






## ASSP Products Catalogue

2015.11



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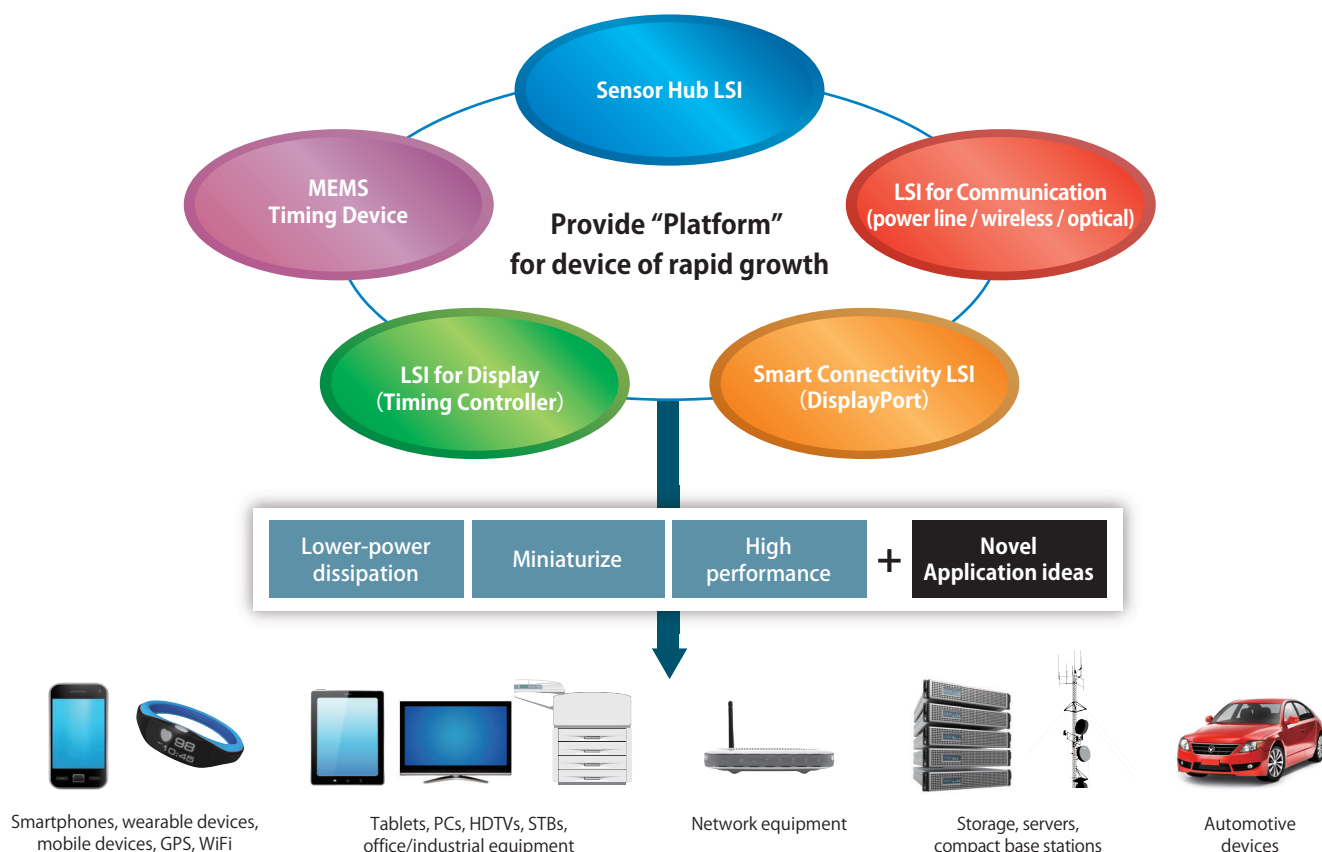
## Notes

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# Business Overview of MegaChips Corporation

Humankind is becoming increasingly interconnected via wearable devices, in-vehicle equipment, medical instruments and industrial equipment as well as PCs and mobile devices. MegaChips is an important player in this evolution, providing SoCs essential for the advancement of ASSPs (Application Specific Standard Products). MegaChips will continue to explore the cutting-edge equipment market around the world, accelerating R&D activities and enhancing the platforms to assist its customers.



## Term Description

Term	Description
<b>IoT</b>	The Internet of Things is a concept that describing a world where everything is connected to the Internet and be able to complete tasks such as monitoring and controlling.
<b>Wearable device</b>	Small electronic devices that are worn on the human body, arms and head and often include information related to health and fitness.
<b>MEMS</b>	Micro Electro Mechanical System is miniature device comprising of electric machine construction that is manufactured using semiconductor process technology.
<b>DisplayPort</b>	Video interface standard administrated by VESA in May 2005 for digital display equipment such as LCD.
<b>VESA</b>	VESA (Video Electronics Standards Association) is an international and non-profit corporation that standardizes display-related technologies.
<b>Sensor Hub LSI</b>	This is MegaChips' frizz product that integrally processes various data detected with plural different sensors such as acceleration sensor.
<b>PDR</b>	PDR (Pedestrian Dead Reckoning) is one of indoor positioning methods that calculates pedestrian's movement locus according to sensor information of acceleration and gyro.
<b>PLC</b>	PLC (Power Line Communication) is a technology to use a power line as a communication line.
<b>Hybrid communication</b>	MegaChips' original network communication technology combining wireless and power line communication. (patent applied in the fiscal year ending in March 2012)
<b>Smart Grid</b>	Power network that enables blackout prevention, adjustment of transmission and various power contracts through communication and control functions of smart meter.
<b>SubGHz band wireless communication LSI</b>	MegaChips' BlueChip Wireless products conforming to IEEE 802.15.4g.
<b>IEEE 802.15.4g</b>	This is an extension of short range wireless communication network standard (IEEE 802.15.4) that is suitable for inter-device connection chiefly for industrial applications.

# MegaChips ASSP Applications

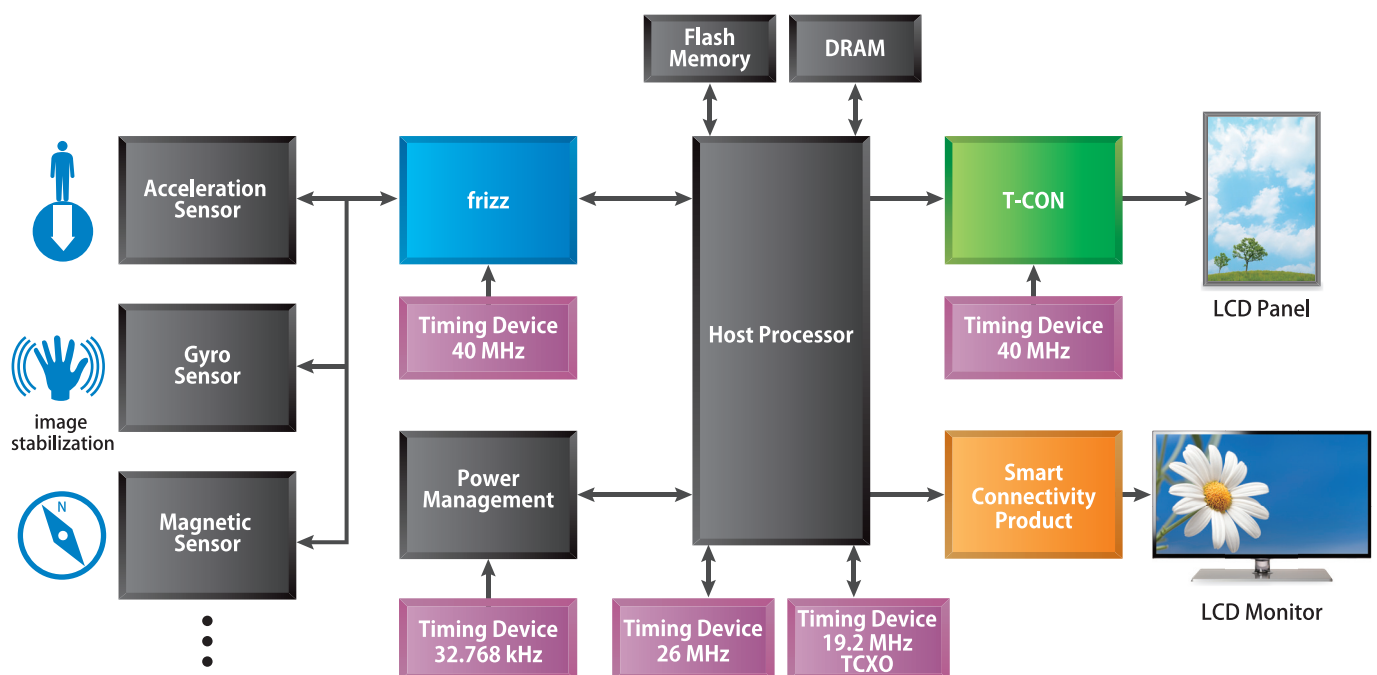


## ASSP Products

<b>Timing Device</b>	<b>MEMS Timing Device</b>	Silicon-based MEMS oscillator of highest performance delivered by top level engineering team	<b>p.5</b>
<b>T-CON</b>	<b>LCD Timing Controller</b>	Timing controller LSI for liquid crystal panel to support input/output interfaces based on proven analog design technology	<b>p.7</b>
<b>Smart Connectivity Product</b>	<b>Smart Connectivity LSI</b>	Audio-video interface that enables high-speed transmission and conversion (DP↔HDMI) of high solution image	<b>p.9</b>
<b>frizz</b>	<b>Sensor Hub LSI</b>	LSI that performs high-end arithmetic processing based on the information from various sensors	<b>p.11</b>
<b>BlueChip Wireless</b>	<b>SubGHz band wireless communication LSI</b>	SubGHz band wireless communication LSI that covers a wide area with low power consumption	<b>p.13</b>
<b>BlueChip PLC</b>	<b>Broadband PLC Communication LSI</b>	Broadband communication LSI compatible with multi-hopping that uses existent wiring	<b>p.15</b>

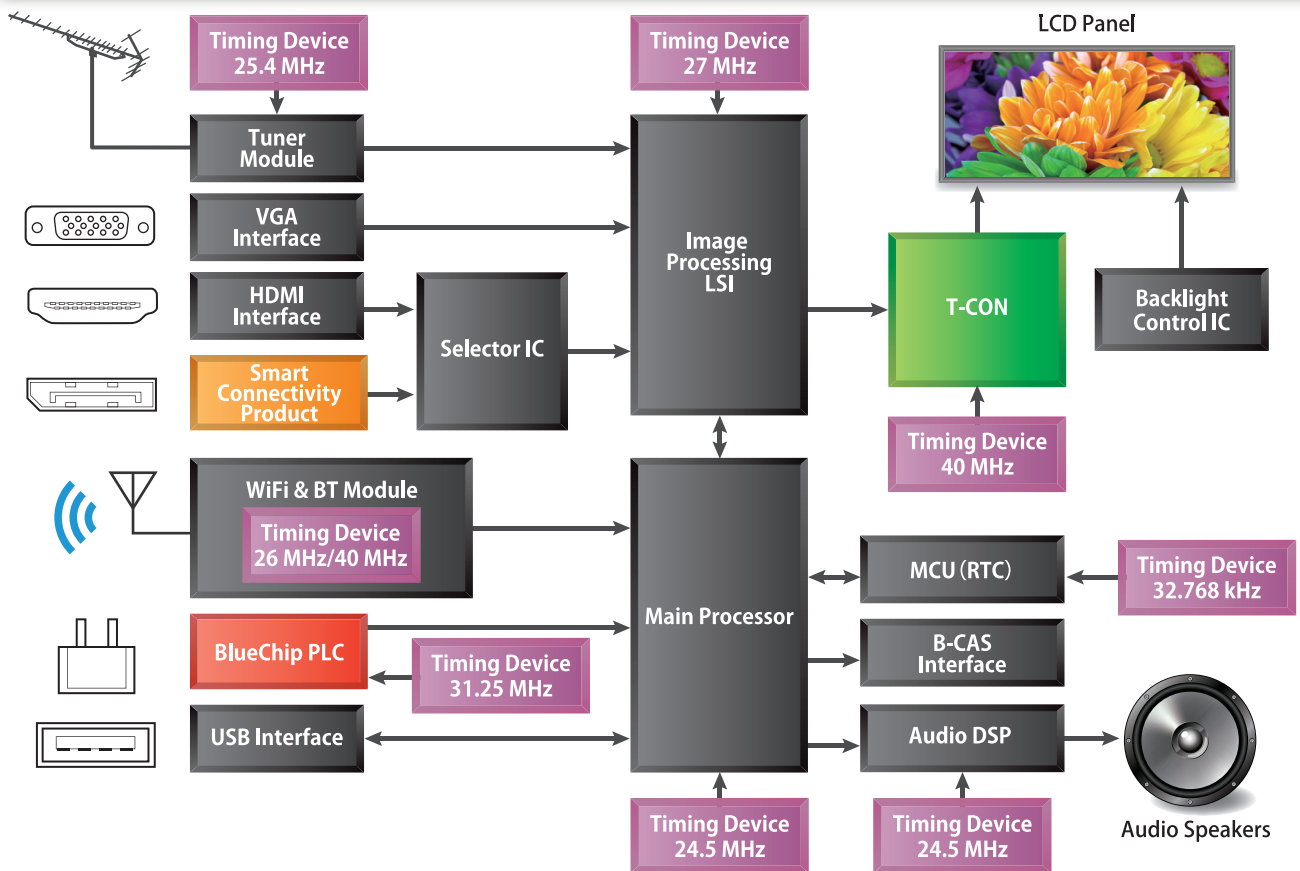


## Smartphones, Tablets and Wearable Devices

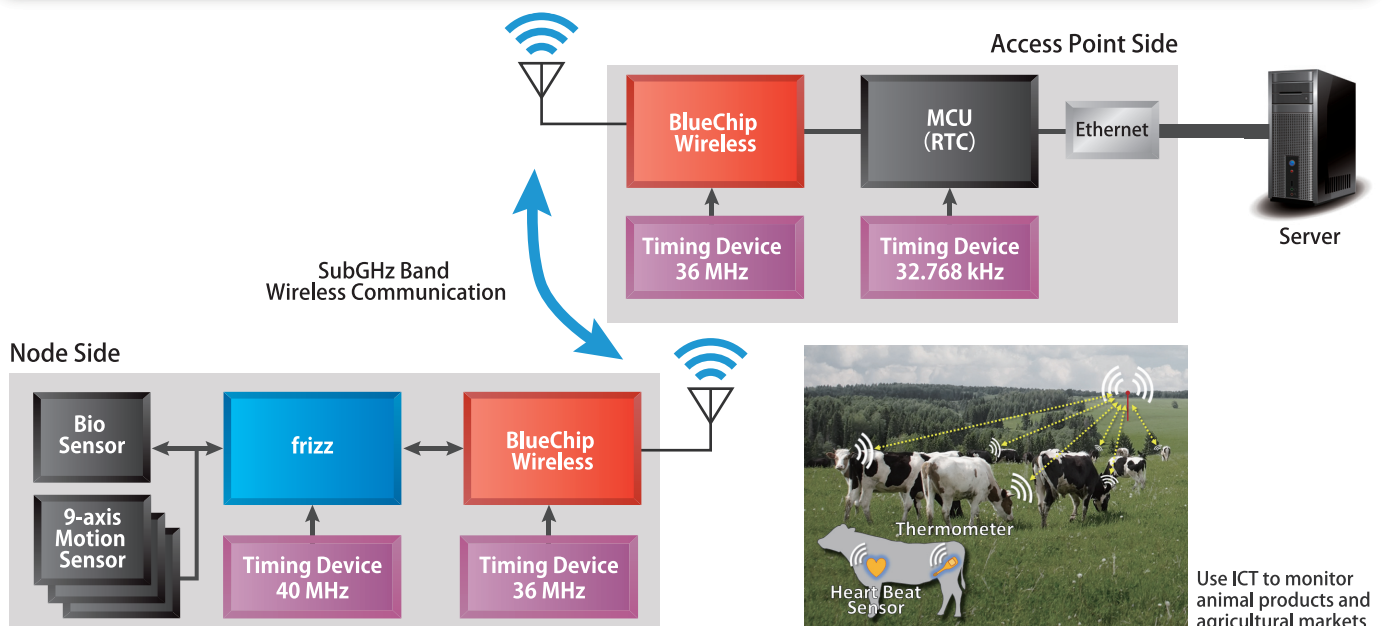




## Displays, TVs and Video Devices



## Communications for Industrial Applications

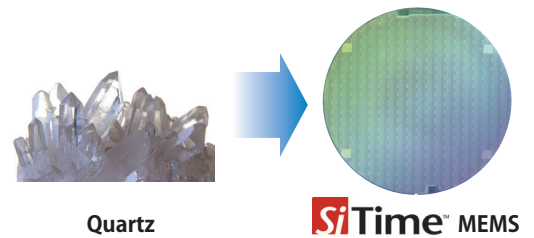


Application diagram and frequency of timing device are examples.



As part of the MegaChips Group, SiTime offers feature-rich, low-cost MEMS oscillators that outperform quartz oscillators and have a smaller footprint. Unlike quartz suppliers, we design our own analog solutions with advanced MEMS resonators.

## From Quartz to Silicon device era



Quartz

SiTime™ MEMS

## Features

### 1 Ultra-high frequency stability

Our unique PLL (phase-locked loop) results in low jitter and high oscillation accuracy.

### 2 Excellent reliability

Aging deterioration is smaller compared to quartz oscillators and can be functioned over wide environmental temperatures.

### 3 Small footprint

World's smallest of a mere 1.5 x 0.8 mm for both products of kHz band and MHz band.

### 4 Ultra-low power

Since the waveform is stable at oscillation start, power consumption at system startup is vastly minimized. The energy consumption of 32kHz oscillator is as low as **typical 1  $\mu$ A** and that of MHz oscillator (SiT8021) is **typical 60  $\mu$ A** that is world's lowest.

### 5 Shock and vibration resistance

MEMS resonators are ultramicroscopic and not so much affected by any external impact or vibration.

### 6 Low cost

While quartz oscillator requires complex manufacturing flow from cutting artificial rock crystal, silicon MEMS process is similar to a general CMOS IC production and suitable for mass production so the products of stable quality are realized.

### 7 Feature-rich

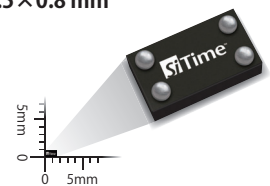
Frequency customizable from 1 Hz to 625 MHz \*Frequency range varies by products  
Product lineups for special functions of SS (spread spectrum) and differential output as countermeasures to unwanted radiation.

### 8 Short lead-time

While quartz-based products requires longer lead time to obtain particular frequency products, MEMS oscillator enables very short lead times for all frequency.

#### Ultra-small & $\mu$ Power Oscillators

1.5 x 0.8 mm



## Applications

For applications in which space and power are at a premium - such as wearable devices and IoT applications - our timing devices can be easily integrated. They are also highly accurate, making them well suited for cellular base stations.



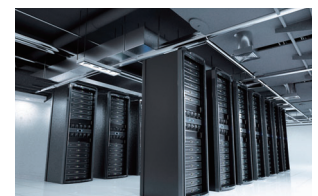
#### Mobile device / Wearables

Smallest Size, Lowest Power, XTAL Replacement



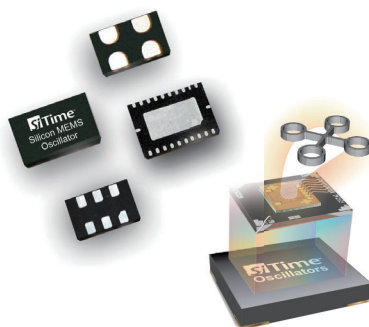
#### Consumer appliances

Best Cost, Shortest Lead Time, Smallest Size, Low Power



#### Cloud Big Data

Up to 625 MHz,  $\pm 10$  PPM Stability, Ultra Resilient, Shortest Lead Time



#### Communications infrastructure

Up to 625 MHz,  $\pm 2.5$  PPM, High Temp, Ultra Reliable



#### Industrial equipment

High Temp, EMI Reduction, 50,000 g Shock, 70 g Vibration



#### Automotives

AEC-Q100, Best Quality, 32 kHz to 137 MHz

## Product Lineups

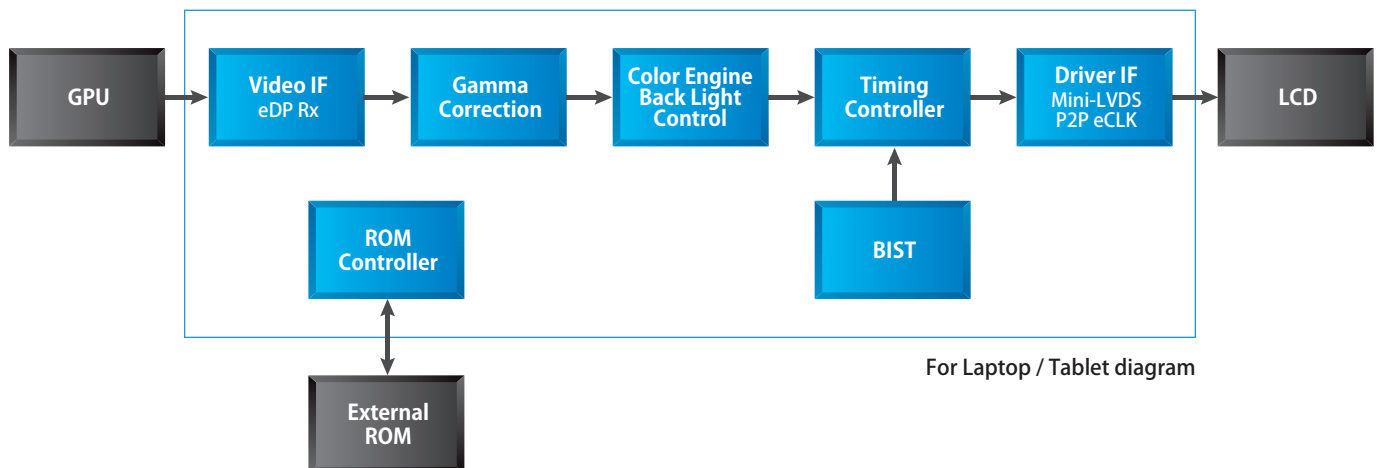
SiTime Base Part No.	Output Freq.	Frequency Stability (ppm)	Supply Volt. (V)	Supply Current (Typical)	Packages (mm×mm)	Output Logic	TMII* Support
<b>Ultra-Small 32 kHz Solutions   XTAL replacements</b>							
SiT1532, SiT1533	32.768 kHz	10, 20 room; 75, 100 over temp.	1.2 to 3.63	0.90 (µA)	1.5×0.8×0.55H (CSP), 2.0×1.2×0.6H (DFN)	NanoDrive™. LVCMOS	
SiT1534	1 Hz to 32.768 kHz	10, 20 room; 75, 100 over temp.	1.2 to 3.63	0.90 (µA)	1.5×0.8×0.55H (CSP), 2.0×1.2×0.6H (DFN)	NanoDrive™. LVCMOS	
SiT1552 TCXO	32.768 kHz	±5, ±10, ±20 over temp.	1.5 to 3.63	0.99 (µA)	1.5×0.8×0.55H (CSP)	LVCMOS	
<b>µPower Oscillators (LVCMOS)   1 to 280 µA power consumption, ultra small size</b>							
SiT1630	32.768 kHz	20 room; 75, 100, 150 over temp.	1.5 to 3.63	1.00 µA	2.0×1.2×0.6H (DFN)	LVCMOS	
SiT8021	1 to 26 MHz	±100	1.8	60 to 280 µA (0.9 µA stby)	1.5×0.8×0.55H (CSP)	LVCMOS	
<b>Low-Power Oscillators (LVCMOS)   3.1 to 5.5 mA power consumption</b>							
SiT1602, SiT8008/09	1 to 137 MHz	±20, ±25, ±50	1.8, 2.5 to 3.3	3.1 to 5.5 mA (0.6 - 1.0 µA stby)	2.0×1.6, 2.5×2.0, 3.2×2.5, 5.0×3.2, 7.0×5.0 (DFN)	LVCMOS	✓
<b>Ultra-Performance Oscillators   0.3 to 0.6 ps RMS integrated phase jitter</b>							
SiT8208/09, SiT8225/56	1 to 220 MHz	±10, ±20, ±25, ±50	1.8, 2.5 to 3.3	29 to 36 mA (10 µA stby)	2.5×2.0, 3.2×2.5, 5.0×3.2, 7.0×5.0 (DFN)	LVCMOS	✓
SiT9120/21/22, SiT9156	1 to 625 MHz	±10, ±20, ±25, ±50	2.5 to 3.3	54 to 69 mA	3.2×2.5, 5.0×3.2, 7.0×5.0 (DFN)	LVPECL, LVDS	✓
<b>High-Temperature and Automotive Oscillators   +125°C operating temperature, 0.1 ppb/g (G-sensitivity)</b>							
SiT1618, SiT8918/19 -40 to +125°C	1 to 137 MHz	±20, ±25, ±30, ±50	1.8, 2.5 to 3.3	3.6 to 5.4 mA (1.0 µA stby)	2.0×1.6, 2.5×2.0, 3.2×2.5, 5.0×3.2, 7.0×5.0 (DFN)	LVCMOS	✓
SiT8920/21, SiT8924/25 -55 to +125°C	1 to 137 MHz	±20, ±25, ±30, ±50	1.8, 2.5 to 3.3	3.6 to 5.4 mA (1.0 µA stby)	2.0×1.6, 2.5×2.0, 3.2×2.5, 5.0×3.2, 7.0×5.0 (DFN)	LVCMOS	✓
<b>VCXO   ±25 to ±1600 ppm pull range, &lt;1% linearity, 0.6 ps RMS integrated phase jitter</b>							
SiT3807/08/09	1 to 220 MHz	±10, ±25, ±50	1.8, 2.5 to 3.3	29 to 34 mA (10 to 70 µA stby)	2.5×2.0, 3.2×2.5, 5.0×3.2, 7.0×5.0 (DFN)	LVCMOS	✓
SiT3821/22	1 to 625 MHz	±10, ±25, ±50	2.5 to 3.3	55 to 69 mA	3.2×2.5, 5.0×3.2, 7.0×5.0 (DFN)	LVPECL, LVDS	✓
<b>DCXO (Digitally-Controlled Oscillators)   ±25 to ±1600 ppm pull range, &lt;1% linearity, 0.5 ps RMS integrated phase jitter</b>							
SiT3907	1 to 220 MHz	±10, ±25, ±50	1.8, 2.5 to 3.3	32 mA	3.2×2.5, 5.0×3.2, 7.0×5.0 (DFN)	LVCMOS	✓
SiT3921/22	1 to 625 MHz	±10, ±25, ±50	2.5 to 3.3	55 to 69 mA	3.2×2.5, 5.0×3.2, 7.0×5.0 (DFN)	LVPECL, LVDS	✓
<b>SCXO (Serially-Configured Oscillators)   9 user selectable output frequencies, single-pin programmability</b>							
SiT3509	1 to 220 MHz	±25, ±50	1.8, 2.5, 2.8, 3.3	29 to 31 mA	2.5×2.0, 3.2×2.5, 5.0×3.2, 7.0×5.0 (DFN)	LVCMOS	
SiT3519 Digital Control	1 to 220 MHz	±25, ±50	1.8, 2.5, 2.8, 3.3	29 to 31 mA	2.5×2.0, 3.2×2.5, 5.0×3.2, 7.0×5.0 (DFN)	LVCMOS	
<b>TCXO/VCTCXO   ±12.5 to ±50 ppm pull range, 0.6 ps RMS integrated phase jitter</b>							
SiT5000/01/02	1 to 220 MHz	±5	1.8, 2.5, 2.8, 3.0, 3.3	29 to 34 mA (10 to 70 µA stby)	2.5×2.0, 3.2×2.5, 5.0×3.2, 7.0×5.0 (DFN)	LVCMOS	
SiT5021/22	1 to 625 MHz	±5	2.5, 3.3, 2.25 to 3.63	55 to 69 mA	3.2×2.5, 5.0×3.2, 7.0×5.0 (DFN)	LVPECL, LVDS	
<b>SSXO (Spread Spectrum Oscillators)   ±0.25 to ±2% center spread, -0.5% to 4.0% down spread</b>							
SiT9001/03	1 to 220 MHz	±25, ±50, ±100	1.8, 2.5, 3.3	3.7 to 20 mA (1.2 to 30 µA stby)	2.5×2.0, 3.2×2.5, 5.0×3.2, 7.0×5.0 (DFN)	LVCMOS	✓
SiT9002	1 to 220 MHz	±25, ±50	1.8, 2.5, 3.3	48 to 75 mA	5.0×3.2, 7.0×5.0 (DFN)	LVPECL, CML, LVDS, HCSL	✓
<b>Clock Generators with Integrated Resonator   Single output, low power</b>							
SiT2001, SiT2002	1 to 137 MHz	±20, ±25, ±50	1.8, 2.5 to 3.3	3.6 to 6.4 mA (0.6 to 2.6 µA stby)	2.9×2.8 (SOT23-5)	1×LVCMOS	✓
<b>High-Temp and Automotive Clock Generators   +125°C, integrated resonator, single output, low power, 0.1 ppb/g</b>							
SiT2018/19 -40 to +125°C	1 to 137 MHz	±20, ±25, ±30, ±50	1.8, 2.5 to 3.3	3.6 to 6.4 mA (0.6 to 2.6 µA stby)	2.9×2.8 (SOT23-5)	1×LVCMOS	✓
SiT2020/21, SiT2024/25 -55 to +125°C	1 to 137 MHz	±20, ±25, ±30, ±50	1.8, 2.5 to 3.3	4.0 to 6.2 mA (0.6 to 2.6 µA stby)	2.9×2.8 (SOT23-5)	1×LVCMOS	✓

\*TMII : Time Machine II Oscillator Programmer.

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# LCD Timing Controller

We have been in the business of the timing controller for over 15 years. MegaChips product portfolio covers various end products such as PC monitor, TV, notebook and tablet. MegaChips owns not only high speed IO technology to satisfy a wide variety of display resolution and protocol but also image processing IPs. We offer the best-in-class timing controllers based on our accumulated knowledge from extensive experiences and cutting edge technology.



## Features

- 1 Over 15 years experience in delivering timing controllers
- 2 Superior quality and reliability
- 3 Wide range of products for TVs and displays, from HDTV to 4KTV
- 4 Wide range of products for notebook PCs and tablets, from Full HD to 4K2K
- 5 Interface support for LVDS, V-by-One® HS, eDP; connectable to graphics processors and scalers
- 6 Available in ASSP and custom ASIC chips

## Applications

Our LCD Timing Controller is adopted in some of the most popular mobile devices and display products in the market.

- TVs
- Laptops
- Smartphones
- Car navigation
- Monitors
- Tablets
- Digital signage
- ...and other LCD panels





## Product Lineups

Series	Part number	Function	Application
F series	F4	4K2K and Full HD 240 Hz with built-in Over Drive / V-by-One® HS	TV/Monitor
	F3	Frame Rate Converter (FRC) and 3D format Converter / LVDS	TV/Monitor
	F2	Full HD 120 Hz with built-in Over Drive / LVDS	TV/Monitor
	F1	Full HD 60 Hz with built-in Over Drive / LVDS	TV/Monitor
W series	W1	HD 60 Hz with Over Drive / LVDS	TV/Monitor
T series	T1	Full HD 60 Hz simple product / LVDS	TV/Monitor
M series	M1	De-MURA for Full HD / LVDS	TV/Monitor
S series	S1	Compatible with eDP 1.3 2.7 Gbps	Laptop /Tablet
	S15	Compatible with eDP 1.4a 2.7 Gbps	Laptop /Tablet
N series	N2	Compatible with eDP 1.3 2.7 Gbps for Full HD	Laptop /Tablet

## Interface Macros

We offer a wide variety of Interface Macros, including interface provided by partners.

- Video Interface
  - LVDS
  - eDP
  - V-by-One® HS
  - MiPi DSI
- Driver Interface
  - mini-LVDS
  - iSP
  - CalDriCon®
  - USI-T
  - EPI
- Other
  - DRAM IF

\*"V-by-One®" and "CalDriCon®" are registered trademarks of THine Electronics, Inc.



## IP Macros

We offer a wide variety of intellectual property macros (IP Macros) that contribute to function improvement.

- Over Drive
- Up-Scaling
- Color Space Distortion Correction
- Data Compression
- De-MURA

# Smart Connectivity LSI - DisplayPort

MegaChips offers a variety of DisplayPort converter products, bridging the latest DP standard to other analog and digital audio-video interfaces and addressing both legacy and future connectivity needs. Additionally, these products feature MegaChips' innovative technologies in protocol conversion, audio-video rendering, color fidelity, low power management, uncompromised content security and device anti-tampering.

## Benefits

### 1 Next-generation AV technology today

DisplayPort facilitates the convergence of display, sound and data along with power delivery on a single connection. DisplayPort is now the preferred AV protocol for USB Type-C.



### 2 Cascading displays made simple

DisplayPort multi-stream allows today's mobile devices to share multiple videos concurrently over multiple displays. You can converge, split and route several videos streams from different sources to fill a large size video walls with tiled displays.



### 3 Stunning video on all screen sizes

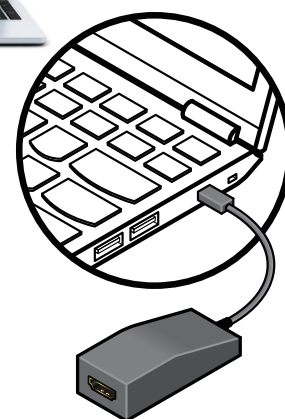
DisplayPort delivers incredibly beautiful video on smart mobile devices or on living room TVs. Enjoy the high resolution, fast frame rate, lifelike colors and zero latency on your personal screens.



## Applications

Our chipsets power some of the most popular mobile devices, accessories, and display products in the market, affecting tens of millions of users.

- Smartphone
- Tablets and Laptops
- A/V equipment adaptor
- USB Type-C dongles (USB Type-C to HDMI/VGA adaptor)
- Expansion unit for notebook and tablet (Docking station)
- Gaming
- Smart devices
- Desktop computers
- Monitors
- TVs
- Projectors
- Digital signage



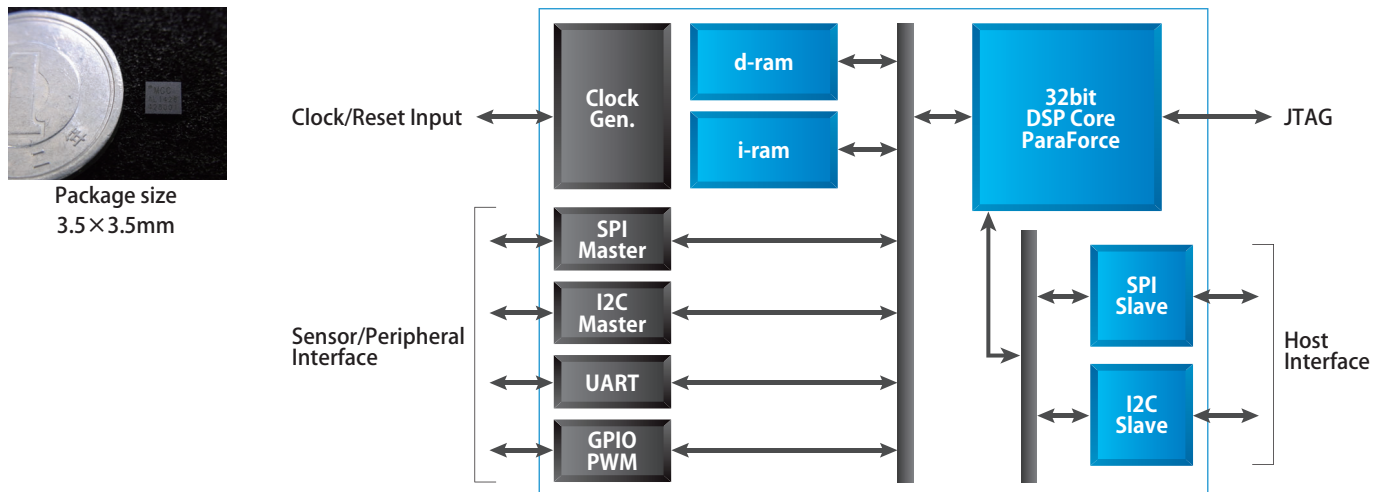
## Product Lineups

Part Number	Feature Differentiation	Application	Package
DP SST Converters			
STDP4020	DP/eDP to QLVDS/TTL	Digital TV, LCD monitor, Mobile display, Projector, etc.	164LFBGA 12×12 mm
STDP4010	DP/eDP to DLVDS/TTL	Digital TV, LCD monitor, Mobile display, Projector, etc.	164LFBGA 12×12 mm
STDP4028	QLVDS/TTL to DP/eDP	Digital TV, Docking station, STB, Game console, etc.	164LFBGA 12×12 mm
STDP3100	10-bit Video DAC (DP to VGA)	Notebook, Desktop PC, Dongle, Desktop PC motherboard, etc.	64LQFP 10×10 mm
STDP3150	10-bit Video DAC (DP to VGA)	Notebook, Desktop PC, Dongle, Desktop PC motherboard, etc.	64QFN 6×6 mm
STDP3160	8-bit Video DAC (DP to VGA)	Notebook, Desktop PC, Dongle, Desktop PC motherboard, etc.	64QFN 6×6 mm
STDP2600	HDMI to DP++	Audio-video accessory (dongle), Docking station, etc.	81BGA 8×8 mm
STDP2650	DP1.2 to HDMI1.4	TV, Projector, Audio-video accessory (dongle), Desktop PC, Notebook, Tablet, etc.	81BGA 8×8 mm
STDP2690	DP1.2 to DP++	Audio-video accessory (dongle), Desktop PC, Notebook, Docking station, Thunderbolt source, Peripheral device, etc.	81BGA 8×8 mm
MCDP2800/2850	DP1.2 to HDMI2.0	Desktop PC, Notebook, Tablet motherboard, DP/USB Type-C docking station, Dongle, etc.	64LFBGA 7×7 mm
MyDP Converters			
STDP2500	MyDP to DP	Audio-video accessory (dongle), Smartphone, Tablet, etc.	81BGA 5×5 mm
STDP2550	MyDP to HDMI	Audio-video accessory (dongle), Smartphone, Tablet, TV front-end, etc.	81BGA 5×5 mm
STDP2530	HDMI to MyDP	Smartphone, Tablet, Camera, Portable media device, etc.	81BGA 5×5 mm
DP MST Hub			
STDP4320	Splitter	Audio-video router, Docking station, Hub, 4K2K TV, Daisy chain monitor, Digital signage, etc.	172LFBGA 12×12 mm
STDP4328	Concentrator	Audio-video router, Docking station, 4K2K camera/recorder, etc.	172LFBGA 12×12 mm

\*MyDP: Mobility DisplayPort, STB: Set Top Box, SST: Single Stream, MST: Multi Stream

# Sensor Hub LSI – frizz

frizz (product number: MA60000) with DSP (Digital Signal Processor) core is our next generation Sensor Hub LSI for low-power, high-end arithmetic processing. frizz delivers high-speed signal processing for state detection and location positioning with motion sensors as well as biological sensor analysis. The ideal solution for navigation healthcare and fitness applications, frizz opens up new possibilities for smart devices and wearables.



## Main features and functions

### 1 Ultra low-power consumption

32bit DSP core “ParaForce” performs high-end arithmetic processing in real time at low power.

### 2 Highly advanced algorithm optimized for frizz

Timely realize application combining with various competitive algorithms.



\*PDR:Pedestrian Dead Reckoning, VDR:Vehicle Dead Reckoning

### 3 Evaluation and development kit for Time to Market

Evaluation and development kits corresponding to each device are available along with the standard software development environment.

## Specification

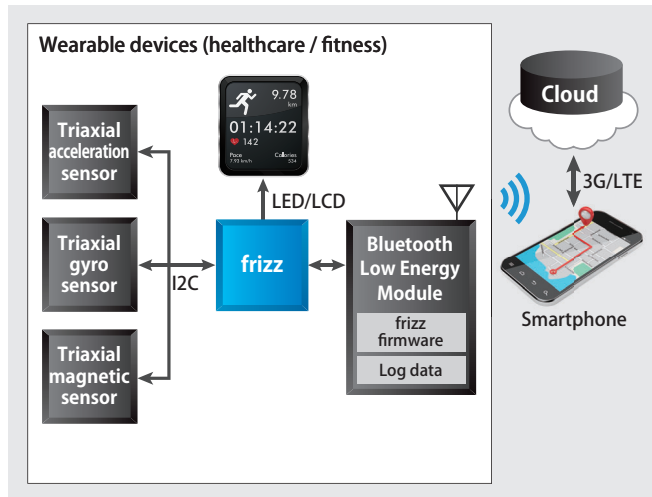
DSP	32 bit DSP Motion engine “ParaForce” Max. Frequency 40 MHz • 3way VLIW • Floating Point 4way SIMD	Power consumption	Active: 8.3mA@40 MHz Sleep (fast): 1mA@40 MHz Sleep (slow): 150 $\mu$ A@100 kHz Standby: 8.3 $\mu$ A
RAM	Instruction RAM: 256 KB Data RAM: 256 KB	External interface	Host CPU Interface: SPI or I2C Dual Purpose RAM (32 bit $\times$ 64 word)
Power voltage	Core 1.2 V IO 1.8/2.5/2.8/3.3 V	Device interface	UART $\times$ 1, SPI $\times$ 1 (4 devices control) I2C $\times$ 1, GPIO $\times$ 4
Power save mode	Sleep/Stop/Standby mode	Package	3.5 mm $\times$ 3.5 mm $\times$ 0.65 mm
System	<ul style="list-style-type: none"> <li>• Timer 32 bit <math>\times</math> 4</li> <li>• Dual Purpose RAM (32 bit <math>\times</math> 64 Word) : FIFO mode or Snap Shot mode</li> <li>• Self Boot from SPI Flash memory</li> <li>• Host CPU Download boot</li> <li>• JTAG debug</li> </ul>		

## Target device

frizz is optimal LSI for Always-on wearable device and smartphone that need to be small in power consumption.

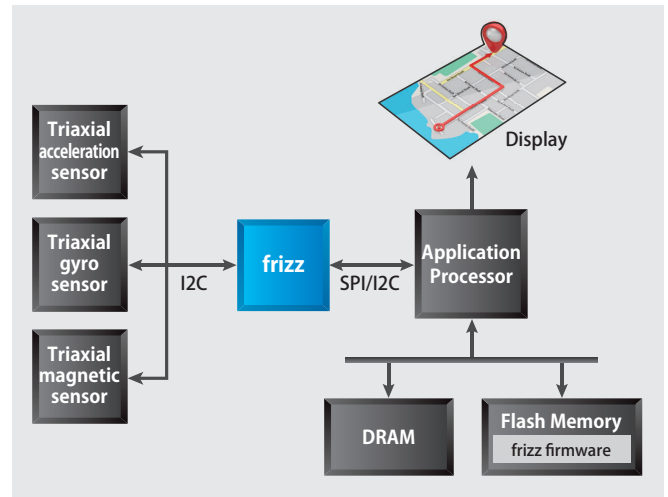
### Wearable device

frizz performs processing in real time with low power the various sensor data and help to achieve next-generation high functional wearable devices.



### Smartphone

As Sensor Hub LSI for smartphone and smartwatch, frizz provides advanced function of indoor navigation and achieves low power consumption of whole system.



## Applications

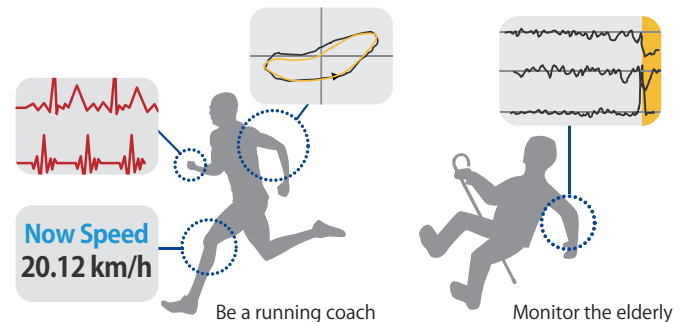
### 1 Indoor navigation

Use frizz to develop applications for indoor navigation in areas where GPS fails. frizz works with acceleration, gyroscope and geomagnetic sensors to estimate speed and direction and provide accurate location information.



### 2 Healthcare and fitness

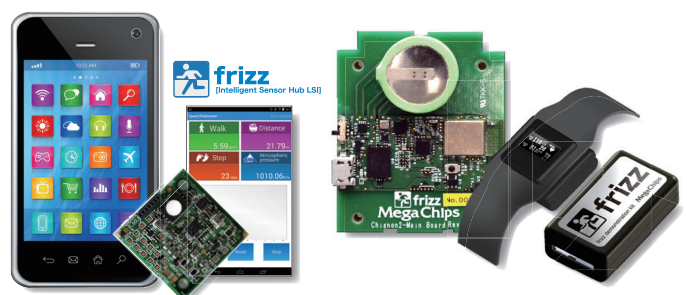
frizz enables to estimate moving speed and distance as well as heart rate measurement. Also, a running-coach function that measures arm motion and swing speed, and applications to determine abnormal attitude condition including a falling-down are available.



## Development environment

We provide evaluation/development kit for finished products and software development environment.

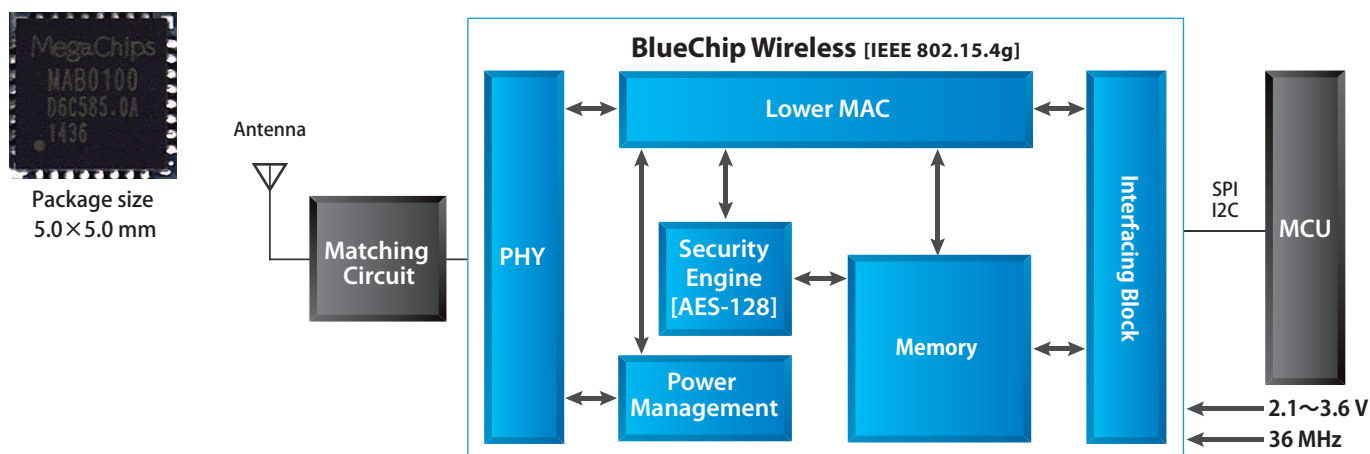
- Evaluation/development kit according to target devices
  - Evaluation/development kit for wearable devices [Chignon]
  - Evaluation/development kit for smartphone [Ayame]
- Software development environment
  - Eclipse based (GCC4.2.0)
  - C/C++ compiler
- frizz reference firmware
- Various algorithm libraries for frizz
- Demo application





# Communication LSI - BlueChip Wireless

The BlueChip Wireless (MAB0100) is a low-power Sub-GHz wireless communication transceiver covering all major worldwide ISM bands. This low cost, high performance chip is especially designed for a wide variety of low-power wide area networks (LPWAN) addressing the new Machine-to-Machine (M2M), and Internet-of-Things (IoT) applications. With various options of external microcontrollers the operation can be further extended to variety of applications such as home, building and factory automation.



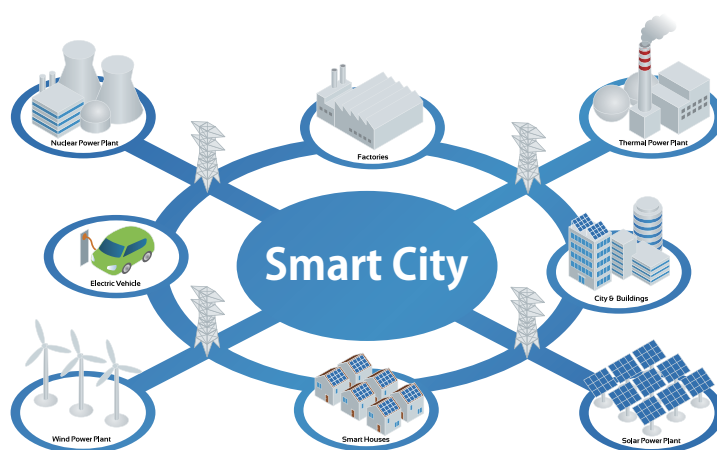
## Main features and functions

- 1 Single-chip Sub-1GHz band GFSK wireless radio transceiver
- 2 Configurable frequency band complies with global regulations (ARIB, CENELEC, FCC)
- 3 Low BOM cost – No SAW filter is required
- 4 Embedded hardware accelerators to reduce cost and improve performance
- 5 Single-Voltage operation with integrated DC-DC converter and LDO
- 6 Up to 1Mbps Turbo Mode – supported for the overseas markets including China
- 7 Supports ARM mbed, and Contiki based Operating Systems

## Applications

This state-of-the-art single-chip Sub-1GHz radio transceiver is designed specifically to work in various cost-sensitive IoT and M2M applications, as well as consumer products.

- Wireless Sensor Networks (WSN)
- Lighting Control
- Alarm and Security systems
- Home and Building automation
- Industrial/Factory automation
- Remote monitoring and control



## Specification

Wireless communication	Frequency band	916~930 MHz (70ch) [Japan] 917~923.5 MHz (32ch) [Korea] 902~928 MHz (130ch) [North America] 863~870 MHz (35ch) [EU] 779~787 MHz (40ch), 470~480 MHz (50ch), 400~434 MHz (50ch) [China]	Hardware accelerator		FSK/MSK Modulation 1000 kbit/s data rate Programmable 'Superframe' Construction CSMA-CA mechanism Automatic ACK response FCS-16 check Security engine (AES-128)
	PHY	GFSK	Power consumption	TX	33 mA@ +13 dBm (with built-in DC-DC)
	MAC	IEEE 802.15.4/4e *		RX	12 mA (with built-in DC-DC)
	Transmission speed	50 kbps, 100 kbps, 200 kbps [GFSK], 1 Mbps Turbo Mode		Sleep	Power down mode when 0.1 µA
	Transmission power (VDD=3.0 V, 25°C)	+13dBm MAX output power (Tip end)	Power-supply voltage		1.8~3.6 V (with built-in DC-DC)
	Receiving sensitivity (VDD=3.0 V, 25°C)	-105 dBm at 50 Kbps GFSK -102 dBm at 100 Kbps GFSK -99 dBm at 200 Kbps GFSK -91 dBm at 1 Mbps FSK/MSK	Input and output signal voltage		1.8~3.6 V
OSC		36 MHz Crystal	Operating temperature limit		-40~+85°C
Security		AES-128	Package		QFN, 32pin, 5.0×5.0 mm
Interface		Host I/F: SPI [Slaver] ×1, I2C [Slaver] ×1, External I/F: GPIO ×3	Other		Pb-free

\* The IEEE 802.15.4 (e) MAC layer runs on an external microcontroller

## Development environment

Megachips provides various hardware and software tools to help speed-up your product development, evaluation, and validation of the BlueChip wireless family of devices.

### 1 Development Tools [HDK/SDK]

- BlueChip Wireless SDK source code
  - Drivers
  - IEEE 802.15.4e MAC
  - Peripheral drivers
  - Sniffer
  - Test commands
  - Sample Firmware
- Tool chain (Compiler, Libraries)
  - Evaluation tools (PER measurement, packet analyzer)
  - User's manual
- Reference designs
  - RF Peripheral circuit diagram
  - BOM
  - Layout
  - Application software support

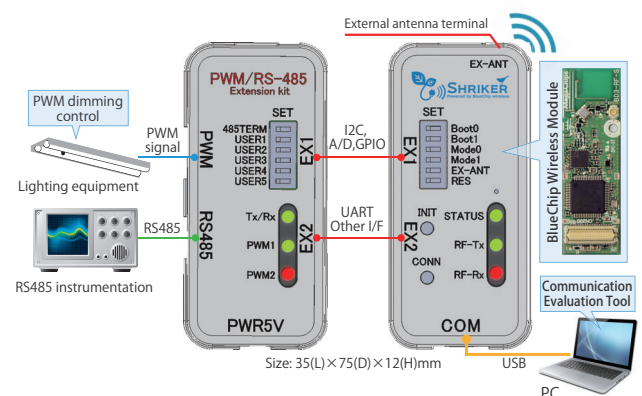
### 2 BlueChip Wireless Software Stack

**Contiki** **ARM<sup>®</sup>mbed<sup>™</sup>**

Applications	Community Libraries
C++ APIs	
Event Framework	Communication Management
Threads	CoAP, HTTP, MQTT, LWM2M
Device Management <i>Bootstrap, Security, FOTA</i>	TLS, DTLS
Crypto & Device Security	IPv4, IPv6   6LoWPAN
CMSIS	IEEE 802.15.4 MAC
	RF driver
Cortex <sup>®</sup> -M	Sensors
	Radio

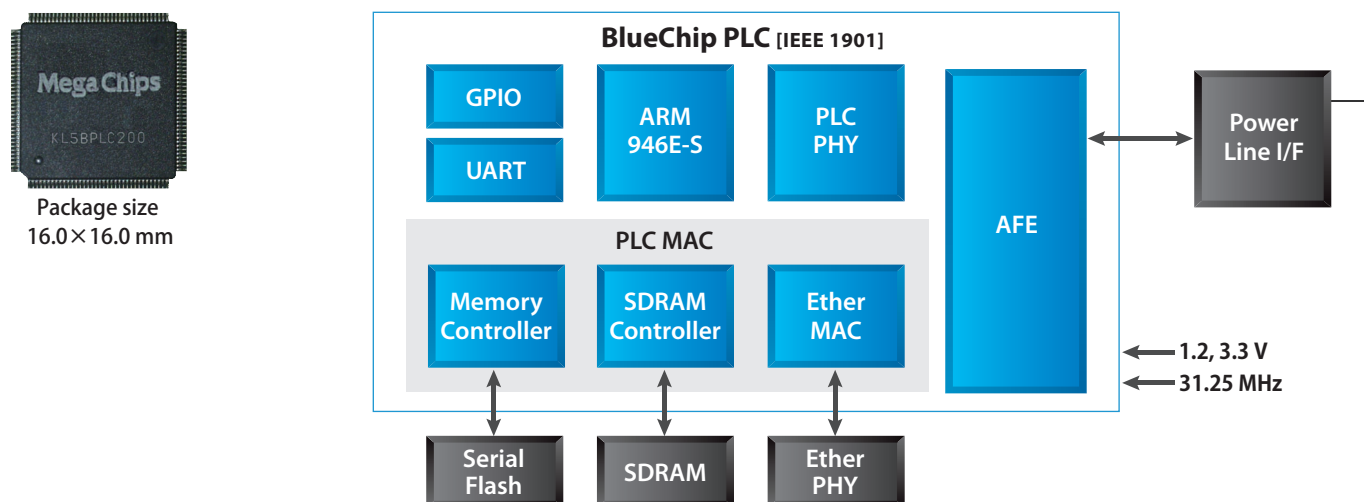
### 3 BlueChip Wireless Communications Evaluation Kit

The BlueChip Wireless Evaluation Kit is a standalone kit for evaluating, prototyping, developing applications and debugging. It includes two evaluation units (Shriker) that integrates the MAB0100 and provides various interfaces (RS485/USB) for easy set up in various environments. It includes a PC application software to configure and control a wide variety of radio parameters such as wireless channel, transmission power, PER measurement (PHY/MAC), number of retransmissions, CRC error measurement, and more.



# Communication LSI - BlueChip PLC

BlueChip PLC (P/N: KL5BPLC200WMP) is the first broadband power line communication transceiver SoC (System-on-Chip) that fully conforms to IEEE 1901 (HD-PLC). It combines the PHY, MAC and AFE in a single-chip providing the most cost effective, smallest form factor, highest performance and lowest power of any available broadband PLC solutions today. The BlueChip PLC reliably delivers robust communications, superb noise immunity, and high quality of service (QoS) over both AC and DC power lines, as well as dedicated lines such as COAX. It is the only PLC solution implementing the ISP mechanism to ensure coexistence with other PLC devices as mandated by IEEE 1901, ITU-T G.9972 (G.hn) Standards and new CENELEC EMC standard EN50561-1.



## Main features and functions

- 1 Low power broadband PLC communication SoC – fully compliant with IEEE 1901 (HD-PLC) specification
- 2 Supports high-speed communications on both AC/DC lines providing superior noise immunity and QoS
- 3 Supports Inter-System Protocol (ISP) mandate by IEEE 1901 and ITU – T G.hn/G.9972
- 4 Achieves data rates as high as 240 Mbps (PHY)
- 5 Low power consumption – 0.4 W for full access, and 0.07 W in power save mode
- 6 EN50561-1 compliant, CENELEC EMC standard of EU

## Specification

PLC method	Frequency band	2~28 MHz	Peripheral I/F		GPIO, UART
	Modulation	Wavelet OFDM	Power consumption	Full access	0.4 W (Typ.)
	PHY/MAC	IEEE 1901 full compliant		Power save mode	0.07 W
	PHY rate	240 Mbps	Supply voltage		1.2, 3.3 V
	Error correction	Reed-Solomon, LDPC-CC	Operating temperature range		-40~+85°C
CPU		ARM946E-S 16 kbyte Instruction cache	Encryption		AES-128 bit
System clock		125 MHz	Package		TQFP, 144pin, 16×16 mm

## Applications

In-home Networking, Set-Top-Box, Gaming, Multimedia Distribution (IPTV), Surveillance (IP Cameras), Smart Grid, Smart Home (HEMS), Smart Buildings (BEMS), WiFi Range Extender, Dedicated Networks, Long-Range Communication

# Communication LSI - BlueChip PLC Multi-hop

BlueChip PLC with multi-hop (P/N: KL5BPLC250WMP) is built on top of our proven broadband PLC technology described in the previous page. It offers the same feature set and performance as our KL5BPLC200WMP, but with the addition of the multi-hop function. It enables high-speed communication over much longer distances (up to 1 Km) over existing power lines.



## Main features and functions

- 1 ITU-T G.9905 Compliant
- 2 Multi-hopping function supports 10 hops and 1024 node
- 3 Achieves maximum transmission speed of 10Mbps (UDP/10hops)
- 4 Uses Centralized Matrix based Source Routing (CMSR)
- 5 Selects best communication route based on link quality

## Applications

Widely used in BEMS and Smart Meter where large scale network is necessary. Power line and dedicated line are usable. Ideal for Ethernet⇔Ethernet and RS485⇔RS485 Bridge.

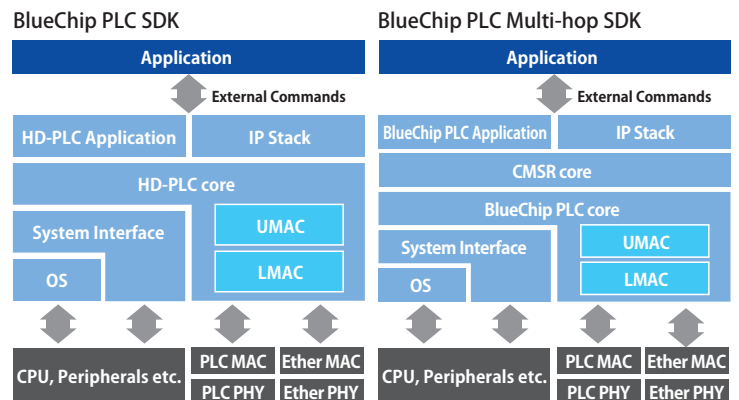
## Development environment (Both BlueChip PLC・BlueChip PLC Multi-hop)

### 1 Software Development Kit [SDK]

MegaChips provides various hardware and software tools to help speed-up your product development, evaluation, and validation of the BlueChip PLC family of devices.

#### Contents of SDK

- BlueChip Master ROM generating tool
- Sample firmware
- External command datasheet
- External command sample program
- Tool Manager
  - Power control tool
  - Channel monitor tool
- Network testing tool  
(Observe communication speed)

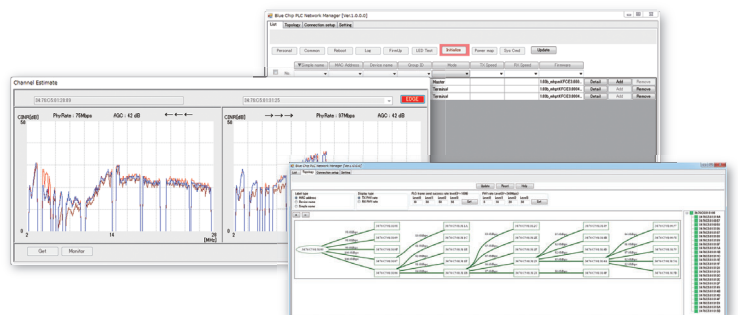


### 2 Maintenance Application [BCP Network Manager]

BCP Network Manager is a maintenance application software. It helps the efficient management of large scale networking.

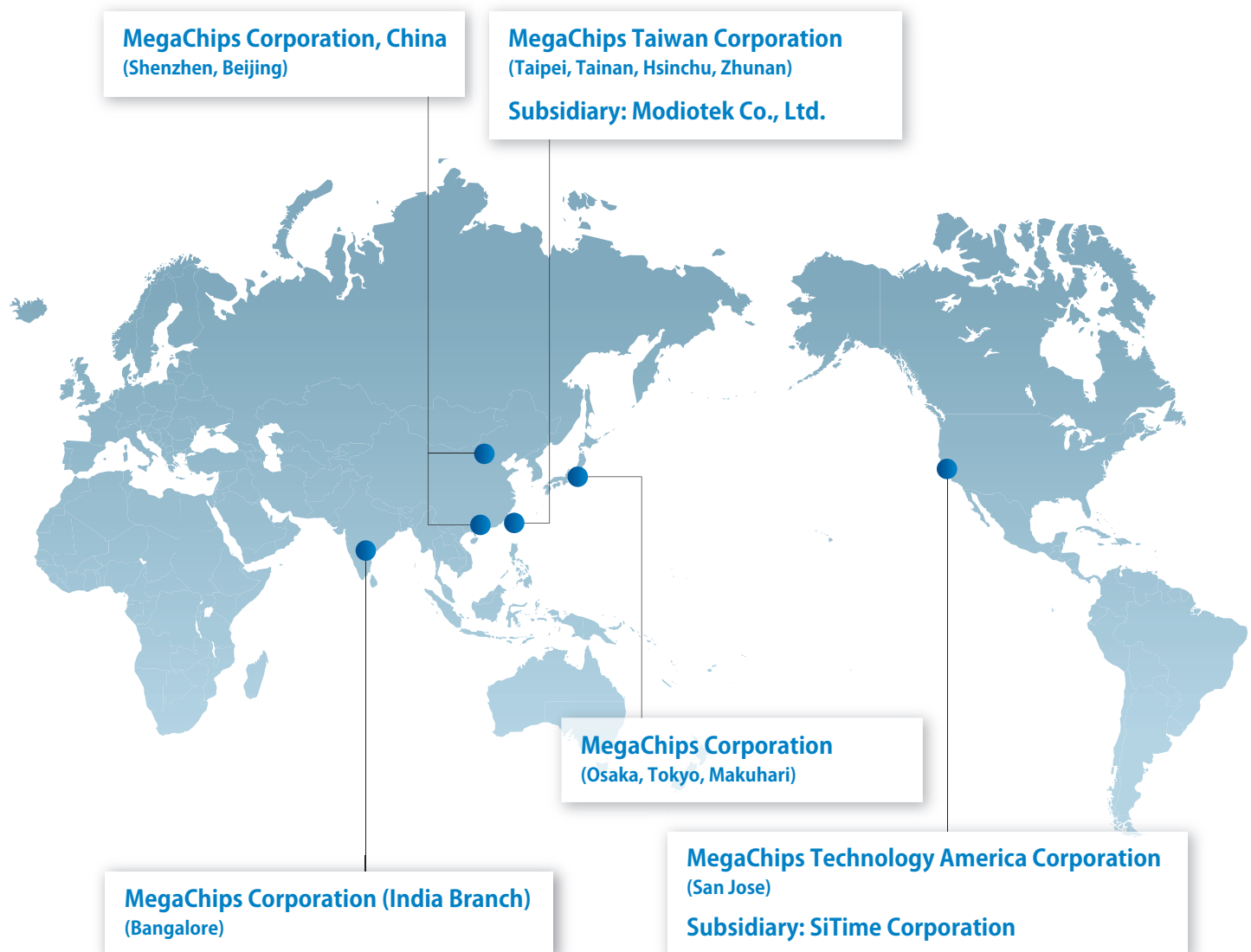
#### Main functions

- Manage a whole network by any terminal
- Configure any terminals easily
- Display network topology
- Display PHY rate
- Display information transmitted and received
- Display CINR
- Display AGC Gain



# Global Network

Our global systems provide products and support to the customers all over the world.



## Quality and environmental policies

MegaChips contributes towards the realization of people's safety and comfort, delightful life, and affluent communication by providing high-tech based creative products in the world. In pursuing the mission, we have the greatest advantages of "fabless business model" in which the production is fully outsourced, and our unique "technology platform business" that is based on our original technologies and innovations. We are committed to improve the quality of all aspects of our operations from product designs, R&D and production management to shipment and after-sale services, and provide products and services for the customer satisfaction.

Also, MegaChips has built an environmental management system that complies with the ISO 14001 standard. For propulsion of global environment preservation, we set challenges of "continued improvement and preventing contamination of system" and "creating a valuable benefit in a community" through our business operation as well as products and services, as our important business factor.



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Rev.2 BSL-Z-2015E0016 9 November 2015  
Edited by CORPORATE MARKETING DIV.