Claims

[Claim 1]
A reception device comprising:
a terminator;
a data signal receiver circuit configured to receive a data signal and a data blanking signal from a transmission device that is operating in one of a plurality of communication modes, the data blanking signal is received during a blanking period of the data signal;
a clock signal receiver circuit configured to receive a clock signal and a clock blanking signal that is in synchronization with the blanking period of the data signal from the transmission device; and
a determination circuit configured to determine that the transmission device is operating in the one of the plurality of communication modes on a basis of one or both of a signal value of the data blanking signal and a signal value of the clock blanking signal,
wherein a first mode of the plurality of communication modes is a high speed mode,
a second mode of the plurality of communication modes is a low power mode, and
a third mode of the plurality of communication modes is one of a high speed idle mode or an alternative low power mode,
wherein the low power mode comprises a data transmission speed that is lower than a data transmission speed of the high speed mode, and
the low power mode comprises a voltage level that is different than a voltage level of the high speed mode,
wherein the high speed idle mode does not have signal activity during the blanking period, and
responsive to determining that the transmission device is operating in the high speed idle mode, the data signal receiver circuit is further configured to not perform a termination control of the terminator during the blanking period, and
wherein the alternative low power mode does not have signal activity during the blanking period, and
responsive to determining that the transmission device is operating in the alternative low power mode, the data signal receiver circuit is further configured to perform a termination control of the terminator during the blanking period,
wherein the data signal transmitted by the transmission device operating in the first mode or the third mode is a differential signal received as the data blanking signal, and the data signal transmitted by the transmission device operating in the second mode is a single-ended signal, and
wherein the clock signal transmitted by the transmission device operating in the first mode or the third mode is a differential signal received as the clock blanking signal, and the clock signal transmitted by the transmission device operating in the second mode is a single-ended signal.

[Claim 2]
A reception device comprising:
a data signal receiver circuit configured to receive a data signal from a transmission device that operates in a plurality of communication modes via a data lane, the plurality

of communication modes including a first mode, a second mode, and a third mode;
a clock signal receiver circuit configured to receive a clock signal from the transmission device that operates in the plurality of communication modes via a clock lane; and
a determination circuit configured to determine that the transmission device is operating in one of the plurality of communication modes on a basis of a signal value of the data signal and a transition of the clock signal, the transition of the clock signal being indicative of the transmission device transitioning from another mode of the plurality of communication modes to the one of the plurality of communication modes,
wherein the first mode is a high speed mode,
the second mode is a low power mode, and
the third mode is one of a high speed idle mode or an alternative low power mode,
wherein the transition of the clock signal is indicative of the transmission device transitioning from the high speed mode to the low power mode, and
wherein the transmission device is already operating in the low power mode when the transition of the clock signal is indicative of the transmission device transitioning from the high speed mode to the low power mode, or
wherein the transition of the clock signal is indicative of the transmission device transitioning from the high speed mode to the high speed idle mode, and
wherein the transmission device is already operating in the high speed idle mode when the transition of the clock signal is indicative of the transmission device transitioning from the high speed mode to the high speed idle mode, or
wherein the transition of the clock signal is indicative of the transmission device transitioning from the low power mode to the high speed mode, and
wherein the transmission device is not yet operating in the high speed mode when the transition of the clock signal is indicative of the transmission device transitioning from the low power mode to the high speed mode, or
wherein the transition of the clock signal is indicative of the transmission device transitioning from the high speed idle mode to the high speed mode, and
wherein the transmission device is not yet operating in the high speed mode when the transition of the clock signal is indicative of the transmission device transitioning from the high speed idle mode to the high speed mode.

[Claim 3]
The reception device according to claim 2, wherein
the clock signal receiver circuit is further configured to
detect when the clock signal is not received from the transmission device via the clock lane during a period of time, and
responsive to detecting that the clock signal is not received from the transmission device via the clock lane during the period of time, output a first control signal to the determination circuit,
the data signal receiver circuit is further configured to
detect when the signal value of the data signal is a first value,
responsive to detecting when the signal value of the data signal is the first value, output a second control signal to the determination circuit, and
responsive to detecting when the signal value of the data signal is not the first value, output a third control signal to the determination circuit, the third control signal being different than the second control signal, and

the determination circuit is further configured to
receive the first control signal, the second control signal, and the third control signal, and
determine the transmission device is operating in the one of the plurality of communication modes on a basis of receiving the first control signal and the second control signal or receiving the first control signal and the third control signal.

[Claim 4]
The reception device according to claim 3, wherein
the clock signal receiver circuit includes a counter that is configured to count a second clock signal that is different than the clock signal, and
to detect when the clock signal is not received from the transmission device via the clock lane during the period of time, the clock signal receiver circuit is further configured to control the counter to count a plurality of clock transitions of the second clock signal that exceeds the period of time.

[Claim 5]
A transmission device comprising:
a data signal transmitter circuit configured to
operate in a plurality of communication modes to transmit a data signal to a reception device via a data lane, and
transmit a data blanking signal in a blanking period of the data signal to the reception device via the data lane;
a clock signal transmitter circuit configured to transmit a clock signal and a clock blanking signal in synchronization with the blanking period of the data signal to the reception device via a clock lane; and
a blanking controller configured to control one or both of a signal value of the data blanking signal and a signal value of the clock blanking signal to indicate that the data signal transmitter circuit is operating in the one of the plurality of communication modes,
wherein a first mode of the plurality of communication modes is a high speed mode,
a second mode of the plurality of communication modes is a low power mode, and
a third mode of the plurality of communication modes is one of a high speed idle mode or an alternative low power mode,
wherein the low power mode comprises a data transmission speed that is lower than a data transmission speed of the high speed mode, and
the low power mode comprises a voltage level that is different than a voltage level of the high speed mode,
wherein the data signal transmitted by the data signal transmitter circuit operating in the first mode or the third mode is a differential signal transmitted as the data blanking signal,
the data signal transmitted by the data signal transmitter circuit operating in the second mode is a single-ended signal,
the clock signal transmitted by the clock signal transmitter circuit, when the data signal transmitter circuit is operating in the first mode or the third mode, is a differential signal transmitted as the clock blanking signal, and

the clock signal transmitted by the clock signal transmitter circuit, when the data signal transmitter circuit, is operating in the second mode is a single-ended signal.

[Claim 6]
A communication system, comprising:
the transmission device of claim 5, and
the reception device of claim 1.

[Claim 7]
A signal reception method, the method comprising:
receiving, with a data signal receiver circuit of a reception device, a data signal and a data blanking signal from a transmission device that is operating in one of a plurality of communication modes via a data lane, the data blanking signal is received during a blanking period of the data signal;
receiving a clock signal and a clock blanking signal that is in synchronization with the blanking period of the data signal from the transmission device; and
determining that the transmission device is operating in the one of the plurality of communication modes on a basis of one or both of a signal value of the data blanking signal and a signal value of the clock blanking signal,
wherein a first mode of the plurality of communication modes is a high speed mode,
a second mode of the plurality of communication modes is a low power mode, and
a third mode of the plurality of communication modes is one of a high speed idle mode or an alternative low power mode,
wherein the low power mode comprises a data transmission speed that is lower than a data transmission speed of the high speed mode, and
the low power mode comprises a voltage level that is different than a voltage level of the high speed mode,
wherein the high speed idle mode does not have signal activity during the blanking period, and
responsive to determining that the transmission device is operating in the high speed idle mode, the data signal receiver circuit is further configured to not perform a termination control of a terminator during the blanking period, and
wherein the alternative low power mode does not have signal activity during the blanking period, and
responsive to determining that the transmission device is operating in the alternative low power mode, the data signal receiver circuit is further configured to perform a termination control of the terminator during the blanking period, wherein
the data signal transmitted by the transmission device operating in the first mode or the third mode is a differential signal received as the data blanking signal, and
the data signal transmitted by the transmission device operating in the second mode is a single-ended signal, and
wherein the clock signal transmitted by the transmission device operating in the first mode or the third mode is a differential signal received as the clock blanking signal, and
the clock signal transmitted by the transmission device operating in the second mode is a single-ended signal.

[Claim 8]

A signal transmission method, the method comprising:
operating, with a data signal transmitter circuit of a transmission device, in one of a plurality of communication modes to transmit a data signal to a reception device via a data lane;
responsive to operating in the one of the plurality of communication modes, controlling one or both of a signal value of a data blanking signal and a signal value of a clock blanking signal to be indicative of the one of the plurality of communication modes;
transmitting the data blanking signal to the reception device during a blanking period of the data signal via the data lane; and
transmitting a clock signal and the clock blanking signal in synchronization with the blanking period of the data signal to the reception device via a clock lane,
wherein a first mode of the plurality of communication modes is a high speed mode,
a second mode of the plurality of communication modes is a low power mode, and
a third mode of the plurality of communication modes is one of a high speed idle mode or an alternative low power mode,
wherein the low power mode comprises a data transmission speed that is lower than a data transmission speed of the high speed mode, and
the low power mode comprises a voltage level that is different than a voltage level of the high speed mode,
wherein the data signal transmitted by the data signal transmitter circuit operating in the first mode or the third mode is a differential signal transmitted as the data blanking signal, the data signal transmitted by the data signal transmitter circuit operating in the second mode is a single-ended signal,
the clock signal transmitted by the clock signal transmitter circuit, when the data signal transmitter circuit is operating in the first mode or the third mode, is a differential signal transmitted as the clock blanking signal, and
the clock signal transmitted by the clock signal transmitter circuit, when the data signal transmitter circuit, is operating in the second mode is a single-ended signal.

[Claim 9]
A communication method, the method comprising:
the signal transmission method of claim 8 and the signal reception method of claim 7.