chip provides parallel-to-serial and serial-to-parallel conversion, clock generation/recovery, and framing for block encoded data. The on-chip transmit PLL synthesizes the high-speed clock from a low-speed reference. The on-chip receive PLL performs clock recovery and data re-timing on the serial bit stream. The transmitter and receiver each support differential LVPECL compatible I/O for copper or fiber optic component interfaces with excellent signal integrity. Local loopback mode allows for system diagnostics. The chip requires a 3.3V power supply.

The S2070 can be used for a variety of applications including Fibre Channel, serial backplanes, and proprietary point to point links. Figure 1 shows the functional block diagram.

Figure 1. Functional Block Diagram



Power and Ground Connections

Recommended power and ground connections are shown below in Figure 2 and Table 1.

Figure 2. Power and Ground Connections

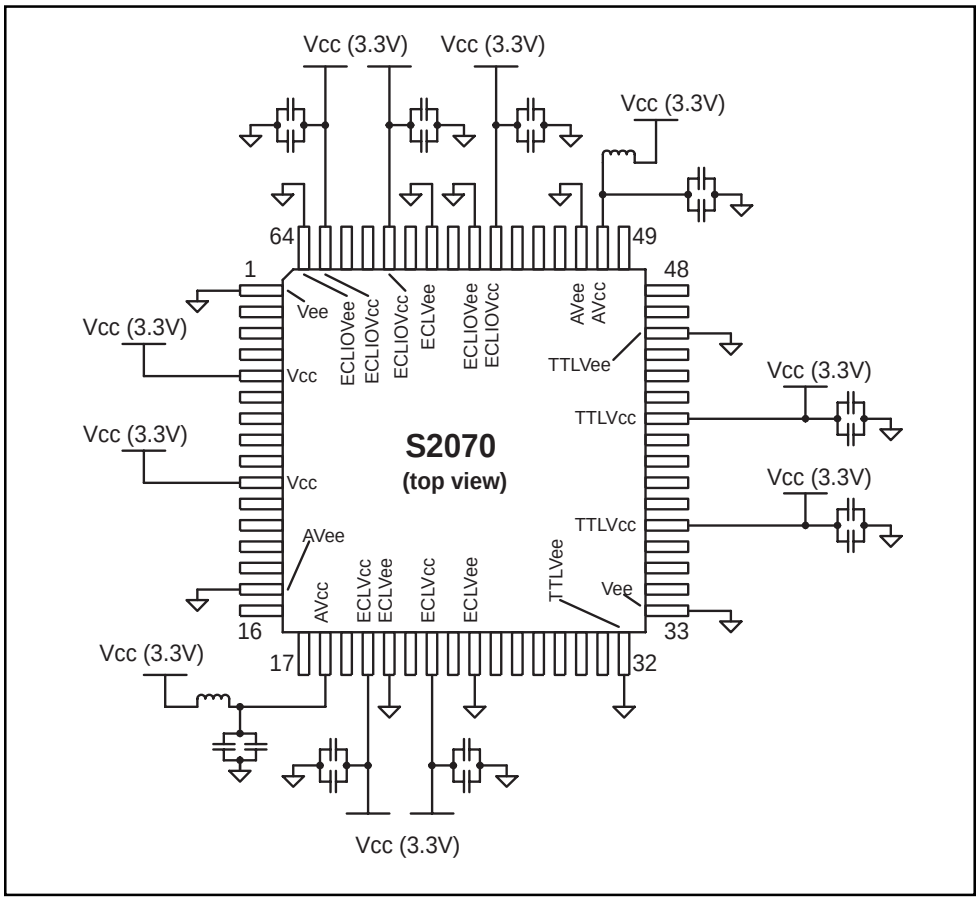


Table 1. Power and Ground Application Information

Function	Pinout Name	Instructions
ANALOG	AVCC	Connect to low noise or filtered 3.3V supply through a ferrite bead (600 Ω at 100 MHz: Murrata BLM31B601S or equivalent). Provide dual local HF bypassing to AVEE (0.1 µf, 100 pf) for low inductance and resistance. A single low inductance 0.1 µf capacitor can be substituted for the pair (Vishay VJ0612 or equivalent, < 0.5 nH max inductance).
	AVEE	Connect to ground plane.
LVPECL I/O	ECLIOVCC	Provide low impedance connection to 3.3V. Provide dual local bypassing to GND plane (0.1 µf and 100 pf in parallel, or a single low inductance Vishay VJ0612 or equivalent 0.1 µf cap).
	ECLIOVEE	Connect to ground plane.
CORE	ECLVCC	Provide low impedance connection to 3.3V. Provide dual local bypassing to GND plane (0.1 µf and 100 pf in parallel, or a single low inductance Vishay VJ0612 or equivalent 0.1 µf cap).
	ECLVEE	Connect to ground plane.
TTL I/O	TTLVCC	Provide low impedance connection to 3.3V. Provide dual local bypassing to GND plane (0.1 µf and 100 pf in parallel, or a single low inductance Vishay VJ0612 or equivalent 0.1 µf cap).
	TTLVEE	Connect to ground plane.

Serial Input/Output Connections

Figures 3 shows the basic coupling termination scheme for the S2070 high-speed serial inputs. The serial inputs are internally dc biased to Vcc –1.3 V. External connections include 0.01 µF AC coupling capacitors and a line-line termination resistor. The termination resistor is required for lines lengths > ~1 cm, which exhibit transmission line effects at these high speeds. The termination must match the characteristic impedance of the differential lines to minimize signal reflections. The 100Ω value shown assumes characteristic line impedance of 50Ω (if the lines are 75Ω, the line-to-line termination resistor should be 150Ω). The AC coupling capacitors allow the dc bias point to be set internally by the input stage. The dc bias can be set externally by implementing a resistor divider network on each line, but this is not recommended since it increases the part count and does not provide performance improvement.

The biasing scheme in Figure 3 should be used for copper interface applications – the pull-up resistor utilized with the S2052 should not be included in the S2070 circuit. FO transceivers require a different approach. When the fiber is disengaged, the noise from the FO device is often nearly as large in amplitude as a good signal. Figure 4 shows a connection to a fiber optic transceiver. The Loss-of-Signal output of the FO transceiver drives the SYNC_EN and –LCK_REF inputs of the S2070. This insures that the PLL will lock to the reference clock and the RBC output clocks will not stretch due to false comma characters. Alternately, the ASIC controller may govern these inputs.

Figure 5 shows the connection diagram for high-speed serial outputs. The 150Ω pull-down resistors set the drive current of the output stage. The value of 150Ω provides compatibility with competing products from other manufacturers. As a CMOS design, the S2070 will perform well with pull-down resistor values as large as 1.5K Ω, which would reduce power consumption on the board. The output stage can drive 30m of twinax cable directly.

Figure 3. High Speed Differential Inputs

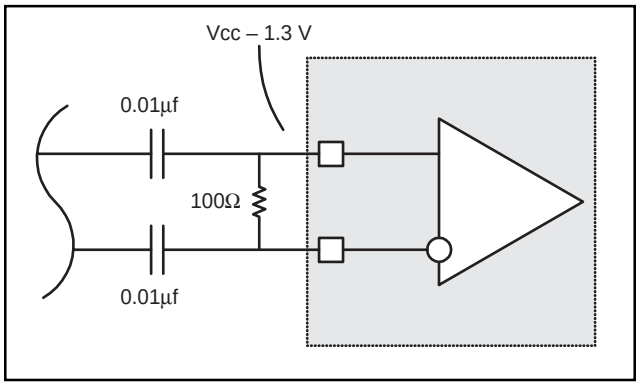


Figure 4. Fiber Optic Transceiver Connection

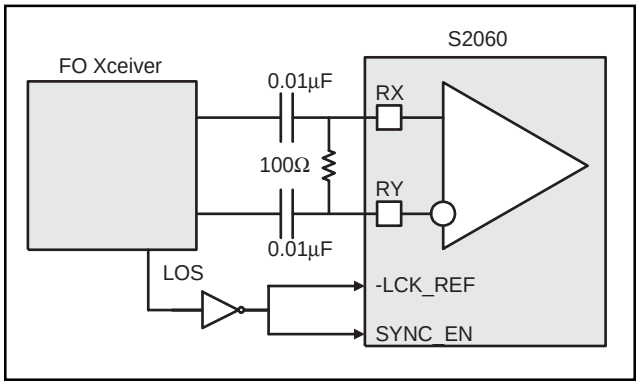
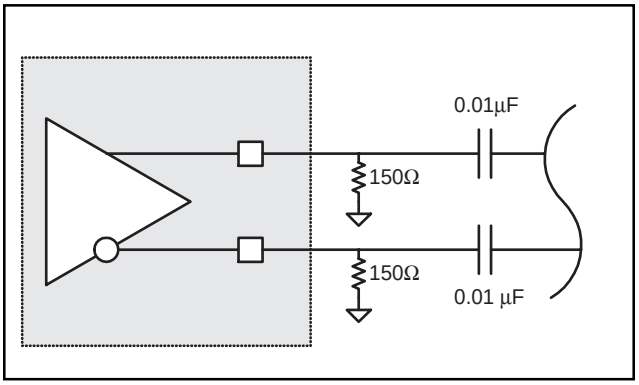


Figure 5. Serial Output Load



Reference Designs

Figure 6 shows a reference design with a 5V MAC. The TBC output of the MAC swings from 0-5 V. The TBC input to the S2070 will not tolerate signals above it's VCC voltage rail, so the TBC signal swing is reduced by using the voltage divider shown in Figure 7. The 43Ω series resistors on the TX and TBC outputs of the MAC provide 50Ω termination (43Ω + ~7Ω output impedance) to dampen any reflections coming from the S2070 inputs. Placing these resistors on TX[0-9] is optional; they should be included if needed for edge rate control or on long lines. These 43Ω resistors should be placed as close to the MAC TBC output as possible.

Figure 7 shows the 3.3V reference design. Note that there is no TBC voltage divider. Also, the Fiber Optic transmitter and receiver may be either dc or AC coupled.

Termination into the Fiber Optic transmitter is shown as 100Ω line-line. Refer to the data sheet or application notes of your FO transmitter of choice for input connection recommendations.

Figure 6. Fibre Channel Application, 5.0V MAC

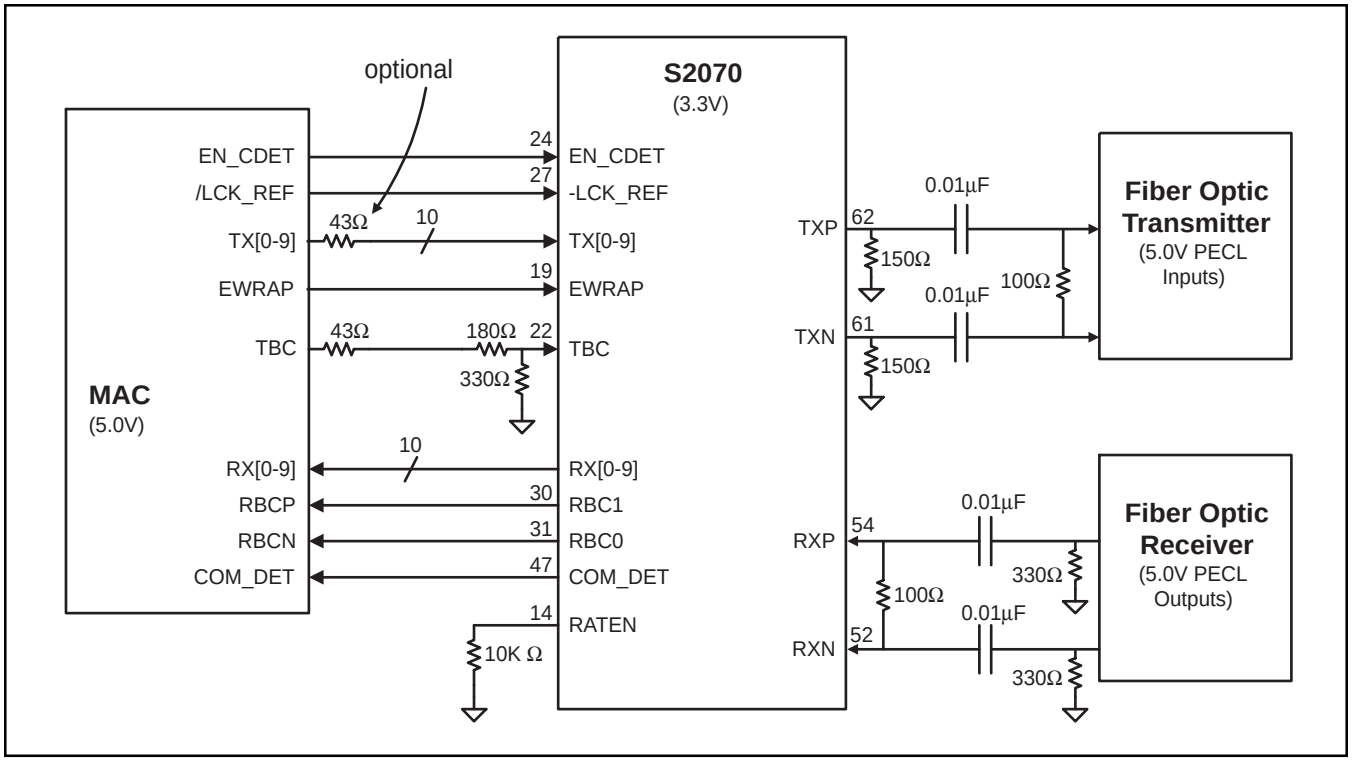
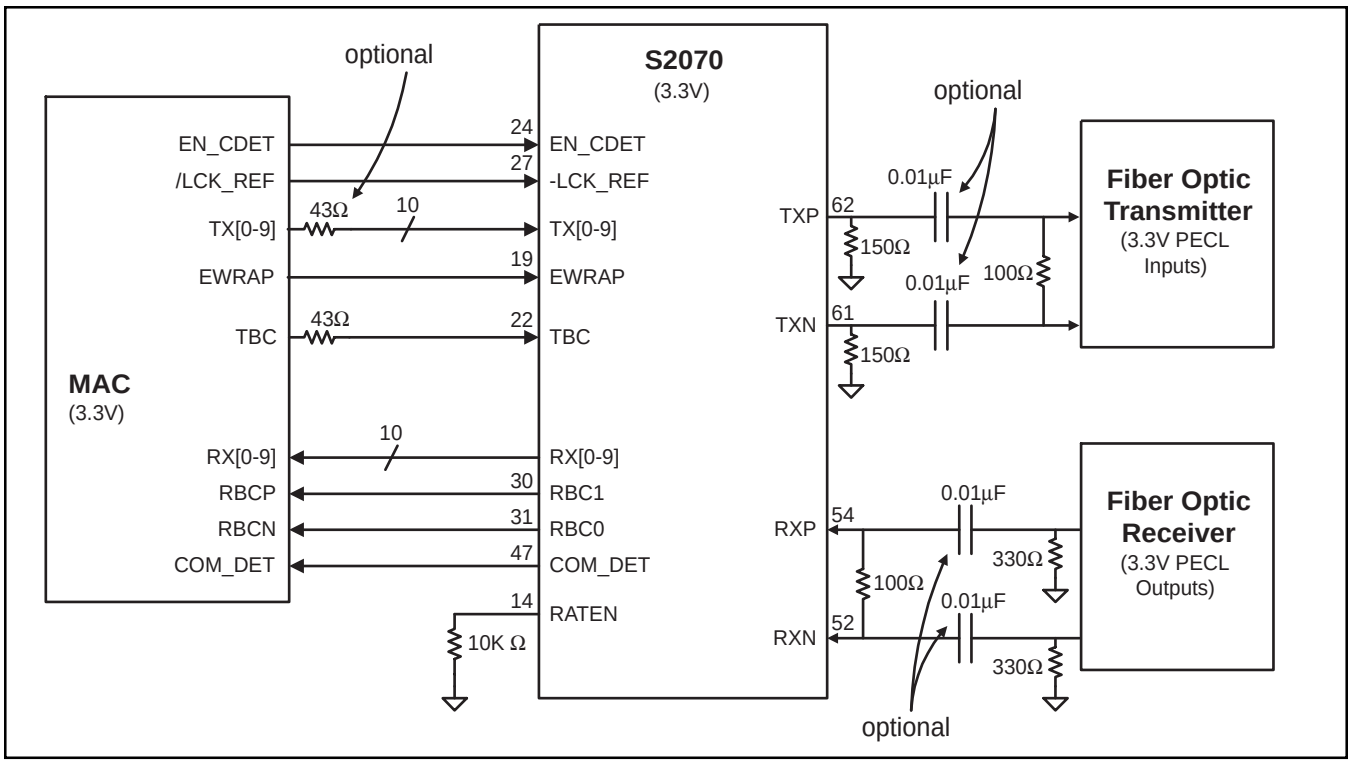


Figure 7. Fibre Channel Application, 3.3V MAC



S2070 Compatibility with Existing Products

The S2070 is the CMOS equivalent of the S2052. The bulleted items below outline the functional differences between the two parts.

- S2070 typical power dissipation is 660 mW. S2052 dissipates 800 mW.
- S2070 serial input bias voltage is VCC–1.3V (standard LVPECL). This complies with both HP and Vitesse.
  S2052 serial input bias voltage is VCC–0.65.
  With the recommended AC coupled input connection, the bias voltage is irrelevant (see previous section on serial input/output connections); however, designers who wish to set the bias voltage externally should take note of the difference in bias voltage.
- S2060 serial input should not have a pull-up offset resistor.
  S2052 pull-up resistor value is 10kΩ (for applications where input data goes away).
- When EWRAP is active, TXP/N outputs are static (High). This complies with the S2052. HP holds both pins High. Vitesse holds the P output High and the N output Low.
- S2070 pin 14 is rate selection pin, held low for normal (full rate) operation. S2052 pin 14 is ground.
- S2070 pin 27 (-LCKREF) can be either floated or held high to lock to input data (normal operation).
  S2052 pin 27 (-LCKREF) must be held high to lock to input data.

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