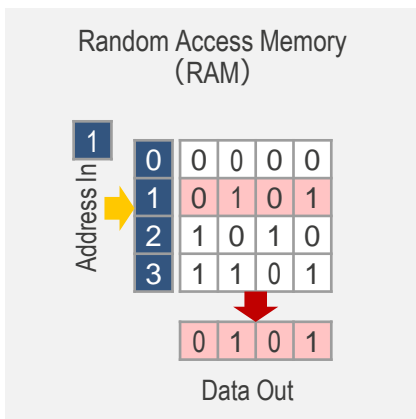


Renesas Electronics IP Products

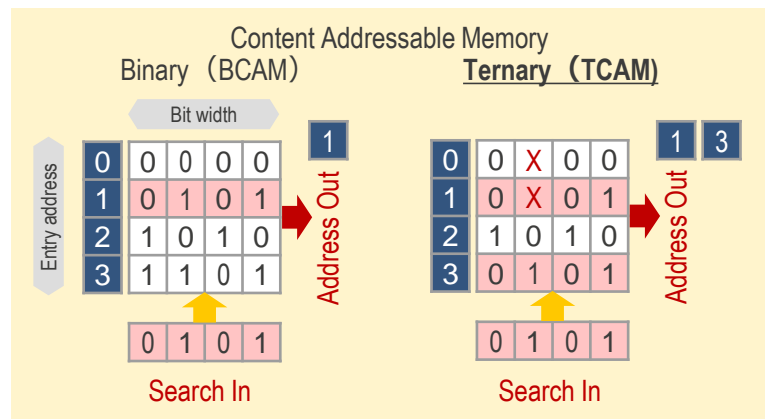
Embedded TCAM IP

WHAT IS TCAM(Ternary Content Addressable Memory) ?

TCAM has traditionally been adopted in network hub equipment and is often used for high-speed IP address searches. RAM, which is a typical memory, specifies an address and outputs the data, but TCAM inputs data and outputs the matching address.



RAM: Input the address and output the data



CAM : Input the data and output the stored address
In addition, TCAM can extract partial matches

KEY FEATURES OF TCAM

- TCAM searches for data that matches the input value in one cycle from all information stored in the memory.
- If there are multiple matching data, find all of them
Also, by adding a priority encoder, it is possible to select one from multiple matching data.
- The search key input (Search In) has capability with a bitwise mask function to support various searches.

RENESAS ELECTRONICS TCAM IP LINEUP

Foundry	Process Technology	Entry Address	Bit width	Frequency (* 2)
SMIC	40LL	128, 256, 512(* 1)	4~40(* 1)	250MHz
	N28HPC, N28HPC+			600MHz
TSMC	N16FF, N16FFC	128, 256(* 1)	4~40(* 1)	950MHz
	N12FFC			1.1GHZ
	N7			1.3GHZ

* 1: It can be extended by the top-level integration wrapper. There are examples of expanded up to 512 addresses, up to 216 bits at TCAM IP license.

* 2: The frequencies in this table are typical for each process. Practical frequencies vary depending on the trade-off with capacity.

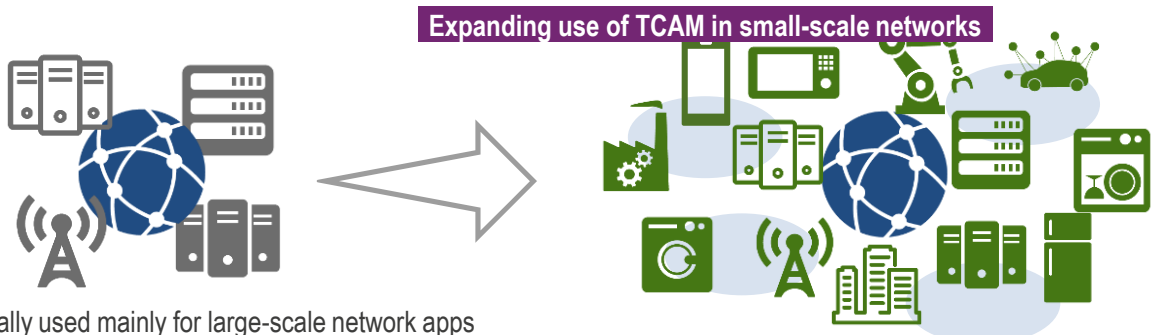
FEATURES OF RENESAS ELECTRONICS TCAM IP

- Designed as small-capacity TCAM hard macro**
 RTL Wrapper provided by Renesas supports Entry Address/Bit width beyond the hardware macro support range.
- Search results for each address are output directly from the hard macro**
 Sorting of search results is realized by adding a priority encoder soft macro
- Efficient search with Valid Bit control function**
 Valid Bit that indicates whether the search target is valid or invalid provided for each address omits the search for areas in which data is not stored. Power consumption is reduced because search operations are not performed with invalid addresses.
- Improved user convenience with Valid Bit Reset function**
 Function to initialize Valid Bit in one cycle and set all addresses to invalid for Simplifies startup sequence at power-on.
- Change search key length by Search Mask function**
 In cases where the search keyword is long, the length of the search key can be changed by partially masking it. It can be specified for each bit.
- Pre-Search function (supported N7 only) saves power**
 Power consumption is reduced by searching a part of the key first and then searching the remaining part only if it matches.

HOW TO UTILIZE RENESAS TCAM IP

- WITH THE PENETRATION OF IOT IN EMBEDDED APPLICATIONS, IT IS APPLICABLE TO A WIDE RANGE OF EMBEDDED DEVICES, NOT LIMITED TO CONVENTIONAL NETWORK APPLICATIONS**

Even in small-scale network environments, there are increasing cases where small-capacity TCAMs are used to increase communication speeds. Renesas TCAM is designed to target small capacity and is suitable for use in small networks.



Traditionally used mainly for large-scale network apps

Expand to wide range of embedded apps in near future

- IN ADDITION TO IP ADDRESS SEARCHES, HIGH-SPEED DETECTION OF SPECIFIC PATTERNS FROM VAST AMOUNTS OF DATA**

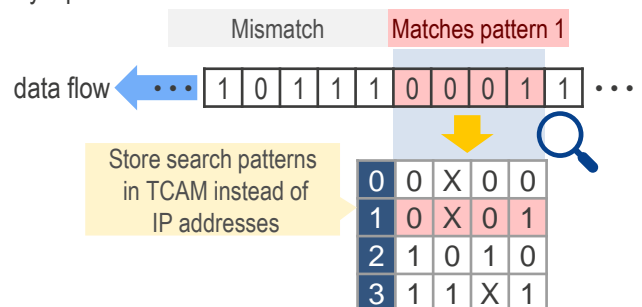
Can be used to check whether a specific pattern exists in continuously input data.

Application example 1:

Virus check function for network traffic data

Application example 2:

A function that controls multiple branch processes that transition to predetermined sequence when a specific key input is detected (Since target key is stored in the TCAM memory, user can be rewritten as necessary)



By utilizing TCAM for these functions

- Even if there are multiple search patterns, determination is possible in one cycle
- Specific patterns can be detected from continuously input data