



Product Name: GBSQ1A L1 Positioning Module

Part Number: GBSQ1A

Features:

- Supports GPS, GLONASS, Galileo, BDS3, QZSS, SBAS
- Extremely fast TTFF: Cold start: 28s, Hot start: 1s
- A-GPS support
- Industrial-grade standards
- Ultra-compact size
- Complies with RoHS
- Fastest possible time-to-first-fix
- Good positioning accuracy and fix validity under weak signal conditions
- Excellent quality and reliability

Applications:

- Automotive navigation
- Personal navigation devices
- Vehicle tracking and security systems
- Drone

GBSQ1A L1 Positioning Module

MODEL: GBSQ1A

Revision History

Version	Description	Date
A	First release	December 8, 2025

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1. Product Overview

The GBSQ1A is a high-performance multi-system navigation and positioning module that supports simultaneous reception of GPS, GLONASS, GALILEO, BDS3, and QZSS satellite systems. It delivers faster positioning, higher accuracy, and more reliable performance.

With its excellent performance, this module provides high-sensitivity, high-accuracy, and low-cost positioning and navigation solutions for in-vehicle and portable handheld terminals, meeting both professional and consumer-level positioning needs.

Its compact size is compatible with internationally mainstream navigation modules on the market. It uses SMD pads and supports standard pick-and-place as well as reflow soldering.



Figure 1.1: GBSQ1A Front View

2. Performance Specifications

Table 2-1 Basic Parameters

Parameter	Description	Specification
Voltage		3.0~3.6V
RF Input	Frequency	GPS/QZSS: L1C/A, L1C GLONASS: L1 BeiDou: B1I, B1C GALILEO: E1 SBAS: L1C/A (WAAS, EGNOS, MSAS, GAGAN, SDCM)
	VSWR	≤ 1.5
	Input Impedance	$50\Omega \pm 10\%$
	Antenna Gain	0~32dB
Physical Size		10.1 x 9.7 x 2.2mm

5F., NO.83, Kewang Rd., Longtan Dist., Taoyuan City 325, Taiwan (R.O.C.)

Tel: 886-3-4072728 |

Data Interface	UART (TTL level)	Baud rate: 1200–921600 bps (default: 115200)
Antenna Detection		Requires external detection circuit

Table 2-2 GNSS Performance

Parameter	Description	Specification
TTFF	Cold Start	28s
	Hot Start	1s
	Reacquisition	1s
Sensitivity	Tracking Acquisition	-165dBm -148dBm
Accuracy	Position	GNSS Open-Sky CEP 2.5m SBAS Open-Sky CEP 2.0m D-GNSS Open-Sky CEP 1.0m
	Velocity	GNSS 0.1m/s SBAS 0.05m/s D-GNSS 0.05m/s
Dynamic Performance	Velocity	500m/s
	Acceleration	4g
	Altitude	18000m (80000m in balloon mode)
PPS		Accuracy: 20 ns
Update Rate		1–10 Hz (default: 1 Hz)
Navigation Data Format		NMEA 0183 V4.1

3. Pin Definitions

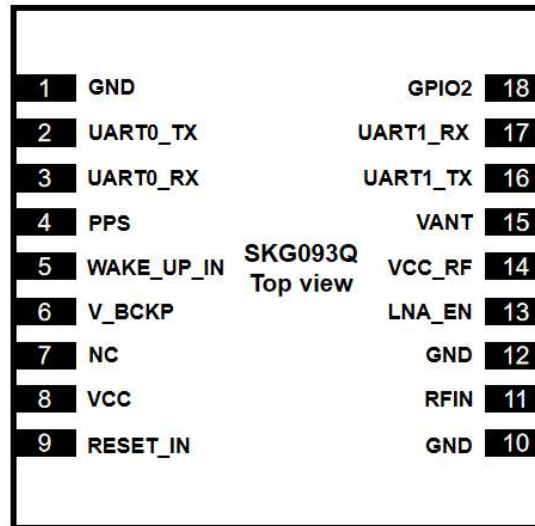


Figure 3.1: GBSQ1A Pin Layout

Table 3-1 Pin Descriptions

No.	Pin Name	I/O	Description	Notes
1	GND	G	Ground	
2	UART0_TX	O	UART0 serial TX	Main serial interface.
3	UART0_RX	I	UART0 serial RX	Main serial interface.
4	PPS	O	PPS Output	
5	WAKE_UP_IN	I	Wake-up Signal	Leave unconnected if not used.
6	V_BCKP	I	Backup Power input	2.0—3.6V
7	NC		Not connect	
8	VCC	I	Power Supply Input	3.0—3.6V
9	RESET_IN	I	Reset Input. Internal 10K ohm pull-up resistor.	Leave unconnected if not used.
10	GND	G	Ground	
11	RFIN	I	GNSS signal Input	50Ω impedance
12	GND	G	Power Ground	
13	LNA_EN	O	2.8V Output (LNA enable)	Output pin to control the external LNA or active antenna. Active high.

14	VCC_RF	O	Output voltage for active antenna.	
15	VANT	I	Antenna Detection Input	Reserved. Leave unconnected if not used.
16	UART1_TX	O	UART1 serial TX	Leave unconnected if not used.
17	UART1_RX	O	UART1 serial RX	Leave unconnected if not used.
18	GPIO2	I/O	General I/O	Leave unconnected if not used.

4. Electrical Characteristics

4.1. Absolute Maximum Ratings

Table 4-1 Power Supply

Parameter	Symbol	Min.	Max.	Unit	Condition
Power Supply Voltage	VCC	3.0	3.63	V	--
VCC Max Ripple	Vrpp	0	50	mV	--
Input Pin Voltage	Vin	2.66	3.08	V	--
Storage Temperature	Tstg	-40	125	°C	--
ESD Protection	VESD(HBM)	--	2000	V	All pins

4.2. Operating Conditions

Table 4-2 Operating Conditions

Parameter	Symbol	Min.	Typ.	Max.	Unit
Supply Voltage (VCC)	Vcc	3.0	3.3	3.6	V
RTC Backup Power	Vrtc	2.0	3.0	3.6	V
Peak Current	Iccp			140	mA
Supply Current	Icc		36		mA
Backup Current	Irtc		64		μA
Input Low Voltage	Vin_low	0		0.2*Vcc	V
Input High Voltage	Vin_high	0.67*Vcc		VCC	V
Output Low Voltage	Vout_low			0.4	V

Output High Voltage	Vout_high	2.66			V
Operating Temp		-40		85	°C
Storage Temp		-40		125	°C

5. Transmission and Peripheral Interfaces

5.1. PPS

The GBSQ1A provides a highly accurate PPS (Pulse Per Second) timing signal. This signal can be used by external systems for precise time synchronization.

- ◆ Pulse width: Adjustable
- ◆ Accuracy: 20 ns
- ◆ Default behavior: Outputs one pulse per second

5.2. UART

Supports both **data transmission** and **firmware upgrades**.

- ◆ Signal type: LVTTTL level
- ◆ Default baud rate: 115200 bps
- ◆ Maximum configurable baud rate: 921600 bps
- ◆ Baud rate is user-configurable

5.3. GPIO (Reserved, Customizable)

Provides 1 general-purpose I/O (GPIO) pin, reserved for flexible user-defined functions.

5.4. EXTINT (Reserved, Customizable)

Provides 1 external interrupt input pin. If not in use, this pin can be left unconnected.

6. Default Configuration

Message Type	Parameter Name	Default Setting	Description
NMEA Message	GGA	1	Outputs at 1 Hz
	GLL	1	Outputs at 1 Hz

	GSA	1	Outputs at 1 Hz
	GSV	1	Outputs at 1 Hz
	RMC	1	Outputs at 1 Hz
	VTG	1	Outputs at 1 Hz
	ZDA	1	Outputs at 1 Hz

Default GNSS Systems Supported by GBSQ1A:

GPS/QZSS: L1C/A

GLONASS: L1

BeiDou: B1I, B1C

GALILEO: E1

7. Output Protocol

7.1. NMEA 0183 Protocol

Table 7.1-1 NMEA-0183 Output Messages

NMEA Sentence	Description	Default
GGA	Global Positioning System Fix Data	Enabled
GLL	Geographic Position — Latitude/Longitude	Enabled
GSA	GNSS DOP and Active Satellites	Enabled
GSV	GNSS Satellites in View	Enabled
RMC	Recommended Minimum GNSS Data	Enabled
VTG	Course and Speed Over Ground	Enabled
ZDA	Date and Time	Enabled

Table 7.1-2 Identifier Mnemonics

Identifier	Data Type
GB	Beidou mode
GP	GPS mode
GL	GLONASS mode
GA	GALILEO mode

GN	Multi-mode (hybrid)
----	---------------------

7.2. GGA - Global Positioning System Fix Data

This sentence includes position, time, and fix quality.

Example:

\$GNGGA,204544.000,204544.000,N,11403.0960,E,1,33,0.50,103.4,M,-2.2,M,,*69

Table 7.2-1 GGA Sentence Format

Name	Example	Unit	DESCRIPTION
Message ID	\$GNGGA		GGA message header
UTC Time	204544.000		Time (HHMMSS.sss)
Latitude	204544.000		ddmm.mmmm
N/S Indicator	N		N = North, S = South
Longitude	11403.0960		dddmm.mmmm
E/W Indicator	E		E = East, W = West
Fix Status	1		See Table 9.2-2
Satellites Used	33		0 to 24
HDOP	0.50		
Altitude	103.4	M	
Geoid Separation	-2.2	M	
Checksum	*69		
EOL	<CR> <LF>		Message terminator

Table 7.2-2 Fix Status

Value	Description
0	No fix or invalid data
1	SPS fix
2	GNSS SPS fix
3	PPS fix

7.3. GLL-Geographic Position – Latitude/Longitude

Provides latitude and longitude position information.

Example:

\$GNGLL,2238.3431,N,11403.0960,E,204544.000,A,A*42

Table 7.3-1 GLL Sentence Format

Name	Example	Unit	Description
Message ID	\$GNGLL		GLL message header
Latitude	204544.000		ddmm.mmmm
N/S Indicator	N		N= North or S= South
Longitude	11403.0960		dddmm.mmmm
E/W Indicator	E		E= East or W= West
UTC Time	204544.000		hhmmss.sss
Fix Status	A		A = valid, V = invalid
Checksum	*50		
EOL	<CR> <LF>		Message terminator

7.4. GSA - GNSS DOP and Active Satellites

Contains fix mode, satellite IDs used in fix, and PDOP, HDOP, VDOP values.

Example:

\$GNGSA,A,3,26,22,194,199,16,31,32,03,,,,,0.84,0.50,0.67,1*07

Table 7.4-1 GSA Sentence Format

Name	Example	Unit	Description
Message ID	\$GNGSA		GSA message header
Mode 1	A		See Table 9.4-3
Mode 2	3		See Table 9.4-2
Satellite ID	26		Sv on Channel 1
Satellite ID	03		Sv on Channel 2
...	...		...

Satellite ID	<Null>		Sv on Channel 12 (Empty if not Used)
PDOP	0.84		Position Dilution of Precision
HDOP	0.50		Horizontal Dilution of Precision
VDOP	0.67		Vertical Dilution of Precision
Checksum	1*07		
EOL	<CR> <LF>		Message terminator

Table 7.4-2: Fix Type

Value	Description
1	Fix not available
2	2D Fix
3	3D Fix

Table 7.4-3: Selection Mode

Value	Description
M	Manual 2D/3D selection
A	Automatic selection

7.5. GSV - Satellites in View

Contains PRN, elevation, azimuth, and signal-to-noise ratio for satellites in view.

Example:

\$GPGSV,4,1,13,26,73,331,46,22,65,106,45,194,63,046,43,199,60,149,41,1*67

\$GBGSV,5,1,17,40,74,180,46,07,67,207,43,39,65,047,42,16,63,024,42,1*72

Table 7.5-1 GSV Sentence Format

Name	Example	Unit	Description
Message ID	\$GPGSV		GSV message header
Total Sentences	4		Total number of GSV sentences (Range 1 to 3)
Sentence Number	1		Sentence number of the total (Range 1 to 3)
Satellites in View	13		Number of satellites in view
Satellite ID	26		Channel 1(Range 01 to 32)

Elevation	73	degrees	Channel 1(Range 00 to 90)
Azinmuth	331	degrees	Channel 1(Range 000 to 359)
SNR(C/NO)	46	dB-Hz	Channel 1(Range 00 to 90, empty if not used)
...			...
Satellite ID	199		Channel 4(Range 01 to 32)
Elevation	60	degrees	Channel 4(Range 00 to 90)
Azimuth	149	degrees	Channel 4(Range 000 to 359)
SNR(C/NO)	41	dB-Hz	Channel 4(Range 00 to 90, empty if not used)
Checksum	*67		
EOL	<CR> <LF>		Message terminator

7.6. RMC - Recommended Minimum GNSS Data

Provides minimum recommended positioning information.

Example:

\$GNRMC,204544.000,A,2238.3431,N,11403.0960,E,0.01,219.75,190522,,,A,V*0B

Table 7.6-1: RMC Sentence Format

Name	Example	Units	Description
Message ID	\$GNRMC		RMC message header
UTC Time	204544.000		hhmmss.sss
Status	A		A=data valid or V=data not valid
Latitude	2238.3431		ddmm.mmmm
N/S Indicator	N		N=north or S=south
Longitude	11403.0960		dddmm.mmmm
E/W Indicator	E		E=east or W=west
Speed Over Ground	0.01	Knots	
Course Over Ground	219.75	Degrees	True Course
Date(UTC)	190522		ddmmyy
Magnetic variation	<Null>	Degrees	Empty if not used

Magnetic Variation Direction	<Null>		E=east or W=west (Empty if not used)
Fix Mode	A		A=autonomous, N = No fix, D=DGPS, E=DR
Checksum	*0B		
EOL	<CR> <LF>		Message terminator

7.7. VTG- Course and Speed Over Ground

Contains heading and speed information.

Example:

\$GNVTG,219.75,T,,M,0.01,N,0.01,K,A*2B

Table 7.7-1: VTG Sentence Format

Name	Example	Units	Description
Message ID	\$GNVTG		VTG message header
Tcourse	219.75		True Course
Reference	T		T = True
Mcourse	<Null>		Magnetic Course (Empty if not used)
Reference	M		M = Magnetic (Empty if not used)
Speed over ground	0.01	Knots	Nautical Miles per Hour
Units	N		Knots
Speed over ground	0.01	Km/hr	in Kilometers per Hour
Units	K		Kilometer per hour
Mode	A		A=Autonomous, N=No fix, D=DGPS, E=DR
Checksum	*2B		
EOL	<CR> <LF>		Message terminator

7.8. ZDA - ZDA-Date and Time

Provides UTC time and date.

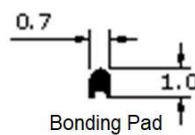
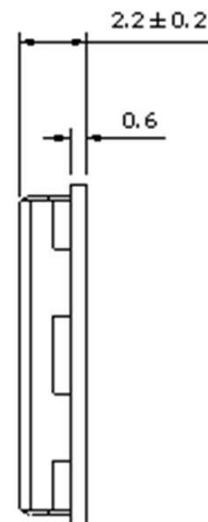
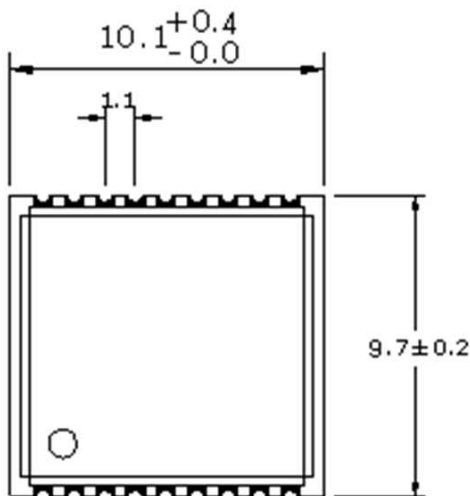
Example:

\$GNZDA,204544.000,19,05,2022,*,44

Table 7.8-1: ZDA Sentence Format

Name	Example	Units	Description
Sentence ID	\$GNZDA		ZDA message header
UTC Time	204544.000		hhmmss.sss
Day	19		UTC time: day (01 ... 31) dd
Month	05		UTC time: month (01 ... 12) mm
Year	2022		UTC time: year (4 digit year) yyyy
Time Zone (h)	/		
Checksum	*,44		
EOL	<CR> <LF>		Message terminator

8. Mechanical Dimensions



Unit:mm

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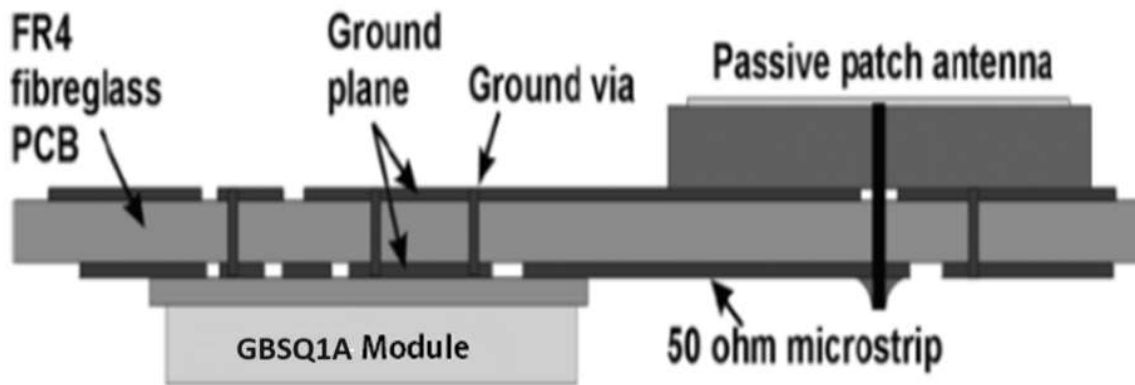


Figure 8.1.1 GBSQ1A Reference Layout

3) Impedance Matching

The antenna feed line **impedance** must be **50 Ohm**. To achieve this, the **microstrip line width (W)** must be calculated based on:

- ◆ the height (H) between the trace and reference ground plane
- ◆ the dielectric constant (ϵ_r) of the PCB material
- ◆ the overall PCB stack-up structure

4) Microstrip Line Design

- ◆ Keep microstrip lines as short as possible.
- ◆ Avoid using unshielded microstrip lines longer than 2.5 cm (1 inch) on standard PCBs.
- ◆ RF signal traces should not be routed near digital signal lines.
- ◆ Use as many vias as possible to connect to the ground plane.
- ◆ Avoid routing near noisy sources such as switching power supplies, digital signals, oscillators, and processors.
- ◆ The reference ground layer under the microstrip line must be continuous.
- ◆ The characteristic impedance of the microstrip line must be 50 Ohm.
- ◆ Avoid sharp angles in the trace routing to minimize signal loss.

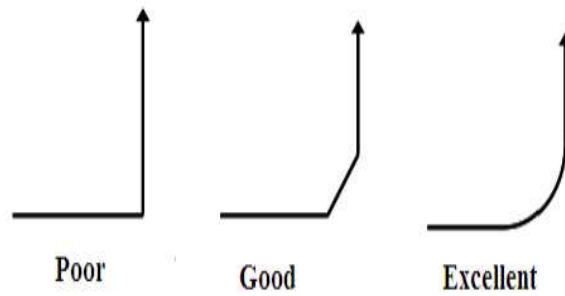


Figure 8.1.2 Recommended Microstrip Design for GBSQ1A

9. Packaging Specifications

The module is packaged in tape and reel, with 2000 units per reel.

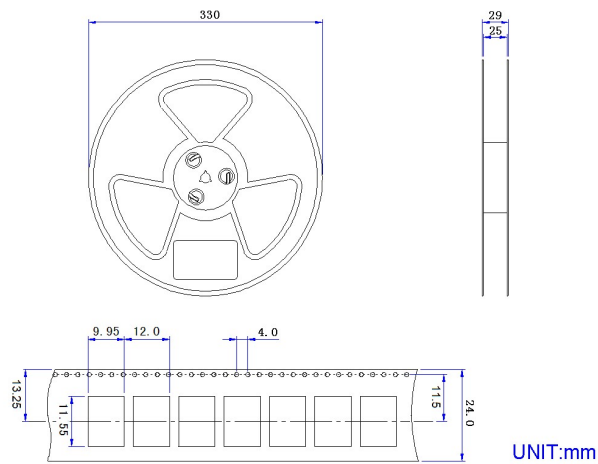


Figure 9.1 GBSQ1A Packaging Diagram

10. Soldering Recommendations

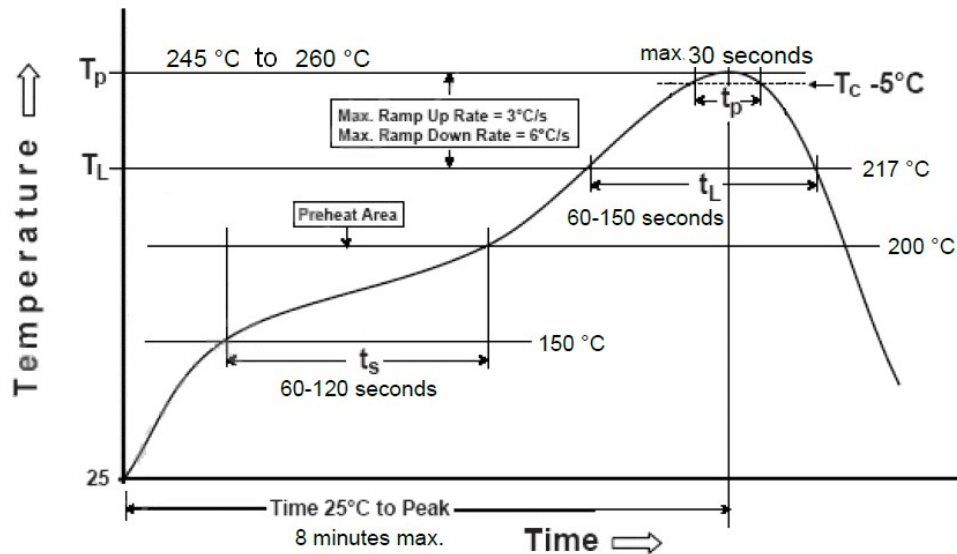


Figure 10.1 Recommended Reflow Soldering Profile

Melting Temperature: 217 °C

Stencil Thickness: 150um

11. Reference Circuit Design

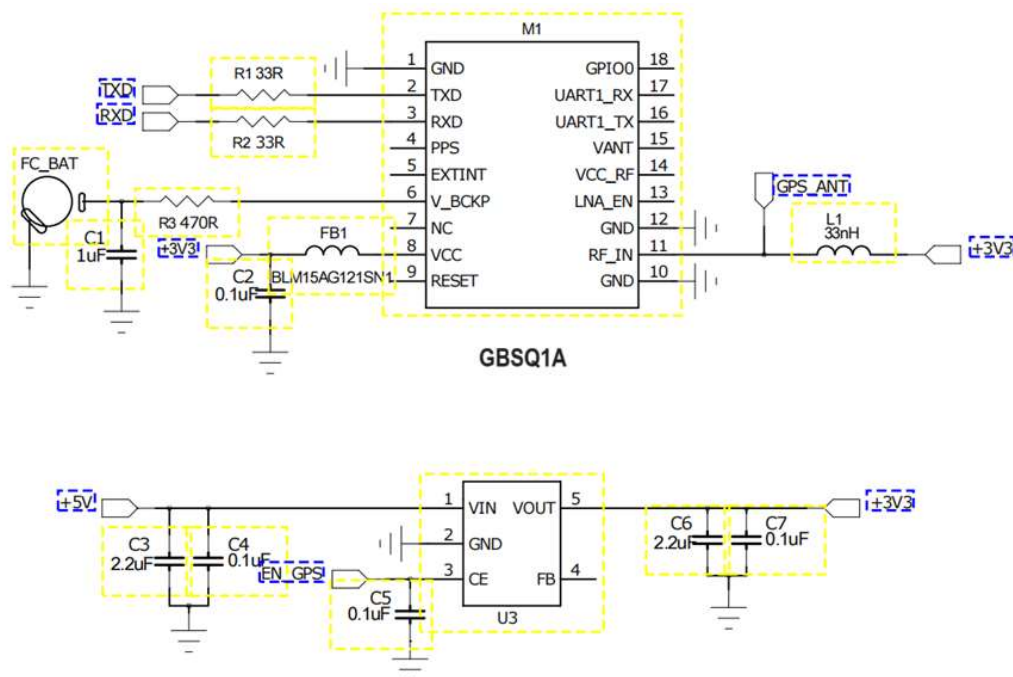


Figure 11.1 Reference Circuit Schematic

5F., NO.83, Kewang Rd., Longtan Dist., Taoyuan City 325, Taiwan (R.O.C.)

Tel: 886-3-4072728 |