Towards an ultra-low power, high density and non-volatile Ternary CAM

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Abstract

Due to rapidly expanding networking industry demands, there is a corresponding need for high speed search capability, reduced power consumption and data masking within Content Addressable Memory (CAM) devices. These devices are used in applications requiring fast database searches. Image or voice systems, computer and communication systems are all CAM users. CAM have advantages in term of performance over other memory search algorithms. This is due to the simultaneous comparison of the desired information against the entire list of pre-stored entries. CAM have arrays designed to enable stored values to be located quickly by comparing input data to memory data to locate a match.

This paper presents a design of a 18Kb non-volatile Ternary Content Addressable Memory (TCAM) integrating Magnetic Random Access Memory (MRAM) devices. Magnetic Ternary Content Addressable Memory (MTCAM) can simplify conventional TCAM cell from sixteen transistors to 2 MRAM cells and 6 transistors. Furthermore, such device is intrinsically non volatile, e.g. power-failure-resistant. The MRAM cells are used both to store the information and to compare it (search) to the inputted data like an XOR logic function, whilst the CMOS part is used to detect and amplify the cell state.

Crocus Technology is developing a unique MTCAM prototype combining .13um CMOS technology and magnetic process enables structural cell size down to 300F2 and below. The device can operate at 100Msps with a 144-bit wide search key and a granular mask function capability. The MTCAM can handle 128 entries and can be designed in order to achieve an average power consumption below 1uW per cell.