Differences between the AT7910E-KB-ER and the AT7910E-KB-E

The AT7910E-KB-ER (new) is functionally equivalent to the AT7910E-KB-E (original) device. However, the specification for the LVDS output common mode voltage has changed. The effect of this is to reduce the common-mode voltage tolerance of the SpaceWire link that the new device is driving, i.e. the tolerance to any potential difference between the grounds of the two units connected by the SpaceWire link.

Device differences

The differences between the AT7910E-KB-ER and AT7910E-KB-E LVDS output buffer specification is listed in Table 1 below.

Table 1 Electrical specification differences between the AT7910E-KB-E (original) and AT7910E-KB-ER (new)

	AT7910E-KB-E (original)	AT7910E-KB-ER (new)	Units
VOS Min (1)	800	600	mV
VOS Max (1)	1568	1840	mV

1. VOS is the output common voltage relative to ground as shown in Figure 1.

The differences in the output electrical characteristics are shown in Figure 1 below.

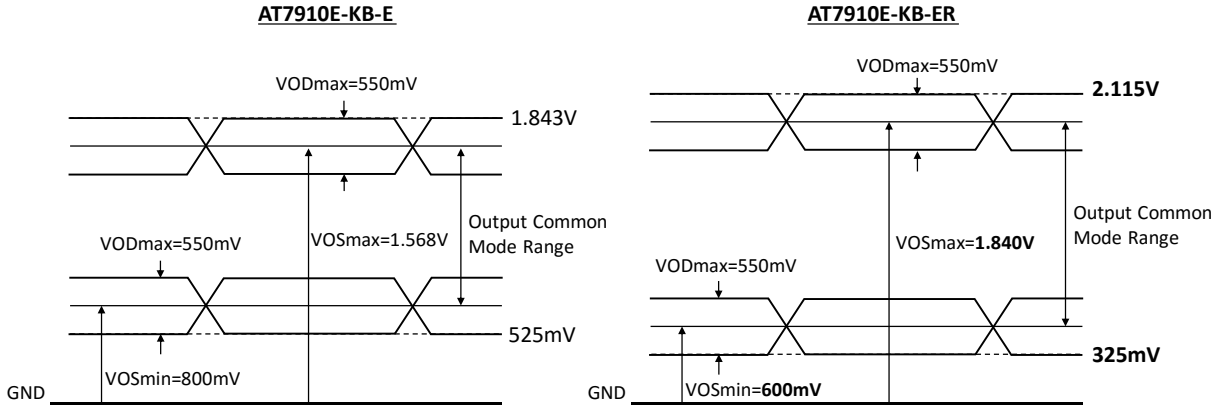

Figure 1 Electrical specification differences between the AT7910E-KB-E and AT7910E-BK-ER

The extreme cases where VOS=max and VOS=min are listed in Table 2 below.

Table 2 Minimum and maximum output voltages of the AT7910E-BK-ER device

	Min	Max	Units
Minimum output voltage	325		mV
Maximum output voltage		2.115	V

Recommendations

This section deals with the absolute and recommended common mode voltage differences between the transmitter and receiver when a device is connected to the AT7910E-BK-ER.

Consider the maximum and minimum voltages that can be applied to the device at the far-end, both absolute and recommended. The LVDS receiver specification provided by the AT7910E-KB-ER is used as an example, but may be different for other devices, see Table 3 below.

Table 3 Absolute maximum ratings and recommended operating conditions of the AT7910E-KB-ER

	Min	Max	Units
Operating supply voltage	3.0	3.6	V
Absolute maximum voltage applied to any i/o	-0.5	Vcc+0.5	V
LVDS Input common mode voltage	0.05	2.35	V
LVDS input differential voltage	100		mV

The voltage applied to the receiver in the extreme cases where VOS=1.84V (max) and VOS=600mV (min) are shown in Figure 2 below. The SpaceWire LVDS specification requires a tolerance of +/- 1V between the ground voltages of the transmitter and receiver.

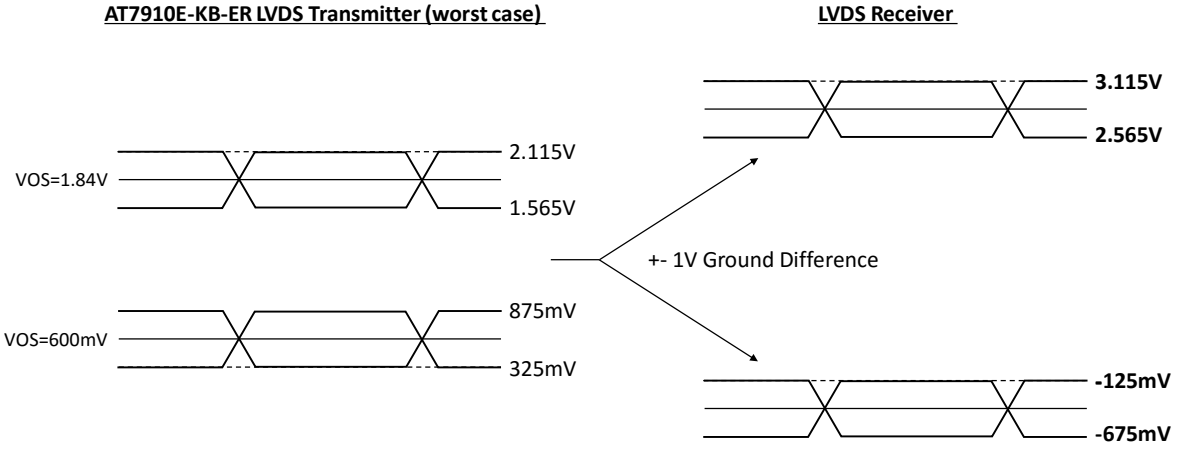

Figure 2 Voltage at receiver

As shown in Figure 2, the difference between the maximum and the minimum common mode voltages at the receiver with +/- 1V of ground difference applied will exceed the absolute maximum ratings for LVDS receivers which have an absolute minimum voltage of -0.5V, including the AT7910E device.

The allowable ground potential difference between the transmitter at the near-end of a link and the receiver at the far-end, which meets the absolute maximums of the AT7910E-BK-ER device, are listed in Table 4 below.

Table 4 Allowable ground potential differences to meet absolute maximum ratings (AT7910E example)

	Min	Max	Units
Allowable ground potential difference when VOS=600mV		-825	mV
Allowable ground potential difference when VOS=1.84V		+1.385	V

The allowable ground potential difference between of the transmitter and receiver which meet the recommended operating conditions of the AT7910E-BK-ER device are listed in Table 5 below.

Table 5 Allowable ground potential differences to meet recommended operating conditions (AT7910E example)

	Min	Max	Units
Recommended ground potential difference when VOS=600mV		-550	mV
Recommended ground potential differences when VOS=1.84V		+235	mV

This is well under the +/- 1 V allowable ground potential difference required by SpaceWire.

Other devices typically have a lower maximum operating I/O voltage of -0.3V to Vcc + 0.3 V.

In this case, when connected to an AT7910E-KB-ER, the allowable maximum ground potential difference between the transmitter and receiver will be +1.185V to -525 mV. The recommended operating conditions of the receiving device should be considered to ensure correct operation.

It is also possible that the AT7910E-KB-ER is connected to a receiver which has Vcc = 2.5 V.
In this case, using the maximum operating I/O voltage of -0.3V to Vcc + 0.3 V, the allowable absolute ground potential difference between the transmitter and receiver would be reduced to +685 to -525 mV. This could be reduced further if the + 2.5V supply is at a lower acceptable value of, say 2.2 V. The ground potential difference tolerance is then +385 to -525 mV. Note: This may be acceptable if the LVDS driver and receiver are on the same board or in the same unit, but will almost certainly result in damage if the link is between units. The recommended operating conditions of the receiving device should be considered to ensure correct operation.

Recent LVDS receiver devices have enhanced common mode voltage, for example the STM RHFLVDS32A, has a -4 to +5 V tolerance when supplied with Vcc = 3.0 to 3.6 V. In this case there is no problem using the AT7910E-KB-ER.

When using SpaceWire it is always important to make sure that the ground potential difference (common mode voltage) between the two units connected by a link is as low as possible and in all cases less than +/- 1 V as specified in the SpaceWire standard.

The following recommendation are made when using the AT7910E-KB-ER:

1. Be aware of the reduced common-mode voltage tolerance.
2. If running the SpaceWire links across a board or inside a unit, it is possible to connect the AT7910E-KB-ER to other LVDS devices which are operating with Vcc at 3.3V or 2.5V.
3. It is better to use 3.3V LVDS devices at the far-end of a link driven by the AT7910E-KB-ER.
4. If driving external SpaceWire links, it is a recommended to use external LVDS buffers.
5. When using external LVDS buffers, it is better to use those with extended common-mode voltage tolerance (e.g. -4V to + 5V for a device with Vcc = 3.0V to 3.6V).
6. In all cases, go through the common-mode voltage calculations to make sure that there is not going to be an issue.

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