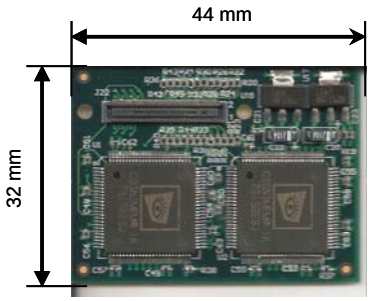
CogniMem embedded stackable module

The CogniMem Embedded module (CM-EMB) is a miniature OEM board populated with one or two CogniMem chips. Its network of 1024 or 2048 neurons implements two reknown non-linear classifiers and can recognize patterns at high speed while coping with ill-defined data, unknown events and changes of contexts and working conditions. Communication is made via a parallel bus or serial bus accessible on the 80-pin hirose connector. Up to four modules can be stacked on top of each other thus expanding the size of the network by increments of 1024 or 2048 neurons, up to 8192.

Features

- 1 or 2 CogniMem chips (i.e. 1024 or 2048 neurons)
- Simple RTL instructions (less than a dozen registers)
- Parallel bus with data strobe and read/write lines, 5-bit register and 16-bit data lines
- I2C serial bus (100 and 400 Kbits)
- Digital input bus for use with the recognition stage built into the chip



Top side


Bottom side

- 1 80-pin hirose connector for single or top-of-stack module
- Two 80-pin hirose connectors for in-the-stack modules (symmetrically mounted on each side of the module)

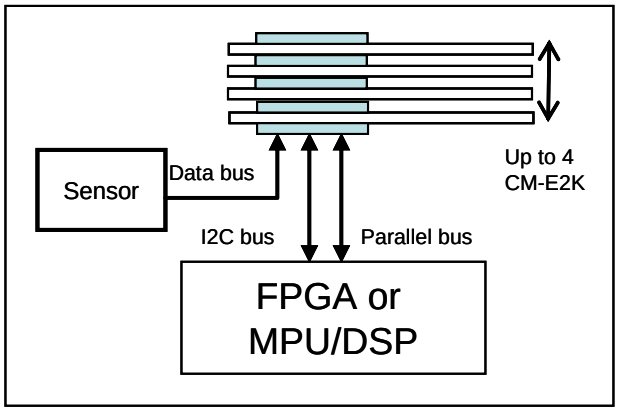
The module is ready to plug onto the evaluation base boards produced by Recognetics as presented below, or it can be integrated “as is” into OEM hardware designs.

Applications:

- Object recognition
- Surface anomaly detection
- Biometrics
- Target tracking
- Video surveillance
- Smart motion detection
- Satellite imaging
- Medical imaging
- Speech recognition
- Radar identification
- EKG, EEG monitoring
- Sonar identification
- Spectrum recognition
- Vibration monitoring
- Data mining

More…

The CogniMem chip implements two powerful non-linear classifiers (RCE and KNN) in a natively parallel architecture. The tremendous benefit of this architecture is a recognition cycle which remains under 11 us whether the entire network is composed of 1, 2 or more chips. Brute computational power is equivalent to 80 gig operations/second @ 27 MHz for one chip, twice as many for two chips, etc. If the real-time recognition engine built into CogniMem is running, the data received on the digital input bus is automatically broadcasted to the neurons and the response of the neuron with the best match is available within less than 11 microseconds after the feed of the last data.



Example configuration

CM1K neural network

- ✓ Parallel architecture with 1024 neurons
- ✓ RCE (Restricted Coulomb Energy)
- ✓ Two classifiers:
  - o Radial Basis Function (RBF)
  - o K-Nearest Neighbor (KNN) classifier
- ✓ Vector data: up to 256 bytes
- ✓ Classification status: Identified (pin 13), Uncertain (pin 14) or Unknown
- ✓ Categories: up to 32768 values
- ✓ Distance calculation: L1 or LSup distance norms
- ✓ Sub-networks: up to 127 context values
- ✓ Trained by example
- ✓ Recognition stage for direct digital input

Connectivity

- ✓ Parallel bus
- ✓ Serial bus I2C (100 kbit, 400 kbit and 3.3Mbit)
- ✓ Male and female 80-pin hirose connector for stackability
- ✓ Compatible with the CogniMem base boards
- ✓ Up to four stacked modules, totaling 8192 neurons

Electrical / mechanical

- ✓ 300 mW @ 27 MHz
- ✓ Single source power supply (5 to 12 volts)
- ✓ Average power management w/ 0.5 watt

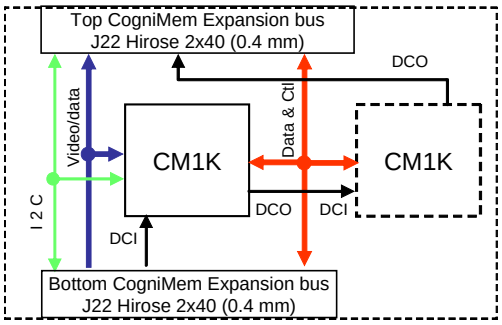
High speed recognition stage for digital input bus

- ✓ V_clock up to 27 Mhz (pin 15)
- ✓ 8-bit data (pins 18-25)
- ✓ 1 sync. line for vector input (pin 16)
- ✓ 2 sync. Lines for video input (pins 16-17)
- ✓ 1 output strobe signal (pin 3) after each vector recognition
- ✓ Digital output bus (pins 4-10)

Timings

@ 27 Mhz with default vectors of 256 bytes

- ✓ Learning time 10 µsec (275 cc)
- ✓ Recognition status in 8 µsec (257 cc)
- ✓ Best match in 11 µs (275 cc)
- ✓ Subsequent match in 3 µs/match (35 cc)
- ✓



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Ordering information

- CM-EMB1K with 1024 neurons
- CM-EMB2K with 2048 neurons, top of stack
- CM-EMB2K-I, 2048 neurons, in-the-stack