DENSO

Hercules 7.1E

"Modular vehicle communications platform designed to support development of advanced V2X and telematics features … support for concurrent C-V2X and DSRC operation "

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Hercules 7.1E is a modular vehicle communications platform designed to support development of advanced V2X and telematics features. DENSO, an industry leader in V2X technologies, has built on the success of the Wireless Safety Unit (WSU) product line to create Hercules, a highly capable development platform bringing together the latest short-range and wide-area vehicle communication technologies.

Hercules includes both C-V2X and DSRC radios to enable V2X performance benchmarking and the evaluation of technology transition strategies, plus LTE and WiFi/Bluetooth radios. Hercules packages these technologies together to promote development of advanced features including vehicle platooning, sensor sharing, high-definition maps, and video streaming.

The Hercules architecture is flexible to support future modem devices (ex. 5G) by using plug-in daughter cards that can be upgraded without changes to the system core. While Hercules is considered a development platform, automotive components and connectors ensure reliable operation for extended field trials.
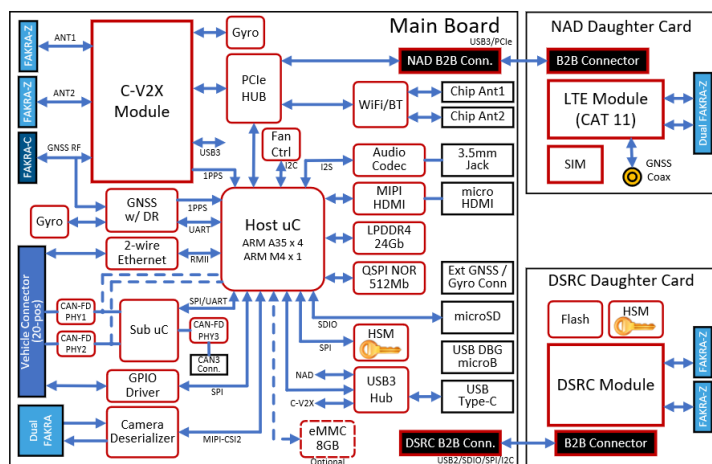

Key Features

- Modular design supports plug-in communication daughter cards without changing system core
- Supports US (IEEE, SAE) and EU (ETSI) V2X protocols
- V2X Application Suite
- V2X Facilities Software (SAE/ETSI protocols)
- V2X Services API (CAN, GNSS, V2X Radio)
- Quad-core ARM A35 @ 1.2GHz + M4 (~9000DMIPS)
- 3GB LPDDR4 SDRAM
- 64MB QSPI NOR flash
- GNSS w/ multi-constellation support and dead reckoning
- DSRC Modem
- C-V2X Modem
- 4G LTE Modem (CAT11)
- 802.11ac WiFi + Bluetooth 4.1
- (2x) V2X Hardware Security Module (HSM)
- 100Mbps automotive Ethernet w/ wake-up
- (1x) Serial digital camera input (up to 2MP)
- USB3.0 (Type-C)
- USB2.0 Debug (microB)
- microSD and 8GB eMMC
- (3x) CAN/CAN-FD w/ wake-up
- micro HDMI Video Output
- 3.5mm Stereo Audio Output w/ Mic Input
- (3x) HMI Output Driver (100mA each port)

Hercules <version> Use Cases:
- Red Light Violation / Green Wave Driving
- Intersection Movement Assist / Left Turn Assist
- Emergency Brake Warning / Emergency Vehicle Warning
- Vulnerable Road User / Pedestrian Warning
- Platooning / Sensor Sharing / Video Streaming
- OTA Software Updates / High-Definition Maps
- Electronic Tolling / E-Commerce

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To protect against connected vehicle cyber-attacks, Hercules uses the latest generation V2X hardware security module for tamper resistant secret key storage. A high performance GNSS positioning solution with dead reckoning is capable of supporting lane level target classification up to 20Hz.

DENSO has invested over a decade in research and development of V2X software architectures and associated connected vehicle applications. DENSO also developed a full complement of modeling and test tools to validate designs and reduce time to market.
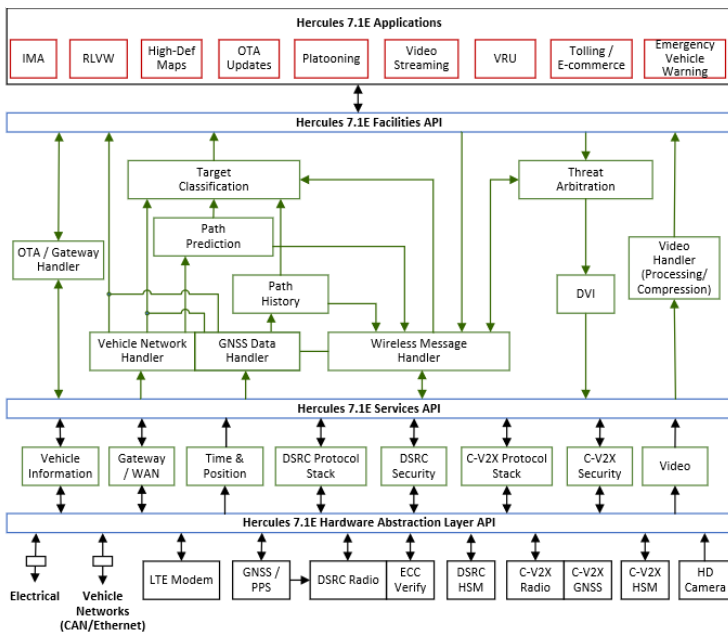
V2X is enabled by Dedicated Short Range Communications (DSRC) and Cellular-V2X (C-V2X) technologies designed for short-range (~1000m) ad-hoc communication. V2X leverages 75MHz of licensed spectrum at 5.9GHz reserved for Intelligent Transportation Systems (ITS). ITS applications supporting safety-of-life demand a reliable, low-latency communication medium.

V2X addresses shortcomings of many automotive safety sensor technologies by providing true 360 degree situational awareness at low cost, even in harsh multi-path and non-line-of-sight environments.

For more information about Hercules:

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Specifications[1]

V2X Standard Conformance
- IEEE 802.11 – 2012
- IEEE 1609 – 2016
- SAE J2735 – 2016
- 3GPP R14 (PC5 C-V2X)
- SAE J2945/1 – 2016
- ETSI EN 302 571
- ETSI EN 302 636
- ETSI TS 103 097

Frequency Band
- C-V2X/DSRC: 5.9GHz ITS
- WiFi/BT: 2.4GHz / 5GHz
- LTE: 2/4/5/7/12/13/17/29 (AT&T)
- GNSS: L1 C/A, L1OF, B1, B1I, E1/BC

Bandwidth
- C-V2X: 10MHz/20MHz   DSRC: 10MHz

Data Rate
- C-V2X/DSRC: 3 – 27 Mbps
- WiFi/BT: 300Mbps / 24Mbps
- LTE: 600Mbps DL / 50Mbps UL (Cat 11)

Antenna Diversity
- C-V2X: RX-MRC
- DSRC: TX-CDD, RX-MRC
- WiFi/BT: 2x2 MIMO
- LTE: 2x2 MIMO

Max Transmit Power
- C-V2X/DSRC: +23dBm
- WiFi: +15dBm (ac)
- LTE: +23dBm (Class 3)

Receiver Sensitivity (w/ diversity)
- C-V2X: -94 dBm
- DSRC: -94 dBm

GNSS
- 2.0m CEP (10Hz with Dead Reckoning)

V2X Security
- NIST/Brainpool ECC up to 512b
- HSM storage > 10k keys, 15 year retention
- FIPS 140-2 Level 3 / EAL6+

Operating System
- Linux 4.9.88 (x64)

Operating Temperature Range
- -30°C to +70°C

Dimensions
- 160mm x 137mm x 50mm (WxDxH)

Power Supply
- 12V / 24V (< 22 Watts)

FCC ID: XPYVERAP173 (DSRC), QWY-V1231-0 (LTE)

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[1] Subject to change without notice