= 7.0 V. The output optical signal was amplified again and collected by an Agilent DCA after optical filter. The measured electro-optics bandwidth reaches 25.6 GHz under $V_{bias} = -5.0$ V and the data rate of the eye diagram reaches 50-Gb/s with an extinction ratio of 5.56 dB as shown in Fig. 5(a) and Fig. 5(b). The measurement eye diagram comes from the silicon modulator with doping profile show in the Fig. 1 which has a phase shifter efficiency of $V_\pi \cdot L_\pi = 26.7$ V·mm. Higher dynamic extinction ratio at 50-Gb/s is achieved with the doping level under $V_\pi \cdot L_\pi = 22.0$ V·mm as shown in Fig. 5(c).

4. Conclusion

We demonstrate high speed silicon MZI modulator with 50.1-Gb/s data rate and 5.56 dB extinction ratio. The measured phase shifter optical loss is 1.04 dB/mm with a modulation efficiency ($V_\pi \cdot L_\pi$) of ~26.7 V·mm at $V_{bias} = -6.0$ V. The modulation efficiency, phase shifter loss and switching speed have a close relation with each other. V_{bias} and doping profile of the phase shifter has to be reasonably chosen in order to achieve the ideal performance of the silicon optical modulator depending on different requirement. Compensation doping method and traveling-wave electrodes will be the mainly two approaches in order to further optimizing the loss and switching speed of the reversed PN junction MZI silicon optical modulator.

#182310 - $15.00 USD Received 21 Dec 2012; revised 6 Mar 2013; accepted 6 Mar 2013; published 16 May 2013