

IoT

LTE



GNSS

MC60 GSM/GPRS+GNSS Combo Module Presentation

July, 2016

3G



2G

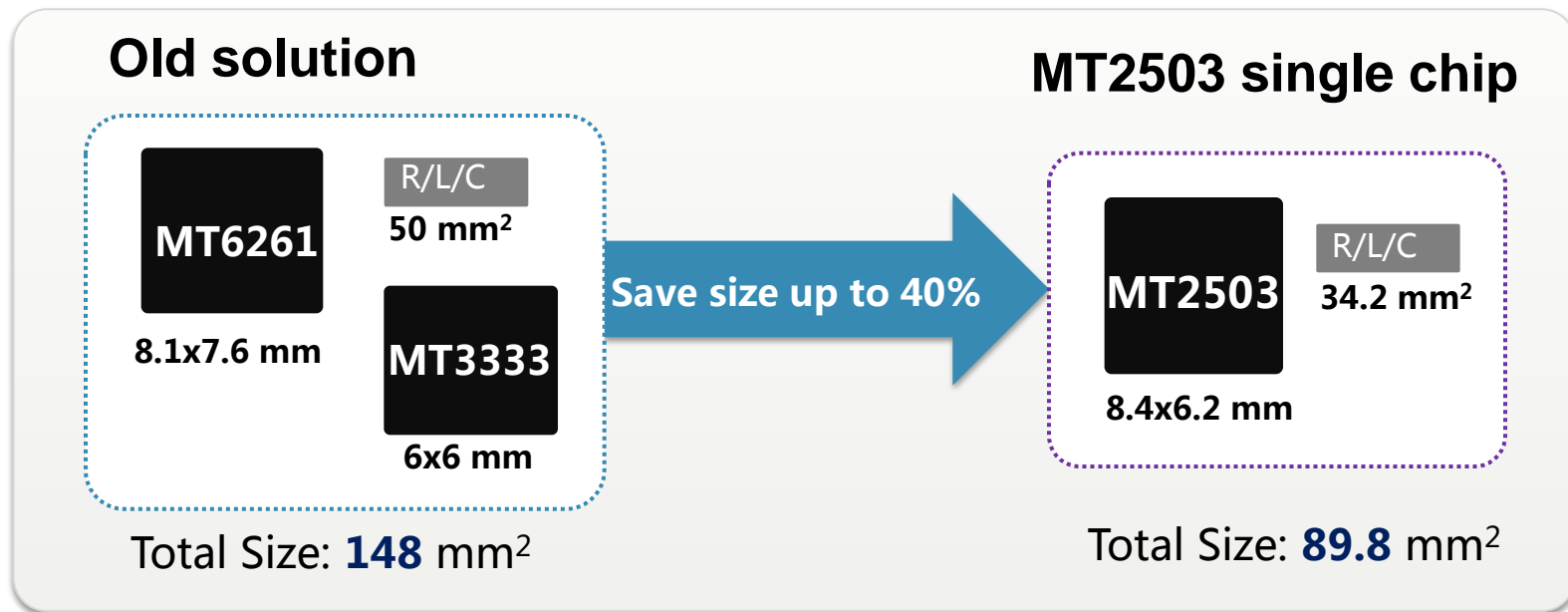
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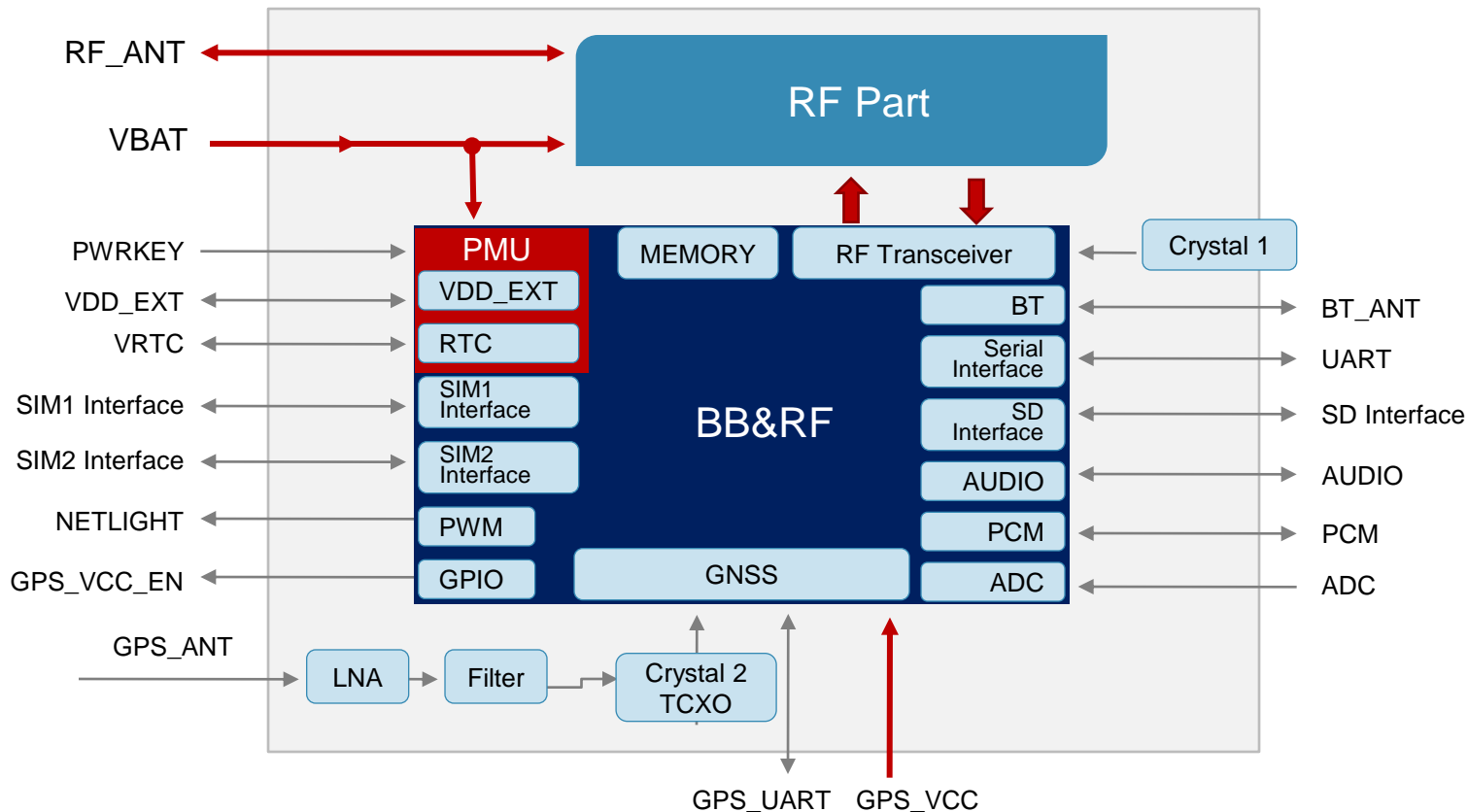
Build a Smarter World

Internet of Things

MC60 is a GSM/GPRS+GNSS combo module based on **MT2503D** platform which is the combination of GNSS platform MT3333 and GSM/GPRS platform MT6261. While offering the same performance as MT6261 and MT3333, **MT2503D** features greatly reduced size, and also offers more advanced features in GNSS part.



Block Diagram

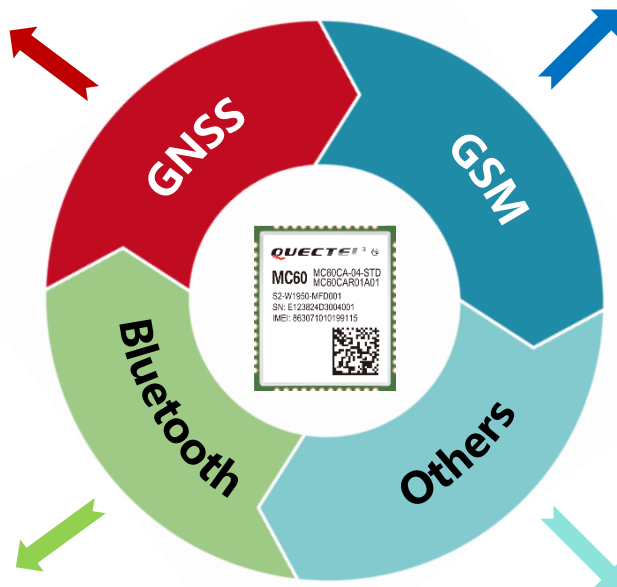


GNSS Features

- GPS + GLONASS
- EASY™
- LOCUST™
- GLP
- DGPS
- AlwaysLocate™
- Build-in LNA
- EPO™*
- SUPL*

Bluetooth

- BT3.0
- Profiles: SPP, HFP-AG



* Under Development

GSM/GPRS Features

- Quad-band: 850/900/1800/1900MHz
- GPRS Multi-slot Class: Class 12
- AT Commands: GSM 07.07, 07.05 and enhanced AT commands
- TCP/UDP/HTTP/FTP/PPP*
- Jamming Detection
- Audio
- QuecFOTA™
- Dual SIM Single Standby
- OpenCPU

Others

- Extended temperature range: -40 °C~+85 °C
- Support 3V/1.8V SIM/USIM cards
- Highly compact size

GPS L1 Band Receiver (1575.42MHz)	Channel	33 tracking channels 99 acquisition channels 210 PRN channels
	C/A code	
GLONASS L1 Band Receiver (1601.71MHz)	SBAS	WAAS, EGNOS MSAS, GAGAN
	Autonomous	<2.5m CEP
Horizontal Position Accuracy		
Velocity Accuracy	Without Aid	<0.1m/s
Acceleration Accuracy	Without Aid	0.1m/s ²
Timing Accuracy	1PPS	10ns
TTFF@-130dBm with EASY™	Cold Start	<15s
	Warm Start	<5s
	Hot Start	<1s
TTFF@-130dBm without EASY™	Cold Start	<35s
	Warm Start	<30s
	Hot Start	<1s
Sensitivity	Acquisition	-149dBm
	Tracking	-167dBm
	Re-acquisition	-161dBm

Quad-band	850/900/1800/1900MHz
GPRS Multi-slot Class	Class 12
GPRS Mobile Station	Class B
Compliant to GSM Phase 2/2+	Class 4 (2W @850/900MHz)
	Class 1 (1W @1800/1900MHz)
Supply Voltage Range	3.3–4.6V 4.0V Typ.
Low Power Consumption	1.2mA @DRX=5
Operation Temperature	-40°C ~ +85°C
Dimensions	18.7 × 15.8 × 2.1mm
Weight	Approx. 1.3g
Control via AT Commands	GSM 07.07, 07.05 and other enhanced AT commands
Speech Codec Modes	Half Rate (HR) Full Rate (FR) Enhanced Full Rate (EFR) Adaptive Multi-Rate (AMR)
Echo Arithmetic	Echo Cancellation Echo Suppression Noise Reduction
Bluetooth	BT 3.0 Profile: SPP, HFP
SIM/USIM	3V/1.8V
UART	×3

- Standard V.25ter AT commands
- GSM 07.07
- GSM 07.05 (SMS)
- GPRS AT commands in accordance with GSM 07.07
- TCP/IP stack AT commands
- STK (SIM Application Toolkit)
- Quectel defined AT commands (Enhanced Functions)



MC60's GNSS part supports PQ commands which are developed based on SDK. The commands and corresponding functions are:

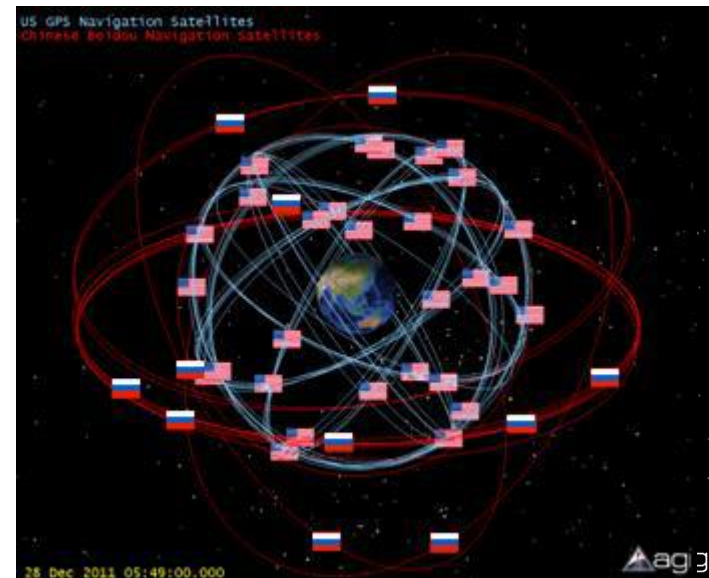
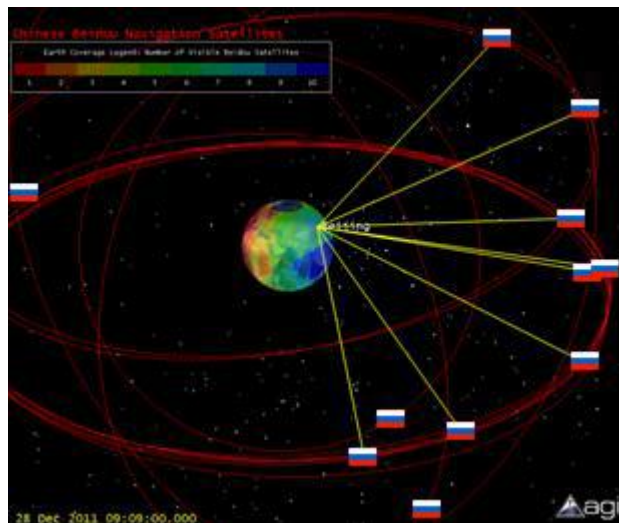
PQ Command	Description
PQBUAD	Set NMEA Port Default Baudrate
PQEPE	Enable/Disable PQEPE Sentence Output
PQECEF*	Enable/Disable ECEFPOSVEL Sentence Output
PQODO*	Start/Stop Odometer Reading
PQPZ90*	Enable/Disable Switching from WGS84 to PZ-90.11
PQVEL*	Enable/Disable 3 Ways Velocity Sentence Output



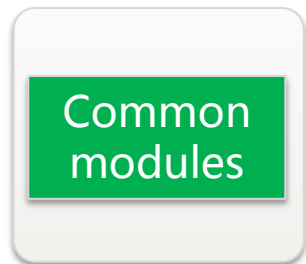
* Under Development

MC60 supports GPS+GLONASS

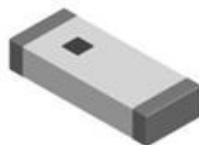
- GPS: max acquisition 10 SV
- GPS+GLONASS: max acquisition 22 SV
More satellites are available for position calculation, which greatly improves accuracy.



The two-constellation system is especially suitable for urban areas with high-rise buildings and complex environments.



- Expensive active antenna
- Increased external circuits



- Low-cost ceramic/chip antenna
- No need of external circuits

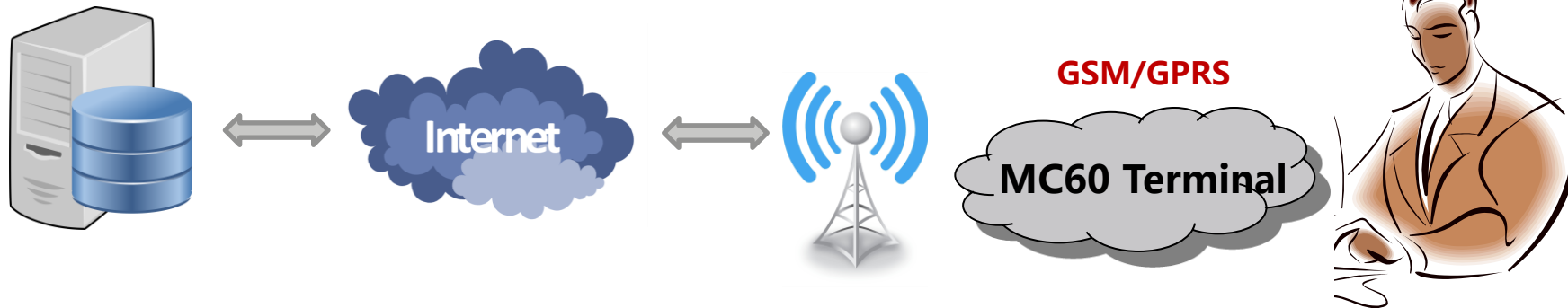
EPO Function

It is a kind of offline AGPS technology which provides predicted Extended Prediction Orbit to speed up TTFF.

Key Benefits:

- No need of extra server.
- EPO data downloading through GPRS network and upload to GNSS engine automatically.
- Small data size ensures short download time.

MTK EPO Server

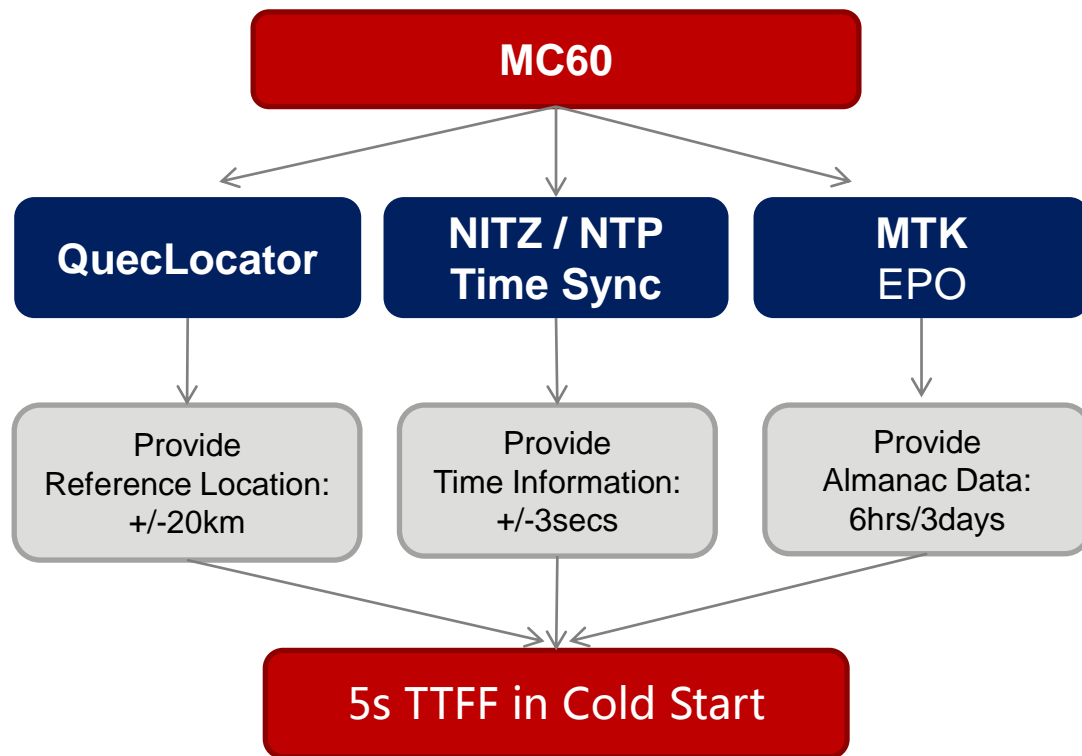




TTFF Comparison

Test Condition		TTFF without EPO™	TTFF with EPO™
Under real network conditions and conductive power level of -130dBm	Cold Start	<35s	<15s
	Warm Start	<30s	<5 s

MC60 supports SUPL, an online AGPS technology which integrates EPO data, NITZ/NTP time sync, and QuecLocator to achieve 5 seconds TTFF for Cold Start in Open Sky.



- In acquisition or tracking condition, GLP (GNSS Low Power) is the best power-saving mode.
- In GLP mode, MC60 module still outputs NMEA data at 1Hz data update rate.
- The module will automatically exit from GLP mode when positioning conditions are not satisfied.

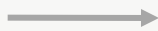
Normal Mode



GLP Mode

100%

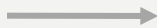
Power consumption



Only 40%

Power consumption

**Maximum
accuracy**



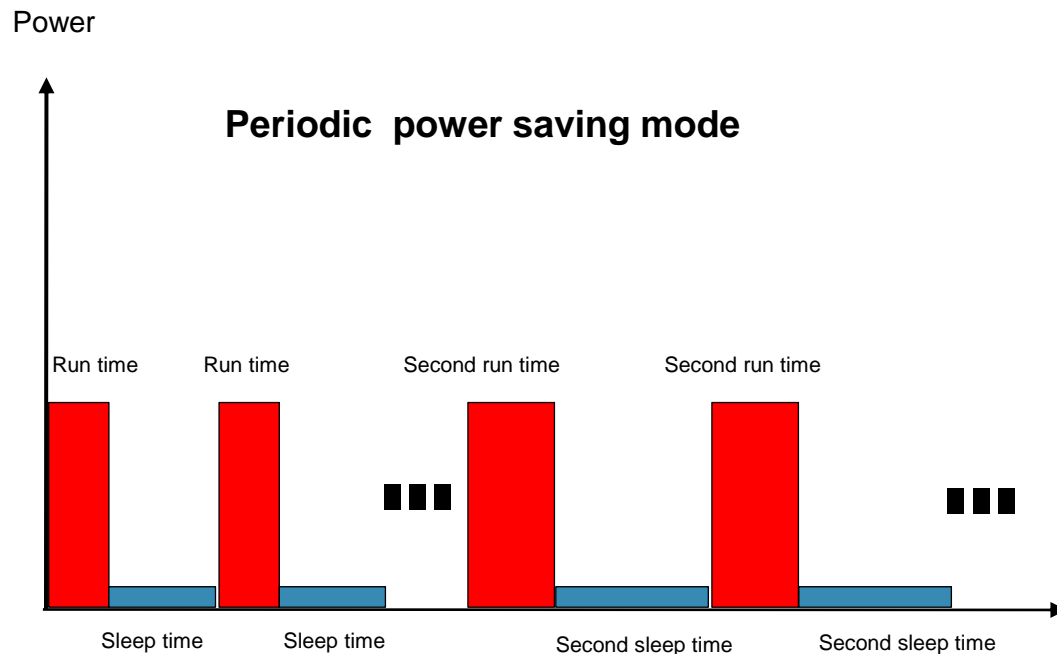
**Tiny Accuracy
Trade-off**

(No Effect on Wearable Devices)

Average Current Consumption in GLP and Normal Modes

Scenario	In GLP Mode (mA)	In Normal Mode (mA)
Static	8.9	22
Walking	11.2	22
Running	11.5	22
Driving	21.5	22

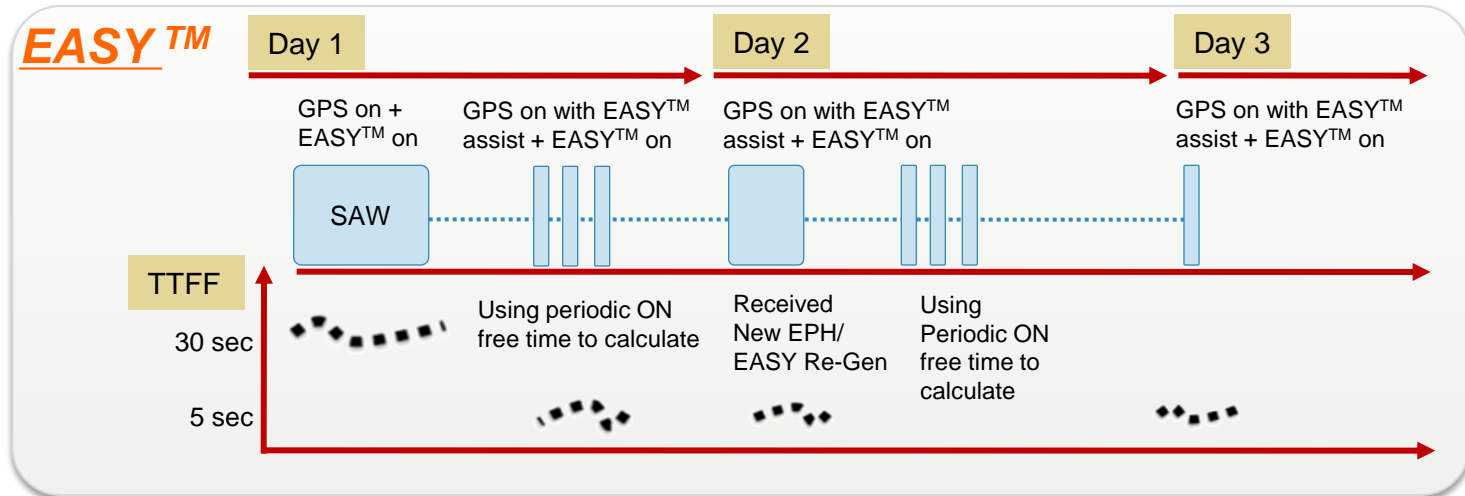
- Periodic standby mode can control the power on/off time of MC60's GNSS part periodically to reduce average power consumption.
- The on/off time can be configured by using PMTK command. For details, please see the figure on the right.



Positioning - EASY™ Technology (1)

EASY™ is the abbreviation of Embedded Assist System for quick positioning. With EASY™ technology, MC60's GNSS engine can automatically calculate and predict orbits automatically using the ephemeris data (up to 3 days) when the power is on, and then save the predict information into the memory. So the GNSS engine can use the information for positioning later if there is not enough information received from the satellites.

This function is helpful for positioning and TTFF improvement under indoor or urban conditions.

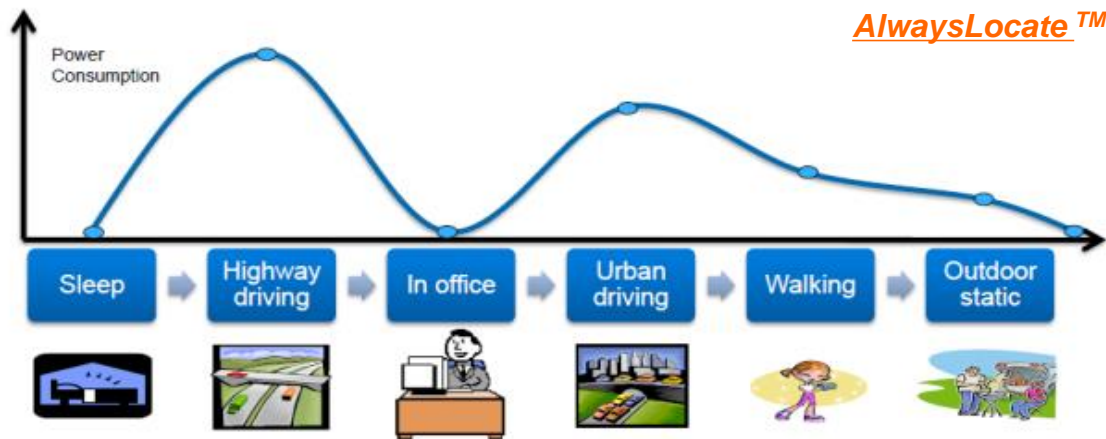




TTFB Comparison

Test Condition		TTFB without EASY™	TTFB with EASY™
Under GNSS signal generator, and conductive power level of -130dBm	Cold Start	<35s	<15s
	Warm Start	<30s	<5 s

AlwaysLocate™ is an intelligent controller of periodic mode.



MC60's GNSS part can adaptively adjust the on/off time to achieve balance between positioning accuracy and power consumption according to the environmental and motion conditions. So the average power consumption is lower in AlwaysLocate™ power saving mode than that in periodic power saving mode. The typical average power consumption is 2.8mA.

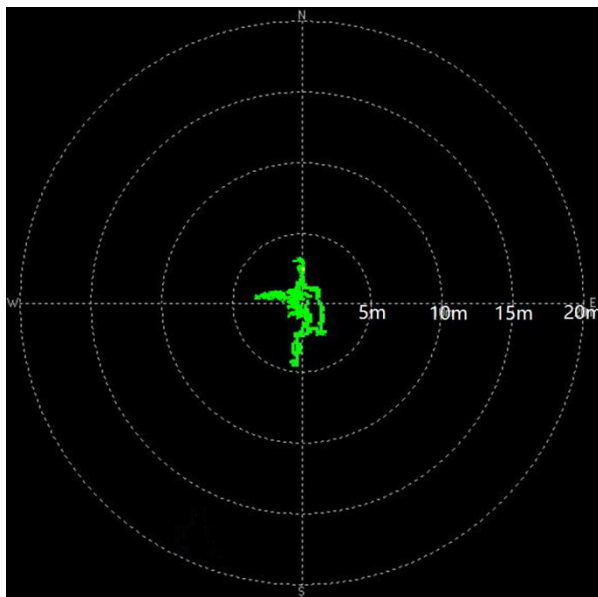
LOCUS is an embedded logger function of MC60's GNSS part. When enabled by PMTK command, it allows the module to log GNSS data (data format: UTC, Latitude, Longitude, Height) to internal flash memory automatically without the need of host CPU (MCU) or external flash.

Benefits:

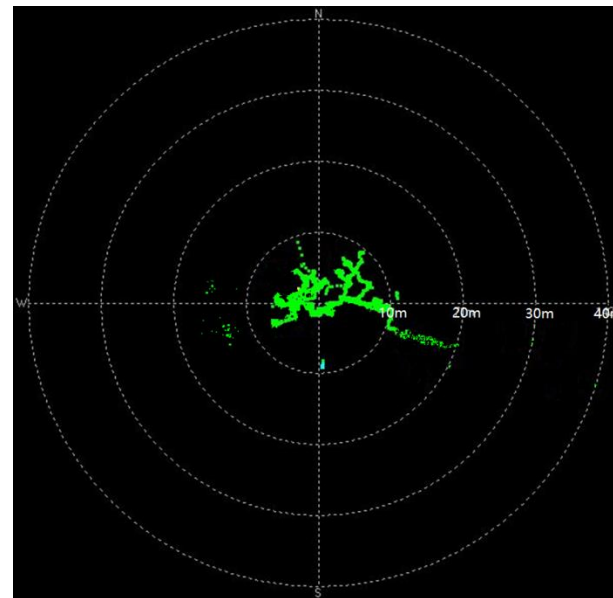
- Automatically log data to chipset internal flash, with the no need to wake up HOST
- Smart overlapping mechanism to keep the latest logger data (4KB base)
- **Logger capability in chipset internal flash:**
 - ✓ With 1 sector flash (64KB), user can log >16 hours
 - ✓ With AlwaysLocate™, user can log up to 48hrs (2 days) under standard scenario.



The following is a 12-hour testing result in static field.

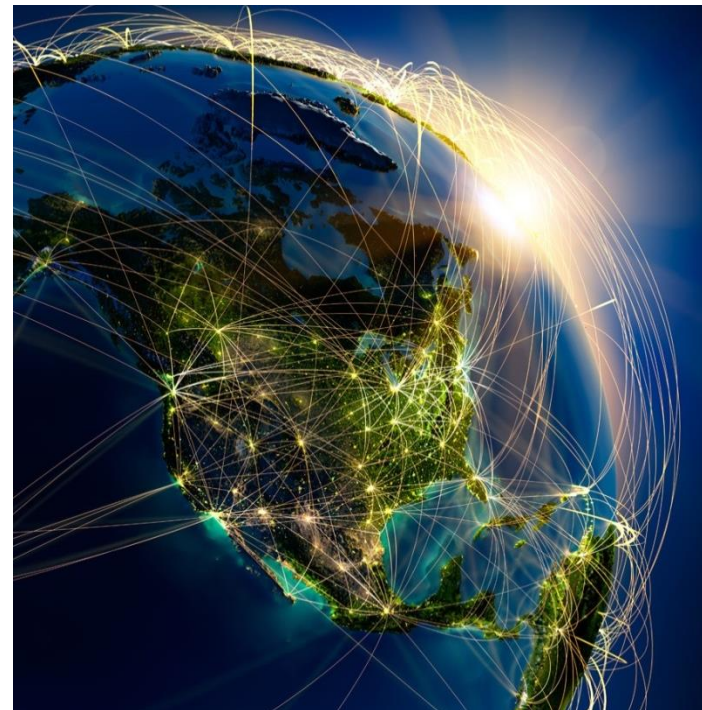


GPS+GLONASS

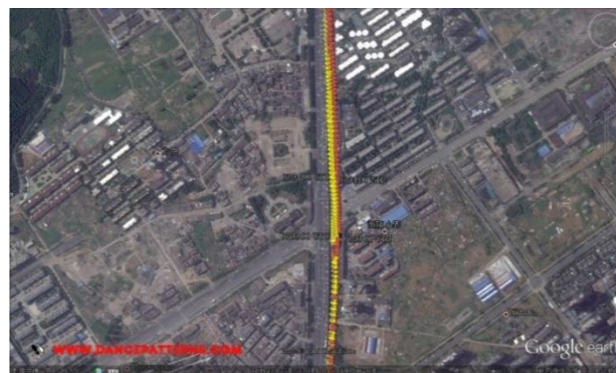


Only GPS

- **Estimated Position Error**
Large error values can be filtered via **PQEPE** command.
- **Static Speed Threshold**
Threshold setting can effectively suppress static drift.



Positioning - Dynamic Field Testing



U turning

Under Viaduct

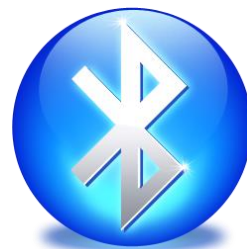
Turning



uCompany M8



MC60

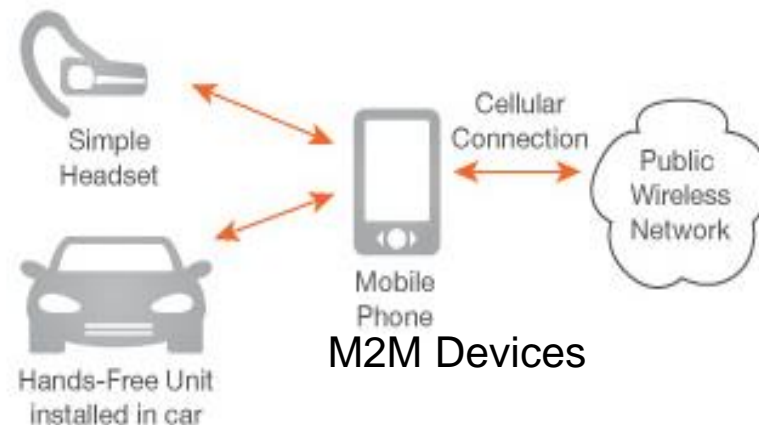


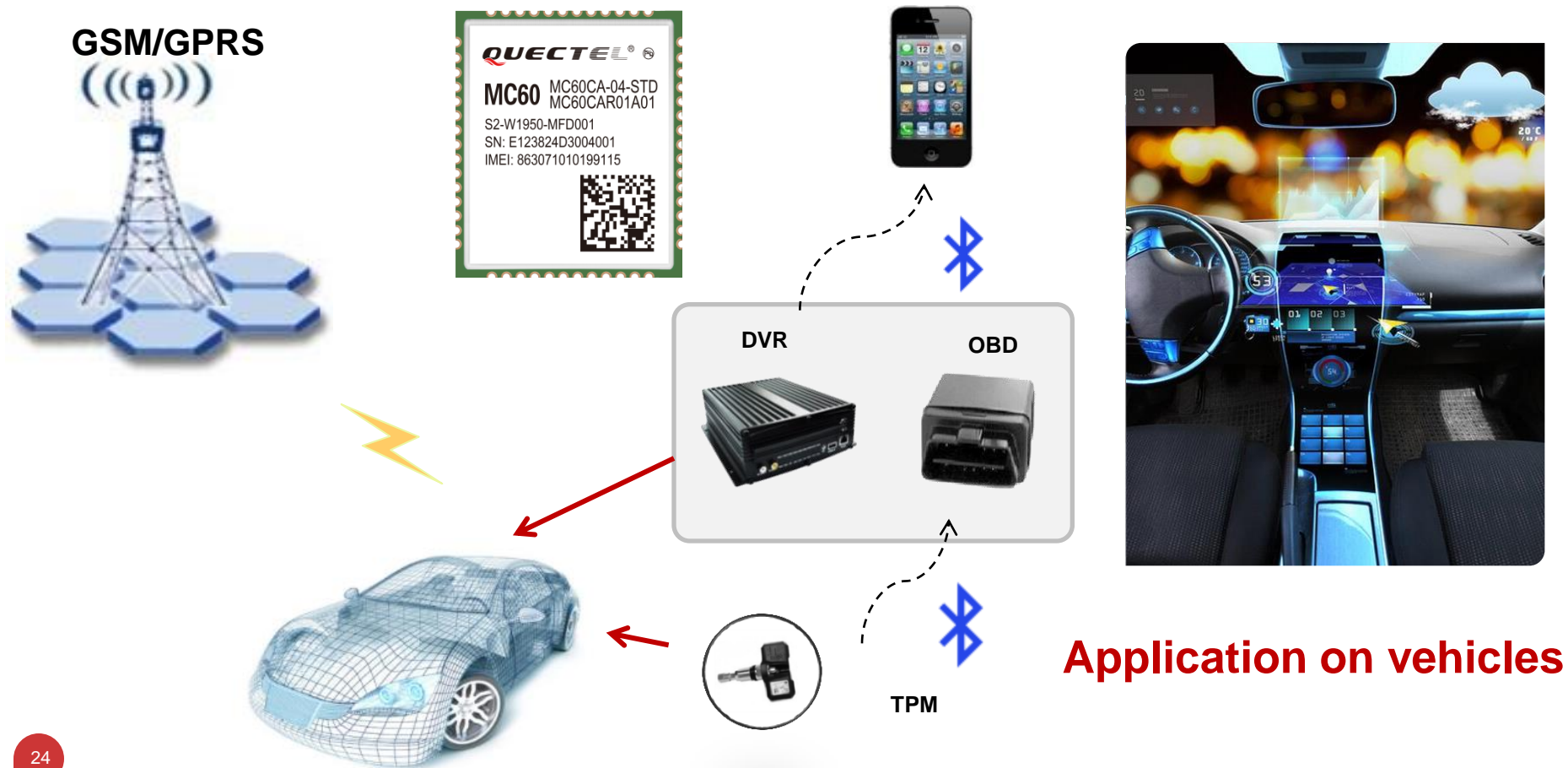
BT3.0

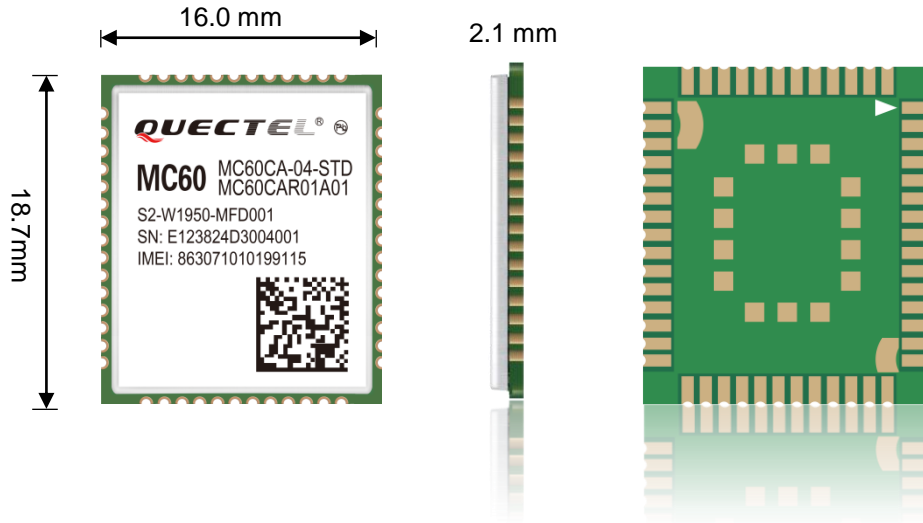
- Profile: SPP



- Profile: HFP+AG







Length: 18.7mm (± 0.15 mm)

Width: 16.0mm (± 0.15 mm)

Height: 2.1mm (± 0.2 mm)

Weight: Approx. 1.3g

- Highly compact size
- Easier soldering process with LCC package

**Vehicle
Tracker**



**Wearable
Devices**
(e.g. watch)

**Personal
Tracker**
(e.g. shoe
tracker)



**Pet
Tracker**



Evaluation Board

GSM-EVB Kit

- GSM EVB Board
- GSM Antenna
- Serial port cable
- RF cable for GSM Antenna connection



MC60-TE-A Kit

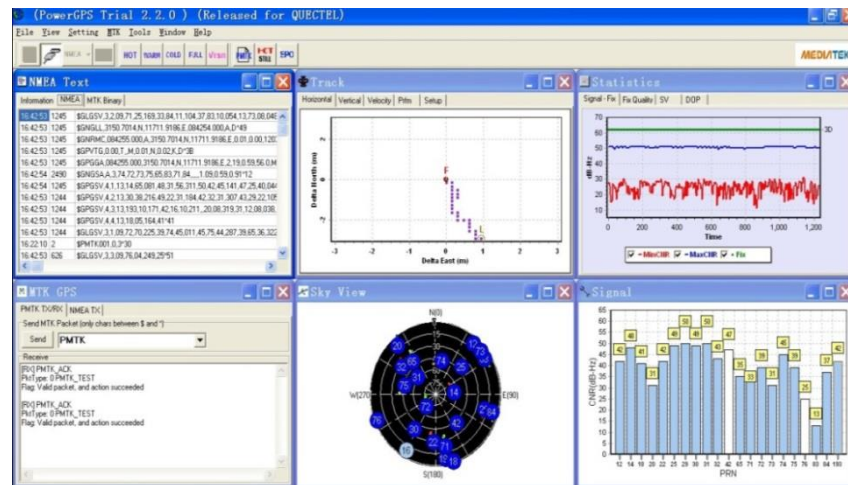
- MC60-TE-A
- GNSS Antenna
- RF cable for GNSS Antenna connection

Documents

- [Specification](#)
- [Hardware Design](#)
- [MC60 AT Commands](#)
- [MC60 GNSS AT Commands](#)
- [Footprint&Parts in PADS and Protel Formats](#)
- [Evaluation Board User Guide](#)
- [Reference Design](#)

PC tool

- [PowerGPS - GPS/GLONASS testing tool](#)



IoT

LTE



GNSS



3G

2G

Thank you!

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