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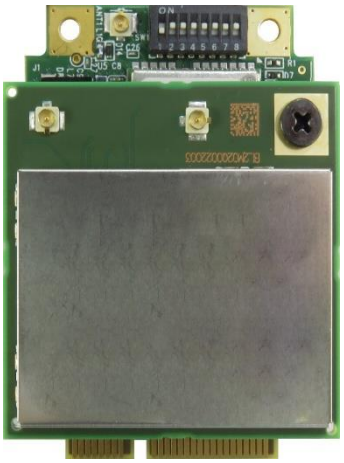
SOM-301U Information Sheet

V2X mPCIe System-On-Module,
DSRC stack, V2Xcast®



Overview:

Unex's innovative SOM-301U is designed to meet the rising market demand for easy-to-use DSRC V2X (Vehicle to Everything) units in connected vehicles, intelligent transportation system (ITS), smart cities, smart farming, mining and to facilitate the development of mass-market solutions. Integrated with automotive-grade multi-core processor, RF, eHSM, RAM, flash, GNSS, DSRC stack and V2Xcast® Service, SOM-301U acts as a self-contained V2X system-on-module that enables V2X ecosystem on various platforms. Featuring V2Xcast® - a highly integrated and modular communication framework, SOM-301U supports rapid scalability on application host without sacrificing quality, making it an ideal V2X module of devices such as On-Board Unit (OBU), Roadside Unit (RSU), Telematics Box (T-Box) or Network Access Device (NAD).

Feature

- Pre-integrated software contains DSRC stack, Security, POTI, and V2Xcast® Service.
- A rich SDK contains facility-layer SAE J2735 messages, APIs and example codes accelerating development of V2X applications.
- mPCIe design and V2Xcast® software support easy migration between DSRC and C-V2X (PC5) without any hardware change on the application host.
- Integrated and modular V2X subsystem allows expandable applications for sensor fusions and AI applications.
- External Molex connector provides all I/O pins for direct deployment on the existing host.

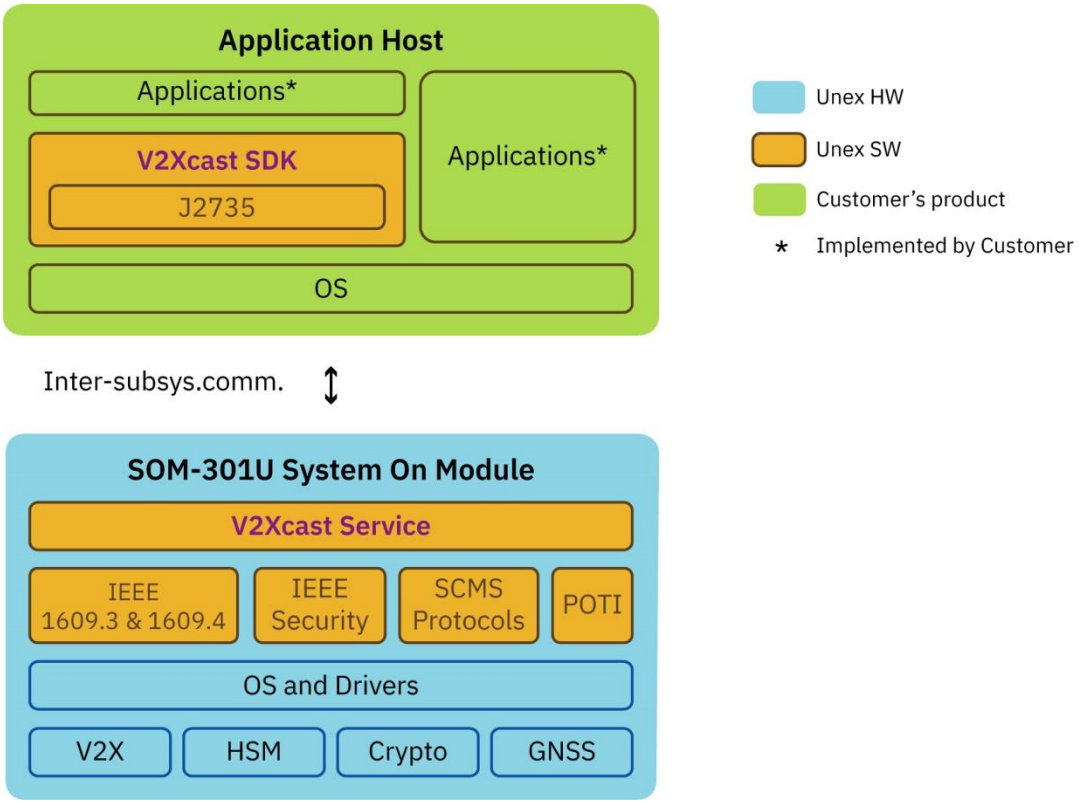
Specifications:

Chipset	❖ Autotalks® CRATON2 V2X communication processor ❖ Autotalks® PLUTON2 V2X RF Transceiver ❖ Embedded Hardware Secure Module (eHSM) ❖ Telit® SL869-V3 GNSS module (SL869-ADR optional)
Operation System	Linux Yocto
Form Factor	PCI Express Mini Card (Mini PCIe)
Host Interface	USB 2.0
Preloaded Firmware	DSRC stack including IEEE 802.11p, IEEE 1609.2/3/4, and SCMS client
Development Tool	V2Xcast® SDK, including POSIX APIs, example codes, and SAE J2735 facility layer messages *. Currently V2Xcast SDK supports X86 64-bit, ARMv7-A and ARMv8-A(64bits) Linux 4.x OS platforms, others by project based
Hardware Security	❖ Secure encrypted off-chip storage of private keys ❖ Private material is inaccessible outside HSM ❖ Capable of > 110 signatures / second, with < 9ms signing latency for ECDSA NIST P256 or ECDSA Brainpool P256R1 ❖ Line-rate ECDSA verification engine (>2500 ECDSA NIST P256 verifications / second) ❖ FIPS 140-2 Level 3 certification ❖ Tamper detection* (*. support by project)
DSRC	❖ Frequency band: 5.85 ~ 5.925 GHz ❖ Radio mode: IEEE 802.11p ❖ Channel: 172, 174, 176, 178, 180, 182, 184 ❖ Channel bandwidth: 10MHz (5MHz & 20MHz by project) ❖ Data rate: 3, 4.5, 6, 9, 12, 18, 24, 27Mbps for 10MHz BW signal ❖ RF transmit power: max. +20dBm, Class C RF spectrum mask

	compliant with margins
ESD design	❖ ESD protects all ports in ESD events. (IEC 61000- 4-2 Level 4, Contact ±8kV, Air ±15kV)
GNSS	❖ GNSS positioning supports 1.5m accuracy (CEP50 with SBAS) and 10Hz update rate. ❖ Telit® SL869-V3 GNSS receiver supports GPS/Glonass/Galileo/QZSS constellations*. SBAS like EGNOS (EU), WAAS (US), and MSAS (JP) are also supported. (*. GPS and Glonass are supported by default)
Operation Power	5V: Imax=2A (during RF transmission, usually less than 2ms), Ityp=0.7A 3.3V: Imax=110mA, Ityp=105mA (preliminary data)
On-board Interface	RF interfaces: ❖ two MHF I RF connectors (DSRC) ❖ one MHF I RF connector (GNSS) Industrial Standard mini PCIe interfaces: ❖ one USB port ❖ one UART (console or external GNSS) ❖ one 1PPS input ❖ one Reset input ❖ 3.3V mini PCIe power input ❖ 5V power input (proprietary) Cable interfaces: ❖ one UART (console or external GNSS) ❖ one 1PPS input ❖ one Reset input ❖ 5V power input (proprietary)
Antenna	❖ DSRC: two MHF I connectors (U.FL compatible)

	❖ GNSS: one MHF I connector (U.FL compatible)
Operation Temperature Range	ambient: -40°C ~ +85°C
Storage Temperature Range	-45°C ~ +90°C
Operating Humidity	10% - 95%, non-condensing
Storage Humidity	max. 95%, non-condensing
Dimension	50.95 mm(L) x 38.5 mm(W) x 11.7 mm (H) (preliminary data)
Environment-Friendly Compliance	REACH and RoHS

Software:



Unex SOM-301U enables ease of V2X software development through its V2Xcast® technology. V2Xcast is a highly integrated and developer friendly software development kit for V2X communication. The solution provides ready-to-use V2X communication services for V2X applications, users can significantly cut time-to-market with less development and testing cost.

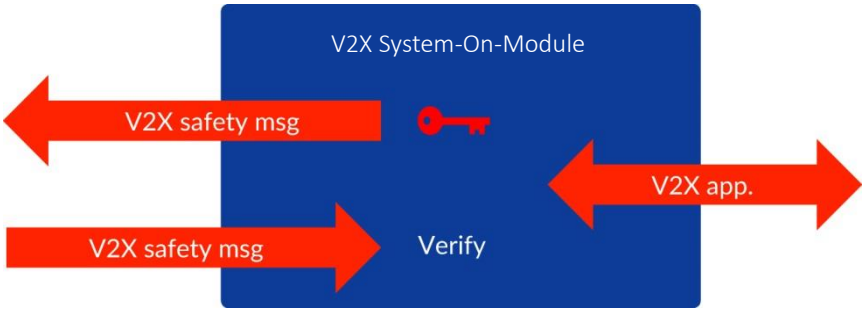
It includes two parts – V2Xcast Service and V2Xcast SDK.

V2Xcast SDK: Deploy V2Xcast SDK in your application host, it includes APIs to get the services from V2Xcast Service and the main functions of facility layer(J2735), such as message encoder and decoder.

V2Xcast Service: V2Xcast Service image resides in SOM-301U, it combines WAVE protocol stack that includes IEEE 1609.2/3/4, SCMS protocol, and POTI. V2X communication protocols will be easily enabled via configuration input without any programming.

Security:

A self-contained and highly integrated V2X system-on-module capable of highly secure V2X applications.



Security functions provided by V2Xcast® are designed based on a highly secure HSM (Hardware Security Module).

The highly secure HSM with FIPS 140-2 Level 3 certification is embedded in SOM-301U.

Cryptographic processor eliminates bottlenecks, maximizes application performance and offload CPU's computation. To protect your sensitive cryptographic keys in a high-assurance key vault, the design provides leverage a keys-in-hardware solution. With the keys-in-hardware solution, all the cryptographic operations are inside HSM and those keys never leave the HSM.

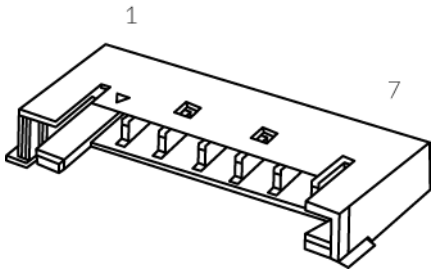
Input Output Interface

mPCIe Pin Definition and Function

Row	Pin	Symbol	Type	Description	Status
0	1	WAKE#	O	Open drain active low signal. This signal is used to wake up the host.	NC
0	3	5V	P	5V/2A Power Input (originally reserved)	Proprietary
0	5	5V	P	5V/2A Power Input (originally reserved)	Proprietary
0	7	CLKREQ#	O	Reference clock request signal	NC
0	9	GND	G		
0	11	REFCLK-	I	PCI Express differential reference clock (100 MHz)	NC
0	13	REFCLK+	I	PCI Express differential reference clock (100 MHz)	NC
0	15	GND	G		
0	-	KEY	-	Mechanical Key	
0	17	UART_RX	I	UART receive data input (originally reserved)	Proprietary
0	19	UART_TX	O	UART transmit data output (originally reserved)	Proprietary
0	21	GND	G		
0	23	PERn0	I	PCI Express RX -	NC
0	25	PERp0	I	PCI Express RX +	NC
0	27	GND	G		
0	29	GND	G		
0	31	PETn0	O	PCI Express TX -	NC
0	33	PETp0	O	PCI Express TX +	NC
0	35	GND	G		
0	37	GND	G		
0	39	3.3 Vaux	P	Max 1100mA	
0	41	3.3 Vaux	P	Max 1100mA	
0	43	GND	G		
0	45	5V	P	5V/2A Power Input (originally reserved)	Proprietary
0	47	5V	P	5V/2A Power Input (originally reserved)	Proprietary
0	49	1PPS	I	GNSS 1 pulse per second input (GATEWORKS standard, originally reserved)	Proprietary
0	51	TAMPER#	I	0=Tampering, 1=Normal operation (PD)	Proprietary

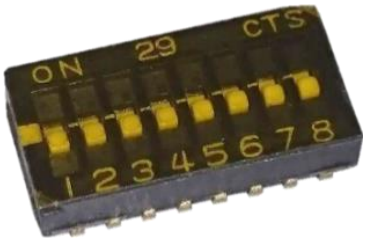
Row	Pin	Symbol	Type	Description	Status
1	2	3.3 Vaux	P	Max 1100mA	
1	4	GND	G		
1	6	1.5 Volt	P	Max 500mA	NC
1	8	UIM PWR	O	SIM Card	NC
1	10	UIM_DATA	I/O	SIM Card	NC
1	12	UIM_CLK	O	SIM Card	NC
1	14	UIM_RESET	O	SIM Card	NC
1	16	UIM_VPP	O	SIM Card	NC
1	-	KEY	-	Mechanical Key	
1	18	GND	G		
1	20	W_DISABLE#	I	Disable wireless communications (Internally pulled up. Active LOW)	NC
1	22	PERST#	I	Module Reset (Internally pulled up. Active LOW, pulse)	
1	24	3.3Vaux	P	Max 1100mA	
1	26	GND	G		
1	28	1.5Volt	P	Max 500mA	NC
1	30	SMB CLK	I	SMBus clock signal compliant to the SMBus 2.0 specification	NC
1	32	SMB Data	I/O	SMBus data signal compliant to the SMBus 2.0 specification	NC
1	34	GND	G		
1	36	USB_D-	I/O	USB 2.0 differential data (-)	
1	38	USB_D+	I/O	USB 2.0 differential data (+)	
1	40	GND	G		
1	42	LED_WWAN#	O	Open drain, active low, max 9mA	NC
1	44	LED_WLAN#	O	Open drain, active low, max 9mA	NC
1	46	LED_WPAN#	O	Open drain, active low, max 9mA	NC
1	48	1.5Volt	P	Max 500mA	NC
1	50	GND	G		
1	52	3.3 Vaux	P	Max 1100mA	

I/O Cable Pin Definition



Function	Pin	Name	Type	Level (V)	Description
Power	1	5V	P	5	5V power
UART	2	RXD	I	3.3	UART RXD
	3	TXD	O	3.3	UART TXD
Reset	4	EX_RSTn	I	3.3	System reset (active LOW) Min assertion time: 10ms
1PPS	5	1PPS	I	3.3	1PPS
Tamper	6	TAMPER#	I	3.3	Tamper switch signal (active LOW)
Ground	7	GND	G		Ground

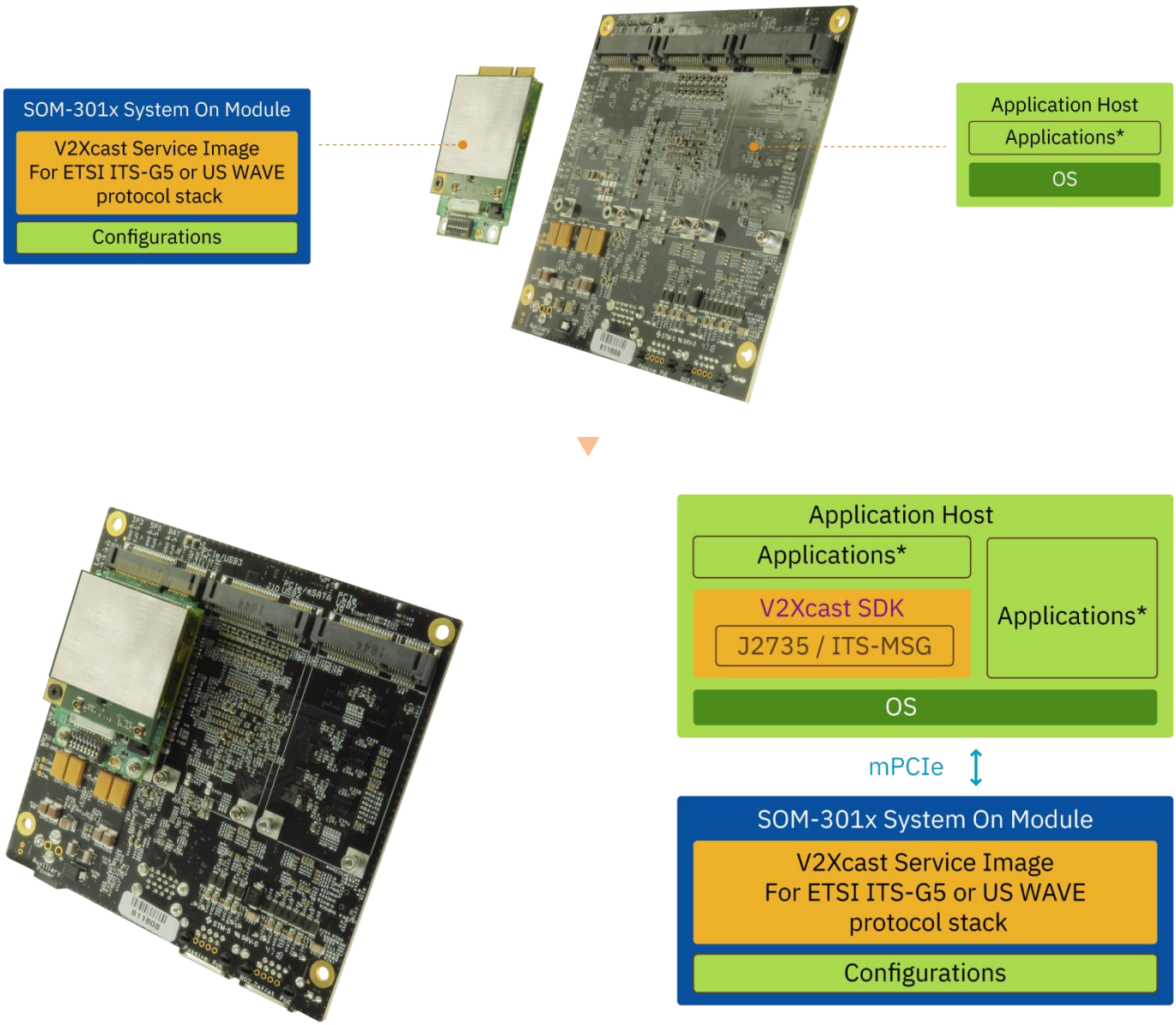
DIP Switch

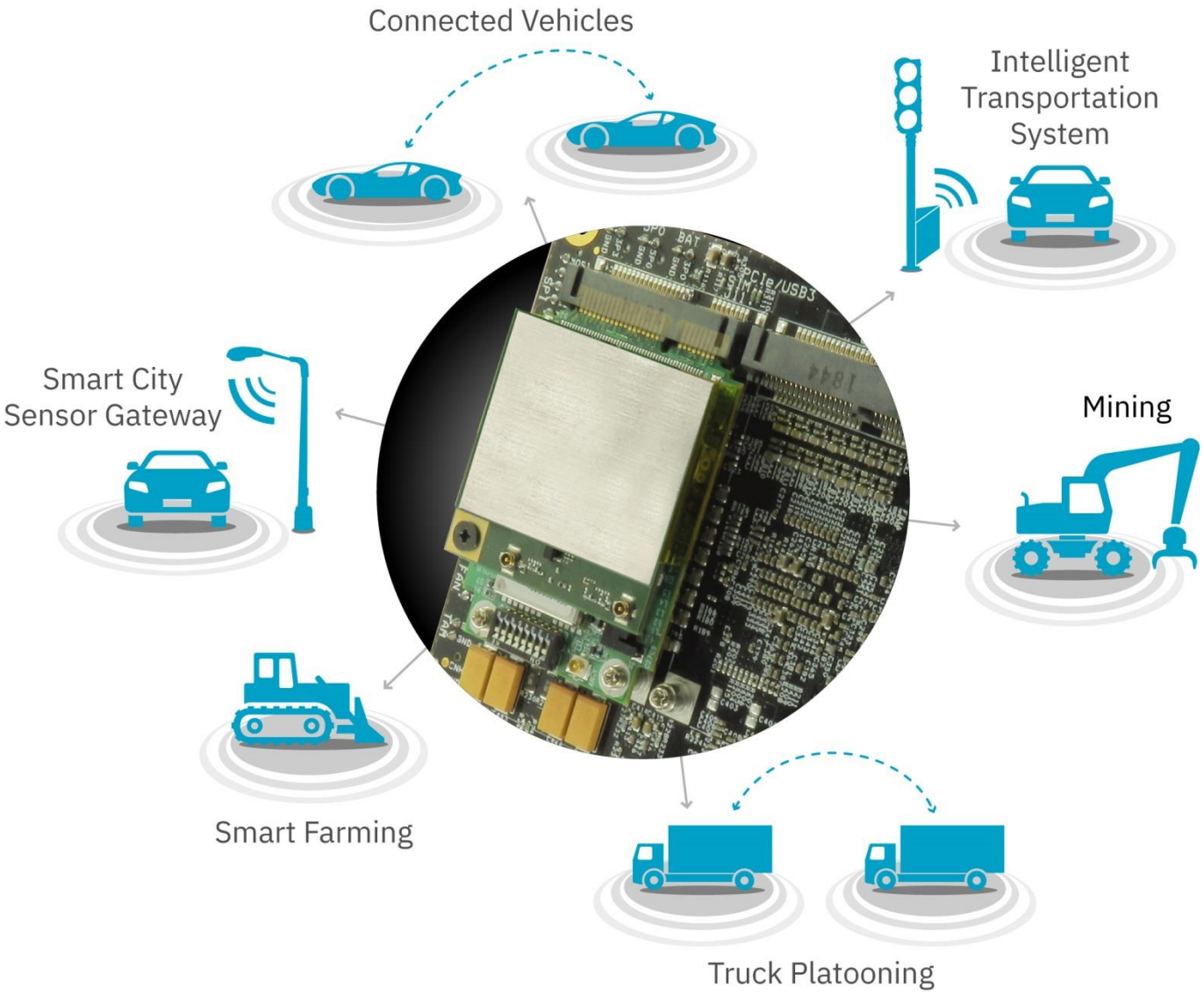


Function	Position	Name	Description
Power	1	5V_SW	Connect 3.3V to a NMOS gate which controls 5V power. ON: 5V power from mPCIe OFF: 5V power from cable
UART	2	RXD_SW	ON: UART RXD from mPCIe OFF: UART RXD from cable
	3	TXD_SW	ON: UART TXD from mPCIe OFF: UART TXD from cable
Reset	4	EX_RSTn_SW	ON: CR2 reset from mPCIe OFF: CR2 reset from cable
1PPS	5	1PPS_SW	ON: 1PPS from mPCIe OFF: 1PPS from cable
Tamper	6	TAMPER#_SW	ON:TAMPER# from mPCIe OFF: TAMPER# from cable
Trigger Mode	7	TRIGGER_SW	ON: Trigger when tamper SW close to GND (1K PU) OFF: Trigger when tamper SW open from 3V3 (30K PD)
Boot Strapping	8	BOOT_SW	ON: Boot from NAND (3K PD) OFF: Boot from USB0 (Open)

Using Cases

Enable V2X on various platforms – from Low Power Devices to AI Applications




Connected Vehicles
Intelligent Transportation System
Smart City Sensor Gateway
Mining
Smart Farming
Truck Platooning

Ordering Information:

SOM-301U	V2X mPCIe System-On-Module, DSRC stack, V2Xcast®

Other Recommended Modules:

SOM-301E	V2X mPCIe System-On-Module, ITS-G5 stack, V2Xcast®