Description

The ISL3178AE is a 3.3V based RS-485 MIL temperature rated transceiver aimed at addressing applications that require high operating temperatures. The receiver inputs A and B are presented in pins 6 and 7; when $\overline{RE}$ is low, this differential input signal is processed and available at the RO pin. The Driver input is presented at pin 4 and the driver differential outputs Z and Y are available at pins 6 and 7 respectively when DE is high. This Application Note aims at characterizing the device at temperatures from +125°C to +200°C.

Device Pinout

ISL3178AE
(8 LD SOIC)
TOP VIEW

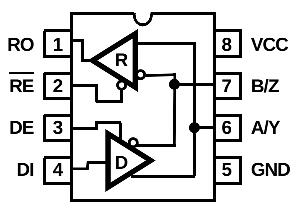

Figure 1 shows the evaluation board schematic. The device evaluation board is common to TX and RX. The mode of operation is determined by the logic presented to the DE and $\overline{RE}$ pins.

RX High Temperature Test

Figure 2 shows the High temperature test setup. The board wired up as the transmitter is called the EVALB TX and the one wired the receiver is called the EVALB RX. The differential lines were hooked up through 200ft. of twisted pair cable terminated on either side by 120Ω. The V_{IN} was set to a worst case of 4.5V. The driver input of the EVALB TX is connected to a function generator capable of providing fast rise and fall times. The function generator output was set to provide a burst mode of five pulses at a bit rate of 10Mbps.The RX device was wired up with two thermocouples one placed on the device case top and the the other placed on the PWB near the GND pin. The RX device was heated using a temperature forcing system from +25°C to +200°C. The Rx showed one threshold point.

At a Data rate of 10Mbps:

1. The pulse width 70% threshold is at a die temp of min. = +190°C and max. = +196°C while operating at a data rate of 10Mbps.

This is based on a sample size of 15pcs. and a six sigma distribution.

TX High Temperature Test

The TX was tested using a the EVALB TX portion of Figure 2. The 200ft cable was disconnected and terminations of 100Ω and 54Ω were connected based on test requirement. The parameters tested were: Driver differential output voltage, propagation delay, and skew. The results are per the “Typical Performance Curves” on page 2.

Supply Current vs High Temperature

The supply current is found to have a knee at around +195°C, and increases rapidly thereafter. The supply current with (driver enabled) DE high is typically around 517µA. This value increases to about 1143.5µA at +240°C. With DE connected to GND (driver disabled) the supply current drops to about 400µA typical. The value of supply current increases from a temperature of +200°C and higher to about 605.6µA.

Driver Input vs High Temperature

The Driver input did not latchup at a V_{IN} = 3.0V up to +220°C. This is likely because the device V_{IN} is below the holdoff.

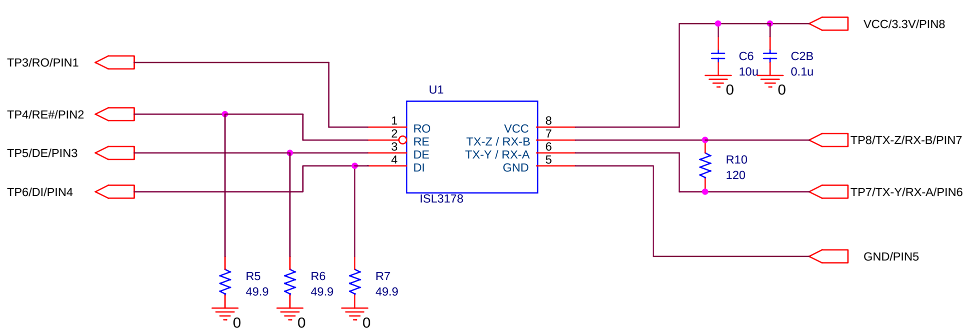

FIGURE 1. EVALUATION BOARD SCHEMATIC

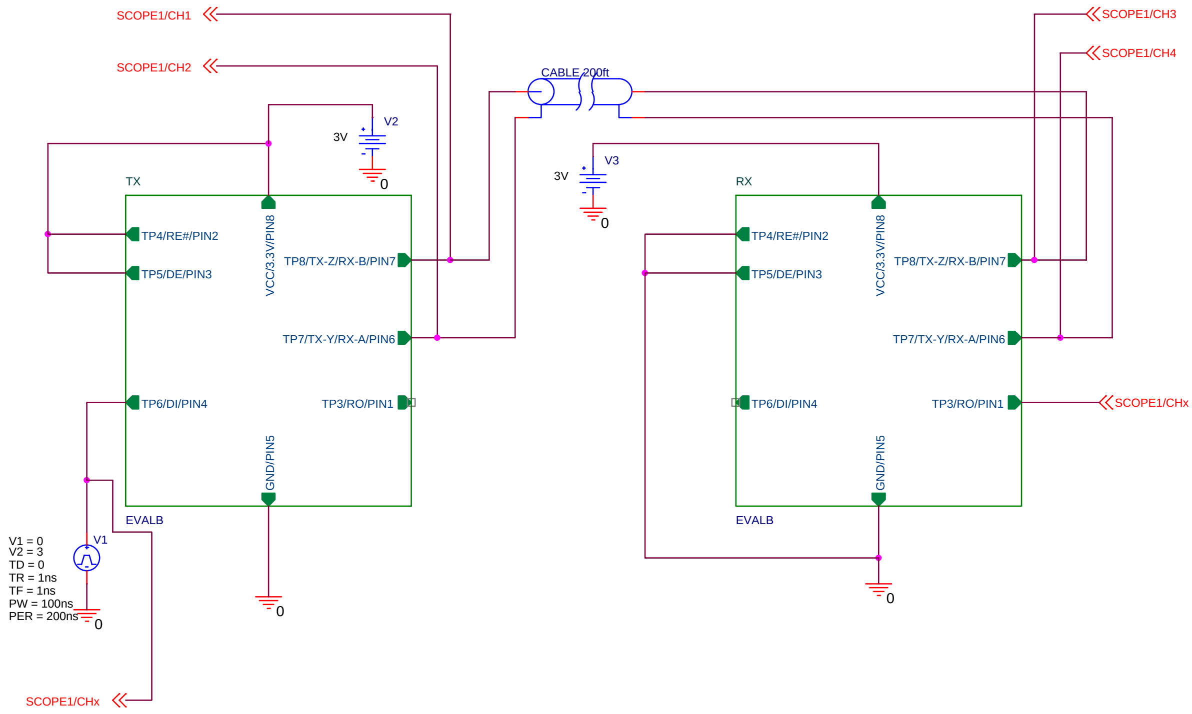

FIGURE 2. HIGH TEMPERATURE SETUP

Typical Performance Curves

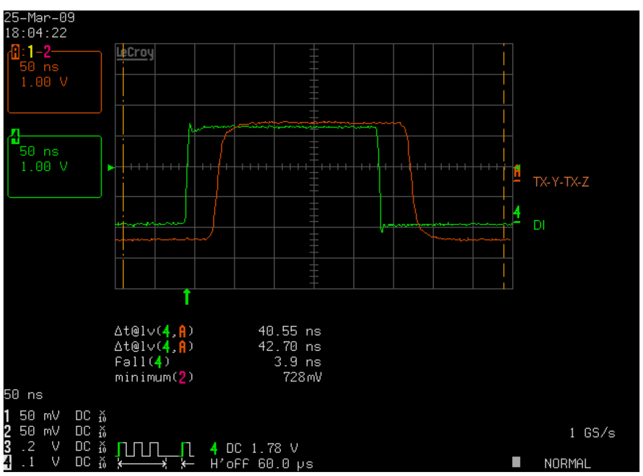

FIGURE 3. T_{PLH} AND T_{PHL} AT A DIE TEMPERATURE OF +231°C

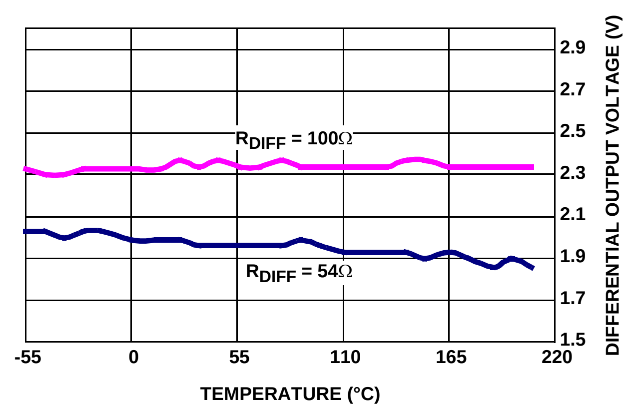

FIGURE 4. DRIVER DIFFERENTIAL OUTPUT VOLTAGE vs TEMPERATURE

Typical Performance Curves (Continued)

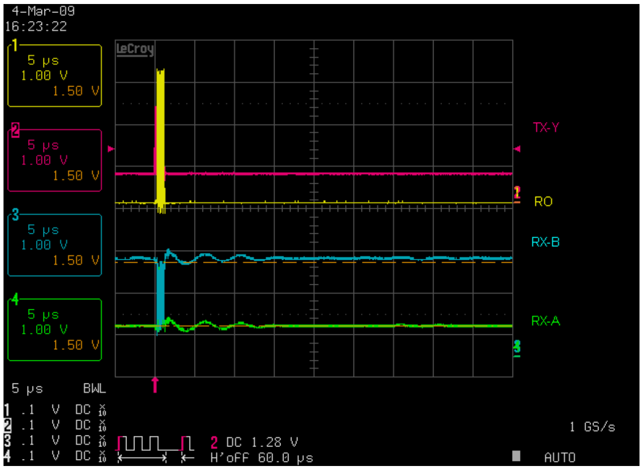

FIGURE 5. COMPRESSED TIMESCALE TO SHOW RINGING AT THE RX INPUT AT +202°C

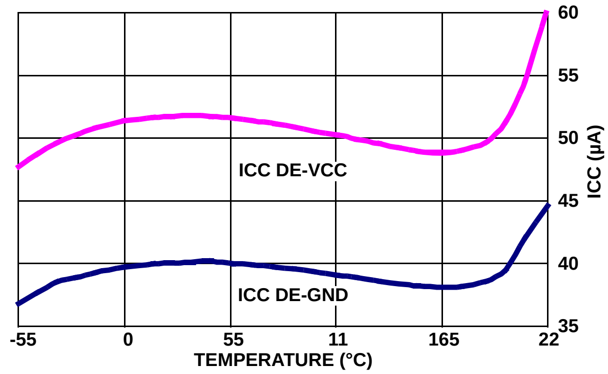

FIGURE 6. SUPPLY CURRENT vs TEMPERATURE

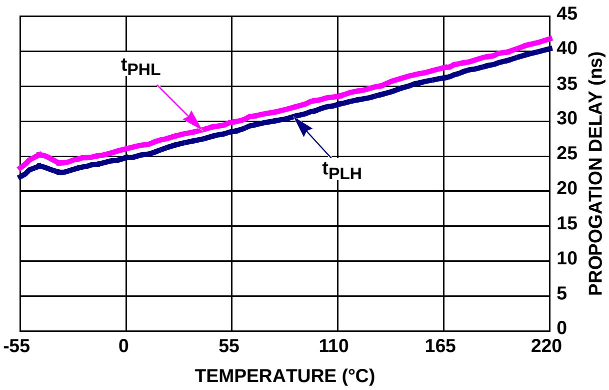

FIGURE 7. DRIVER DIFFERENTIAL PROPAGATION DELAY vs TEMPERATURE

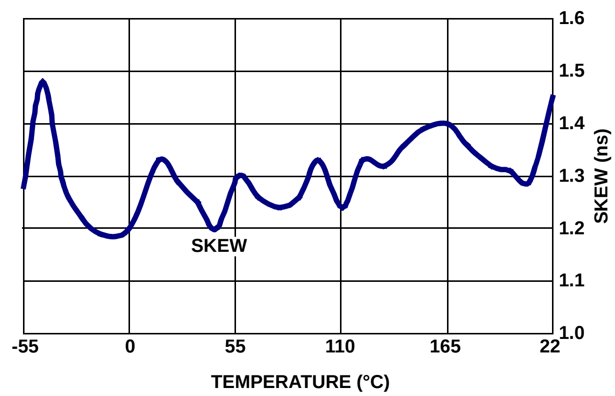

FIGURE 8. DRIVER DIFFERENTIAL SKEW vs TEMPERATURE

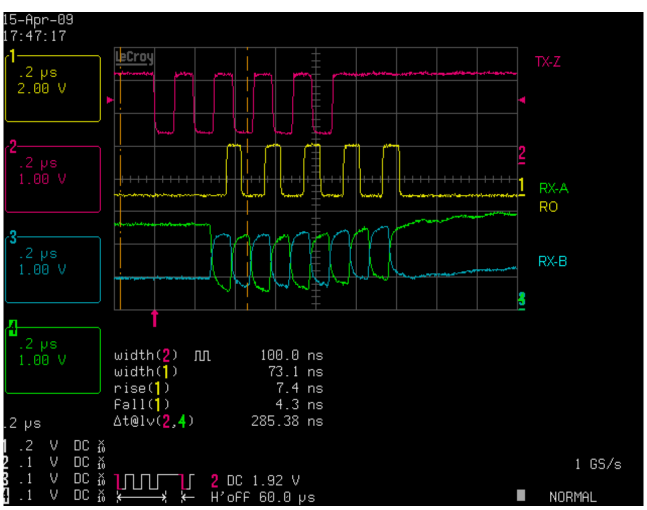

FIGURE 9. TX/RX WAVEFORM AT +194.2°C TYP, 10Mbps AND V_{IN} = 3.0V

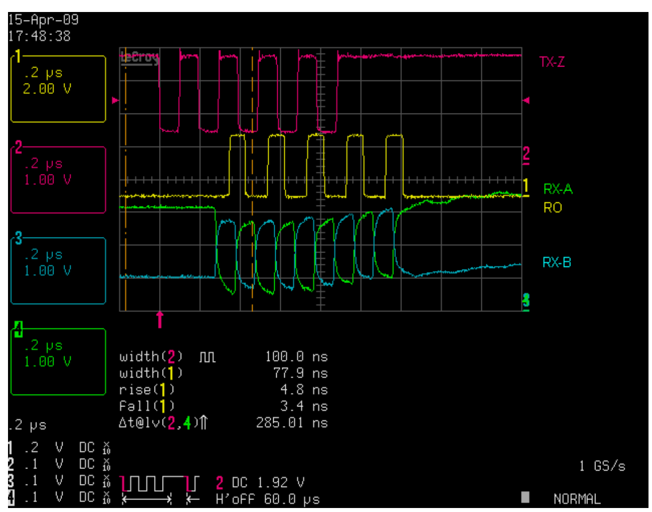

FIGURE 10. TX/RX WAVEFORM AT +194.2°C TYP, 10Mbps AND V_{IN} = 3.0V