



## Low Cost Ternary Content Addressable Memory Using Adaptive Match-line Discharging Scheme

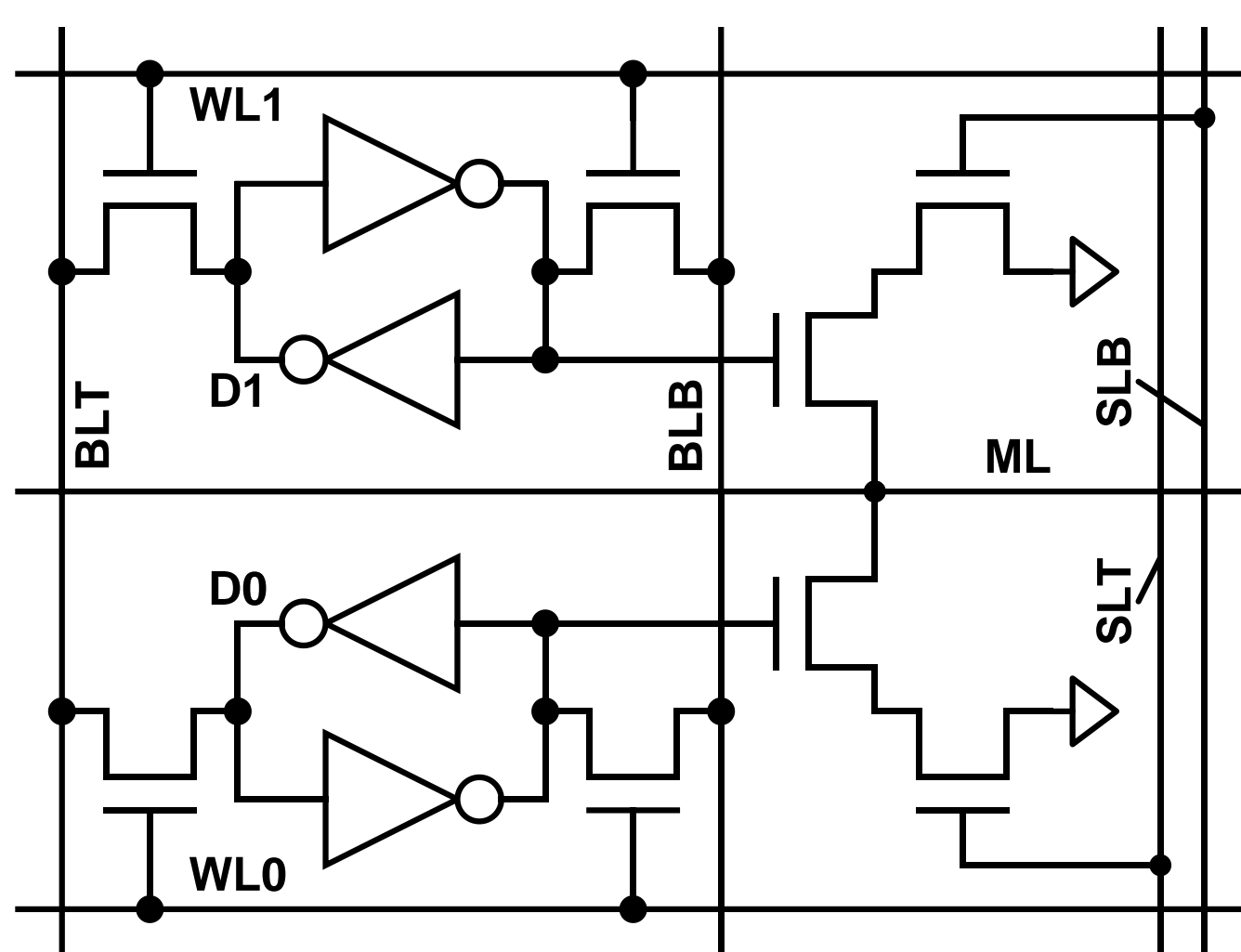
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### Abstract

This paper presents an adaptive match-line (ML) discharge scheme for low-power, high-performance, and compact ternary content addressable memory (TCAM). In the proposed TCAM, the transposed cell topology enables the selectively controlled ML pull-down path and compact array area. By employing the adaptive ML discharge and ML boosting scheme, unnecessary ML discharge and redundant SL switching are eliminated for low-cost TCAM search operation. In order to minimize ML voltage swing at a wide voltage range, a timing calibration scheme is also adopted in the proposed TCAM. A 128 × 64 test chip implemented with 65nm CMOS technology shows that the proposed adaptive ML discharge improves up to 69% of search delay and saves 37% of search energy compared to the conventional approach at 1.1V, 100MHz. The measurement result shows energy efficiency of 0.6 fJ/Bit/Search and 8% improvement of FoM (energy/bit/search) compared with the state-of-the-art works.

### Background

- TCAM is used in the applications such as processor cache, and network routers with fast parallel search. However, It has drawback of large power consumption inducing large heats.

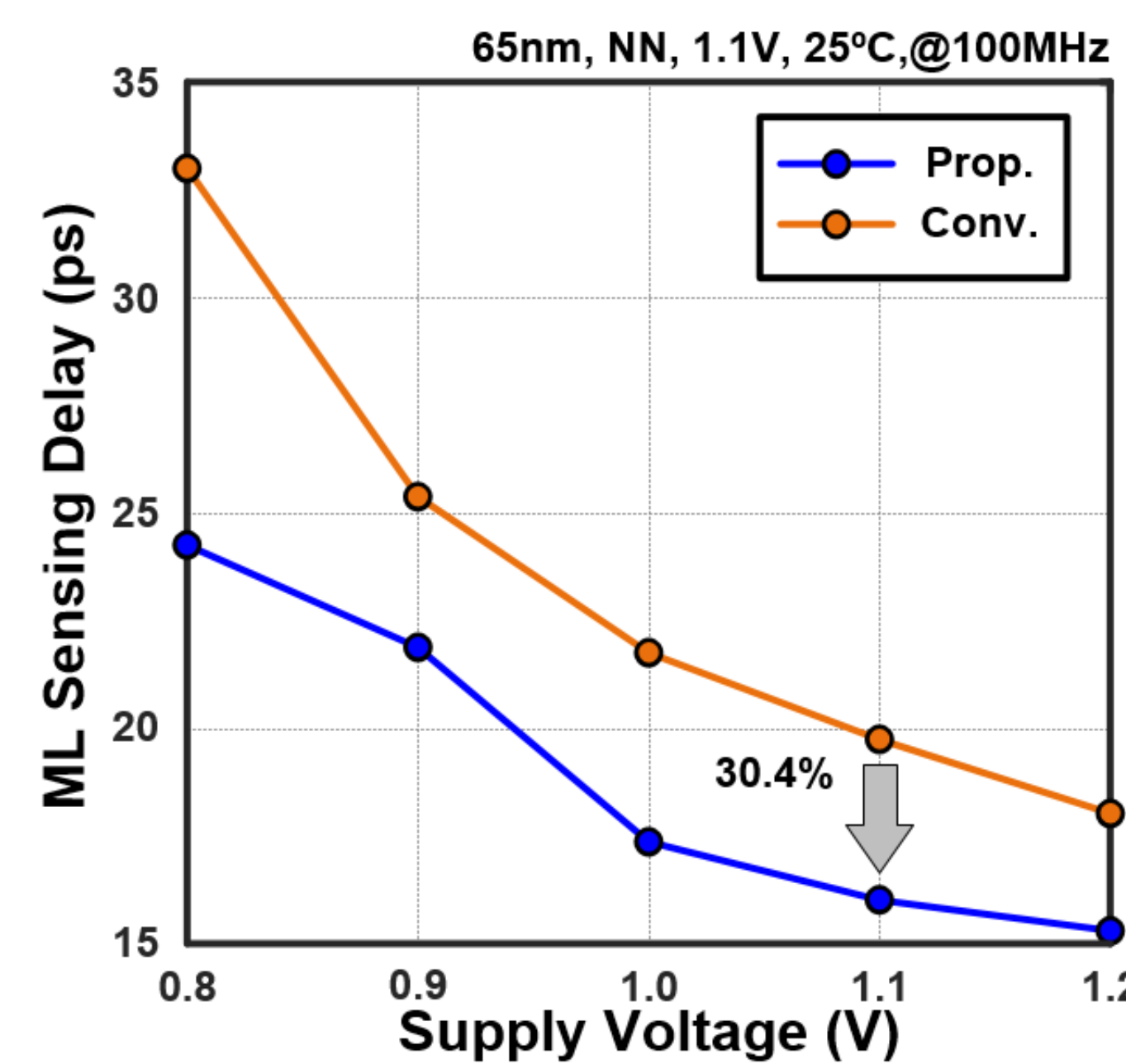


16T NOR type TCAM cell

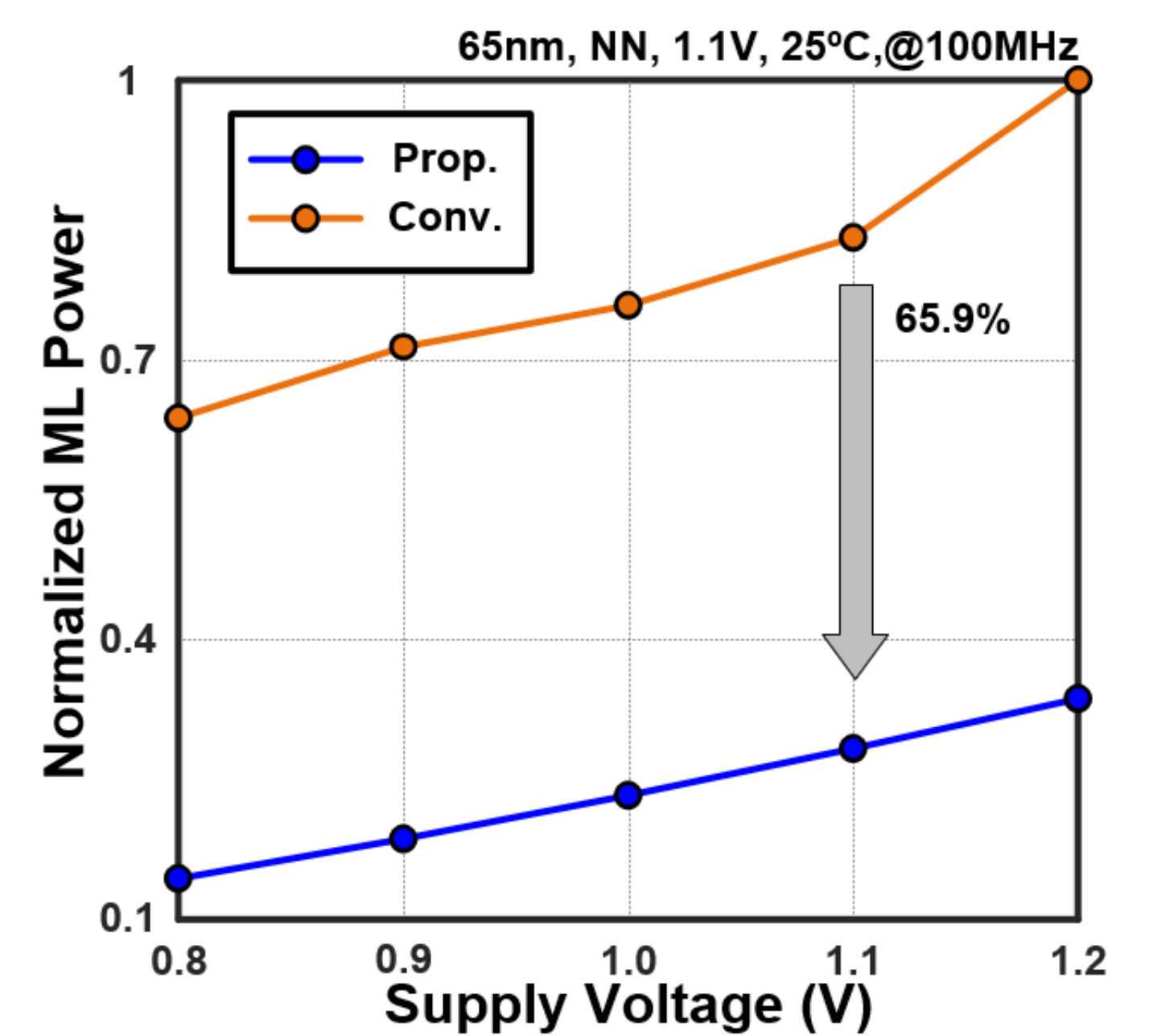
Value	D0	D1	SLT	SLB	ML to VSS
0	0	1	0	1	off
			1	0	on
1	1	0	0	1	on
			1	0	off
X	1	1	0	1	off
			1	0	off

Truth table of TCAM cell

### Simulation results

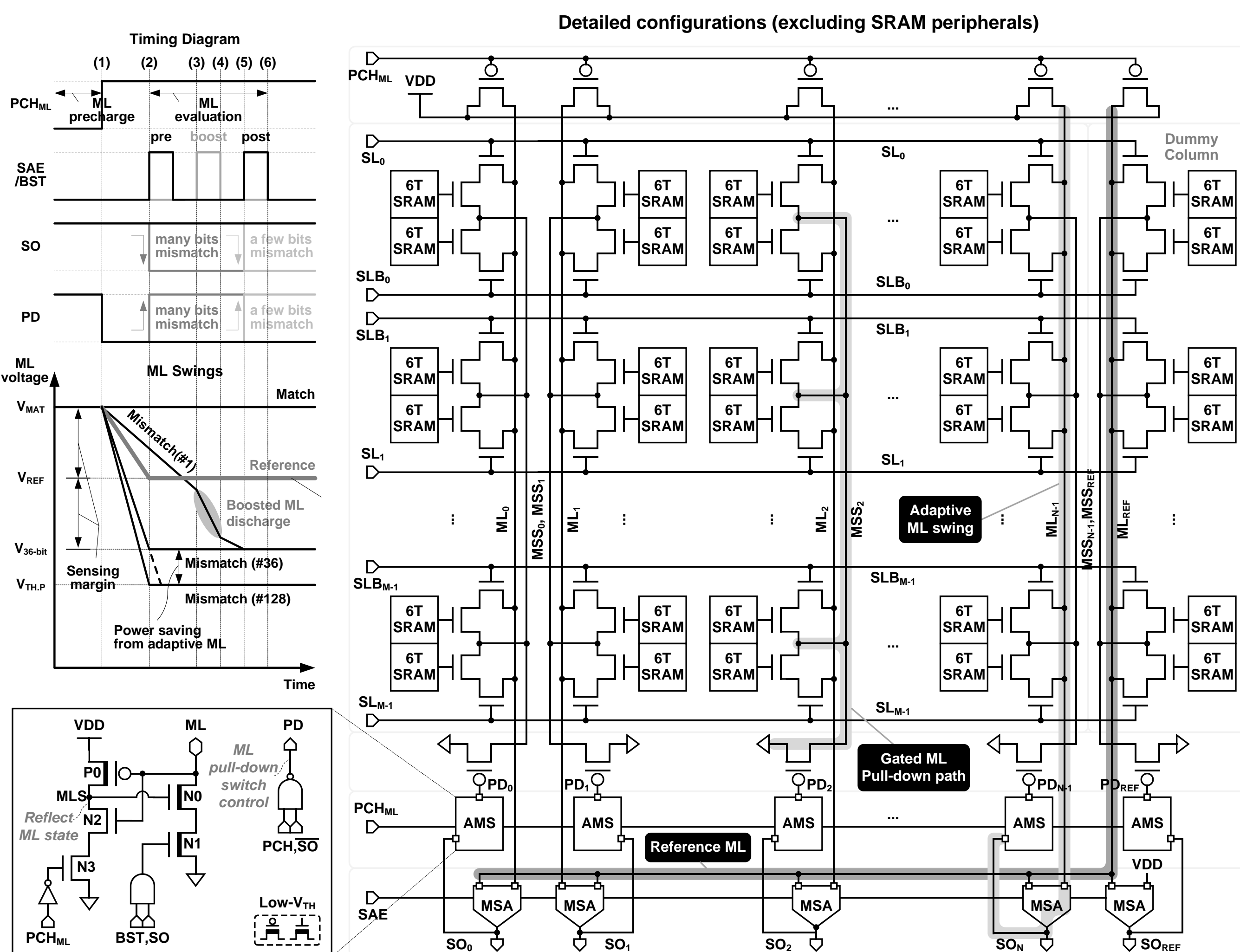


Sensing delay comparison



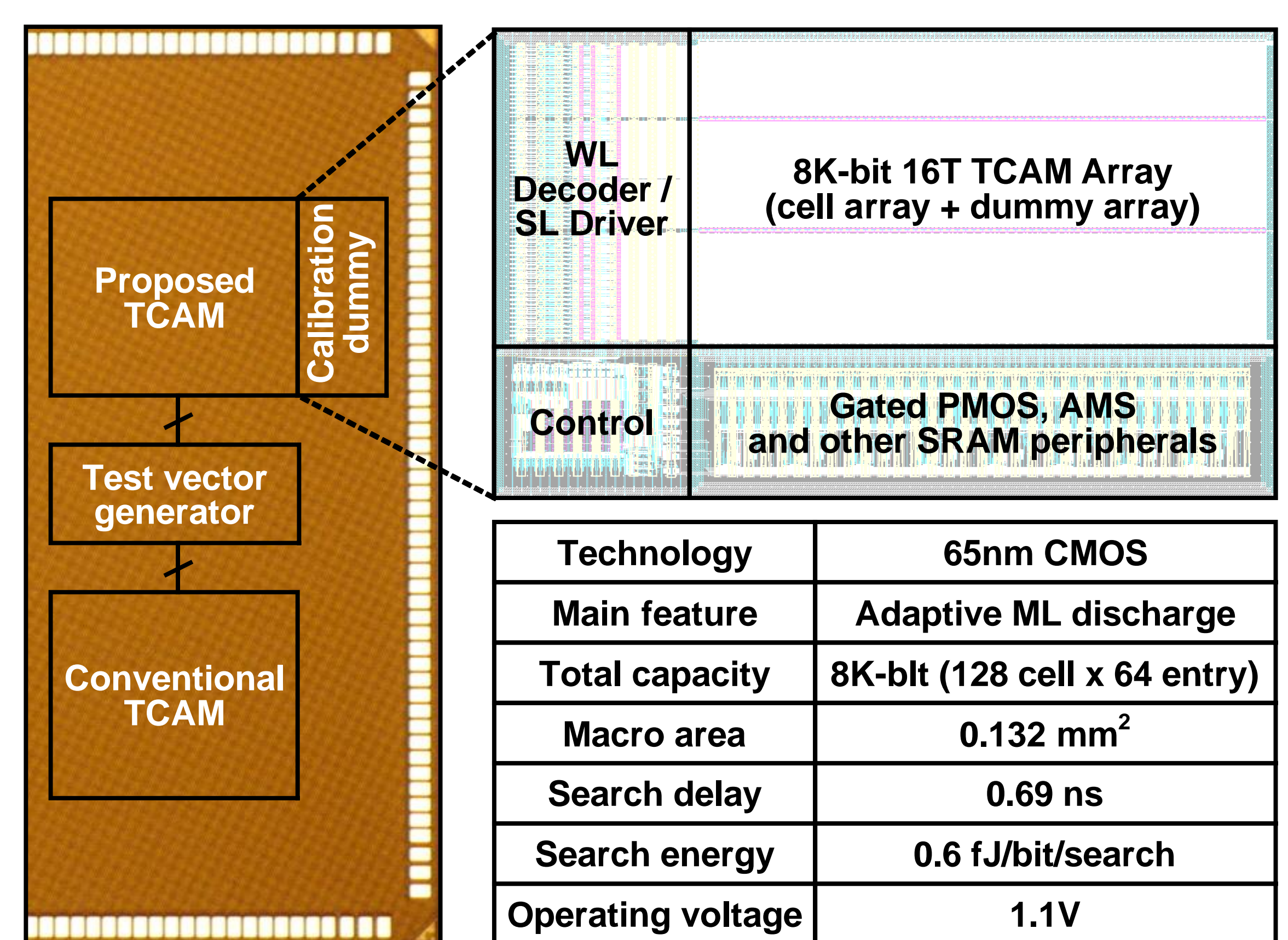
ML power comparison

### Main contribution



- Low-power, high performance, and compact ternary content addressable memory (TCAM) with Adaptive match-line (ML) discharge scheme is presented.
- Adaptive ML discharge and ML boosting scheme eliminate unnecessary ML discharge and redundant SL switching in TCAM search operation.

### Chip Implementation



### Conclusion

The 128×64 (8Kb) TCAM prototype chip is implemented with 65nm CMOS technology. Compared to the conventional TCAM, the proposed adaptive ML discharge technique shows 39% saving of search energy and 69% reduction of search delay at nominal supply voltage (1.1V). Compared with the state-of-the-art works, the proposed TCAM achieves 0.69ns search delay, 0.6 fJ/bit/search at 100MHz, and 8% improvement of nominalized FoM.

Acknowledgement : The chip fabrication and EDA tool were supported by the IC Design Education Center(IDEC), Korea.