Evaluation Metric	Gain		BW		PM		FoM	
	RMSE ↓	Pearson's r ↑	RMSE ↓	Pearson's r ↑	RMSE ↓	Pearson's r ↑	RMSE ↓	Pearson's r ↑
CktGNN	0.682 ± 0.004	0.723 ± 0.003	**0.596 ± 0.009**	**0.806 ± 0.008**	0.993 ± 0.002	0.288 ± 0.009	**0.597 ± 0.009**	**0.806 ± 0.007**
DAGNN	**0.409 ± 0.002**	**0.911 ± 0.003**	0.639 ± 0.002	0.778 ± 0.003	**0.947 ± 0.004**	**0.412 ± 0.004**	0.639 ± 0.002	0.778 ± 0.003
D-VAE	0.467 ± 0.004	0.881 ± 0.003	0.756 ± 0.003	0.667 ± 0.002	0.999 ± 0.004	0.265 ± 0.003	0.755 ± 0.004	0.668 ± 0.003

Table 1: Predictive performance on Ckt-Bench101. Shown is the mean ± s.d. of 10 runs with different random seeds. **Best results** are highlighted. FoM characterizes the quality of the circuit, and it is the metric to optimize in most circuit optimization. Gain, be, pm are other circuit properties.

Methods	Valid DAGs (%) ↑	Valid circuits (%) ↑	Novel circuits (%) ↑	Reconstruction (Acc) ↑
CktGNN	93.10	**91.92**	96.34	**0.453**
DAGNN	**98.81**	37.96	**98.67**	0.180
D-VAE	89.75	39.53	96.78	0.149

Table 2: Effectiveness in real-world electronic circuit design. Overall, the valid circuits proportion plays the most critical role in real-world circuit optimization through Bayesain optimization.

	Bohamiann search		DNGO search	
Methods	Best FoM (detected) $\uparrow$	Regret $\downarrow$	Best FoM (detected) $\uparrow$	Regret $\downarrow$
CktGNN	**175.85 $\pm$ 11.26**	**21.37 $\pm$ 11.26**	**163.29$\pm$ 16.57**	**33.94 $\pm$ 16.57**
DAGNN	168.61 $\pm$ 11.25	28.62 $\pm$ 11.25	162.58 $\pm$ 15.33	34.65 $\pm$ 15.33
D-VAE	154.21 $\pm$ 14.83	43.02 $\pm$ 14.83	152.72 $\pm$ 20.62	44.51 $\pm$ 20.62

Table 3: Bayesian optimization results on Ckt-Bench301. Shown is the mean ± s.d. of 20 runs with different random seeds. **Best results** are highlighted. Best FoM (detected) is the FoM of the circuit detected by the searching algorithm, while regret is the difference of it and the oracle optimal FoM.