

JRC/CRT GPS Module

Hardware Specification

This document specifies the electrical, mechanical, and behavioral characteristics of JRC/CRT GPS engine module.

Module: G591

Version: V2.0

Date: 2008-05-26



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| Drawn | Checked | Released |
|-------|---------|----------|
| | | |

| Revision History | | | |
|-------------------------|---------------------|---------------|---------------------------|
| Revision | Release date | Issuer | Change description |
| G591 V2.0 | 2008-4-20 | | Creative |
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1 Description

This document specifies the electrical, mechanical and behavioral characteristics of JRC/CRT GPS Module — G591.

The G591 is a GPS receiver module which providing the best solution with the highest sensitivity and tracking performance in the world and also with the highest position and speed accuracy in urban conditions.

The G591 GPS module uses the GPS solution with chipsets designed by JRC. Inc.,

The G591 GPS module can supports up to 210 PRN channels, with 66 search channels and 22 simultaneous tracking channels. It supports signal procession of L1 band signals such as GPS C/A and SBAS(including WAAS,EGNOS MSAS).With the flexible software API and library ,customer can realize both autonomous navigation solution and assisted GPS navigation solution to obtain fast TTFF and accurate navigation performance even in harsh urban canyon or weak indoor signal environment.

The G591 GPS module is the best choice for you to design for GPS related products.

As following diagram is the G591 GPS Module architecture.

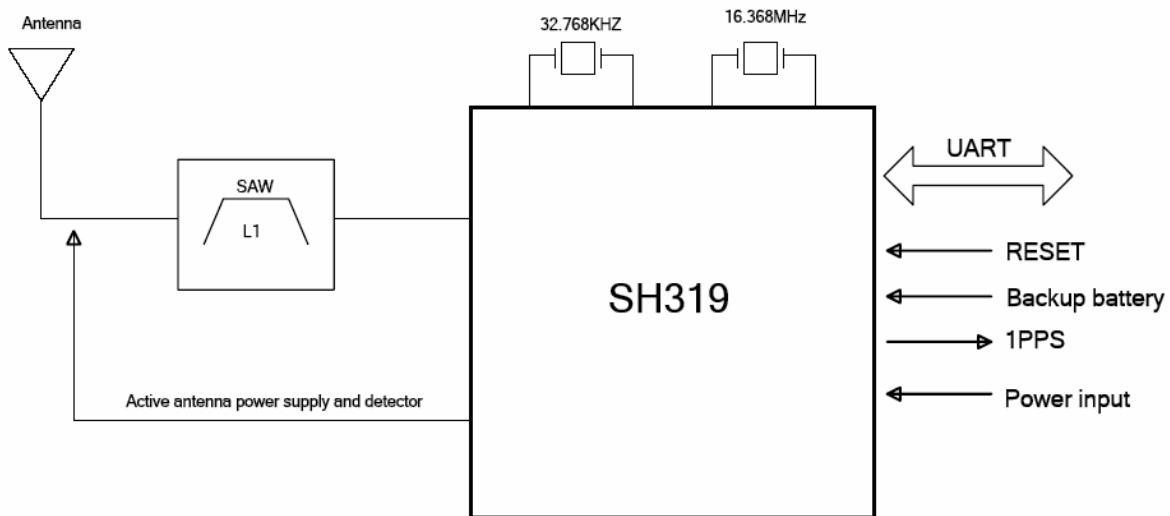


Figure 1 Module architecture

2 Mechanical specifications

The G591GPS module has 36 pins on PCB board. A shield case is made of metallic material for suppressive RF radiation.

Figure 2 is the 3D/2D diagram of it .

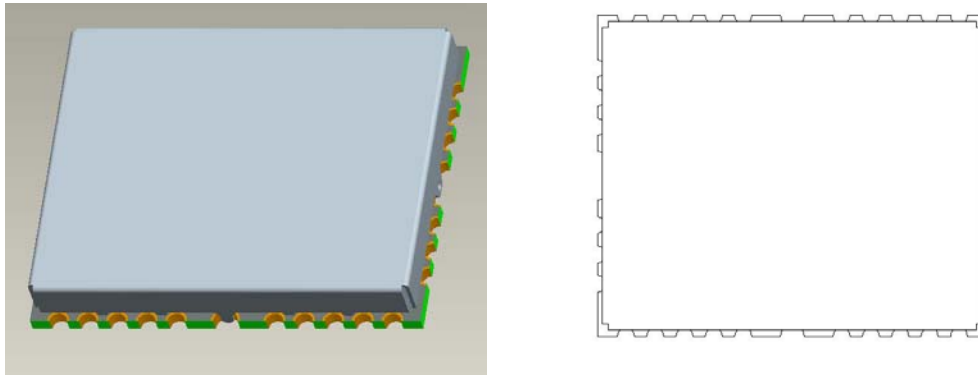


Figure 2

Table 1 is the mechanical dimensions and temperature character.

| Item | Description |
|--------|-------------|
| Width | 13.1mm |
| Length | 15.9 mm |
| Height | 2.5 mm |
| Weight | 1.03 g |

Table 1

Note: Please refer to the Mechanical Dimensions for the details.

3 Electrical Specifications

3.1 Absolute maximum ratings

| Item | Symbol | Min | Max | Unit |
|---|--------|------|-----|------|
| Power supply voltage | Vcc_in | 2.7 | 4.2 | V |
| Backup power input | VBU | 2.7 | 4.2 | V |
| High level input voltage GPIO and data bus | VIH | 2.0 | 3.6 | V |
| low level input voltage GPIO and data bus | VIL | -0.3 | 0.8 | V |
| Operating temperature | Topr | -40 | 85 | °C |
| Storage temperature | Tstg | -40 | 125 | °C |

3.2 Recommended Input Voltage

| Item | Symbol | Min | Type | Max | Unit |
|-----------|--------|-----|------|-----|------|
| Power On | Vcc_in | 2.7 | 3.3 | 4.2 | V |
| Power Off | Vcc_in | | 0 | 0.1 | V |

NOTE: The reasonable power supply ripple would be under 50mVpp

3.3 Recommended backup power input

| Item | Symbol | Min | Type | Max | Unit |
|--------------|--------|-----|------|-----|------|
| Backup power | VBU | 2 | 3 | 4.3 | V |

3.4 Power consumption

| State | Min | Type | Max | Unit |
|-------------|-----|------|-----|------|
| acquisition | — | 50 | — | mW |
| Tracking | — | 38 | — | mW |

4 Typical characteristics

4.1 General information

| | |
|-----------------------|---|
| Receiving Frequency | 1575.42MHZ, C/A code |
| Channel | supports up to 210 PRN channels,with 66 search channels and 22 simultaneous tracking channels |
| Datum | WGS-84 |
| Data output baud rate | 9600bps(TXD,RXD) |
| Data Output Format | NMEA0183 V3.01 |

4.2 Sensitivity

| | |
|----------------|---------|
| acquisition | -148dBm |
| Re-acquisition | -157dBm |
| Tracking | -163dBm |

4.3 Position&velocity &acceleration accuracy

| | |
|-----------------------|----------------------------------|
| Position accuracy | Without Aid: 3.0m (2D-RMS) |
| | DGPS: 2.5m |
| Velocity accuracy | Without Aid: 0.1m/s |
| | DGPS: 0.05m/s |
| acceleration accuracy | Without Aid: 0.1m/s ² |
| | DGPS: 0.05m/s ² |

4.4 Dynamic performance

| | |
|----------------------|---------|
| Maximum altitude | 18000 m |
| Maximum velocity | 515 m/s |
| Maximum acceleration | 4 G |

4.5 Time To First Fix

| | |
|---------------------|--------------------|
| Hot start | <1.5 s |
| Warm start | <34 s |
| Cold start | <35 s (autonomous) |
| Re-acquisition time | <1 s |

5 Pin Definition

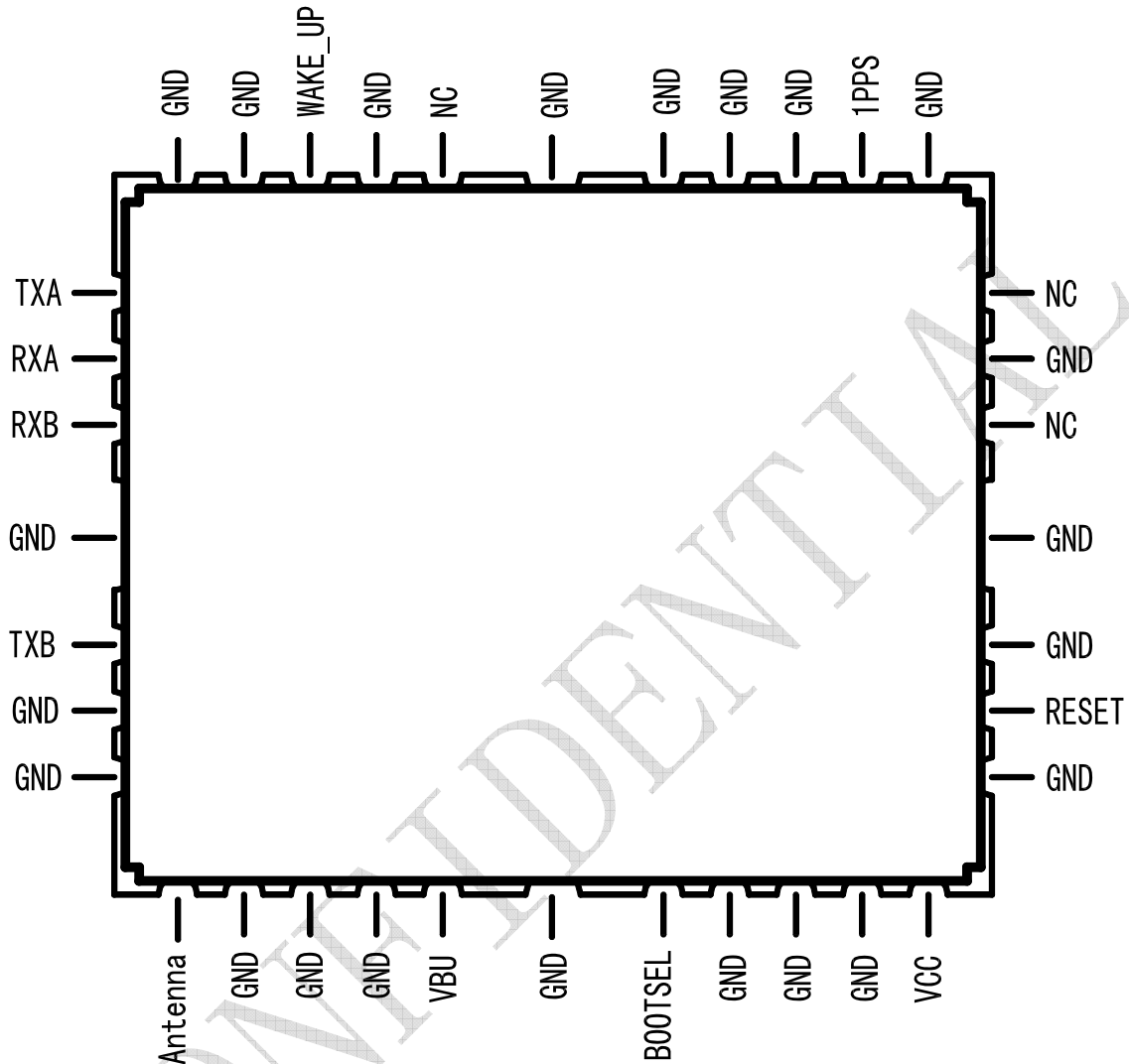


Figure 3

| Pin No. | Pin name | Type | Description |
|---------|----------|------|---|
| 1 | Antenna | I | Active antenna signal input.1575.42MHZ, 50ohm |
| 2 | GND | G | GND |
| 3 | GND | G | GND |
| 4 | GND | G | GND |
| 5 | VBU | I | Backup power input . the type voltage is 3.0V |
| 6 | GND | G | GND |
| 7 | BOOTSEL | I | user has to keep NC for normal connection |
| 8 | GND | G | GND |

| | | | |
|----|---------|---|---|
| 9 | GND | G | GND |
| 10 | GND | G | GND |
| 11 | VCC | I | The main power input.type voltage is3.3V |
| 12 | GND | G | GND |
| 13 | RESET | I | Module reset ,active low Note: user has to keep NC for normal connection |
| 14 | GND | G | GND |
| 15 | GND | G | GND |
| 16 | NC | | Reserve for AGPS |
| 17 | GND | G | GND |
| 18 | NC | | user has to keep NC for normal connection |
| 19 | GND | G | GND |
| 20 | 1PPS | O | 1 Pulse Per Second |
| 21 | GND | G | GND |
| 22 | GND | G | GND |
| 23 | GND | G | GND |
| 24 | GND | G | GND |
| 25 | NC | | Reserve for AGPS |
| 26 | GND | G | GND |
| 27 | WAKE_UP | I | user has to keep NC for normal connection |
| 28 | GND | G | GND |
| 29 | GND | G | GND |
| 30 | TXA | O | Serial output for UART A UART A is as NMEA output and JRC command input |
| 31 | RXA | I | Serial input for UART A UART A is as NMEA output and JRC command input |
| 32 | RXB | I | Serial input for UART B.only for debugging |

6 Reference PCB layout

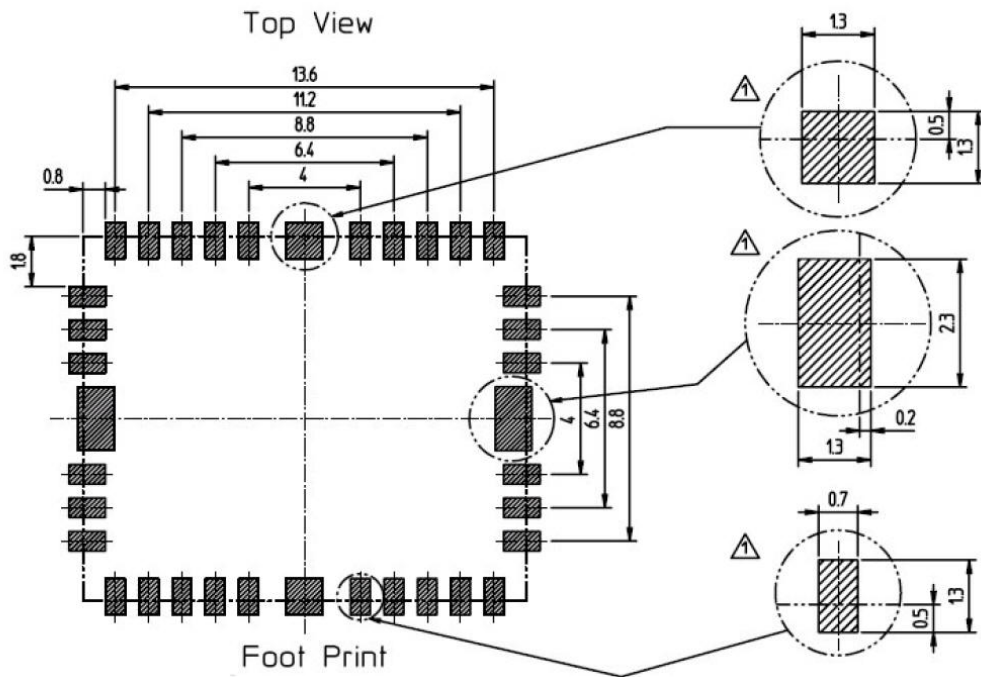
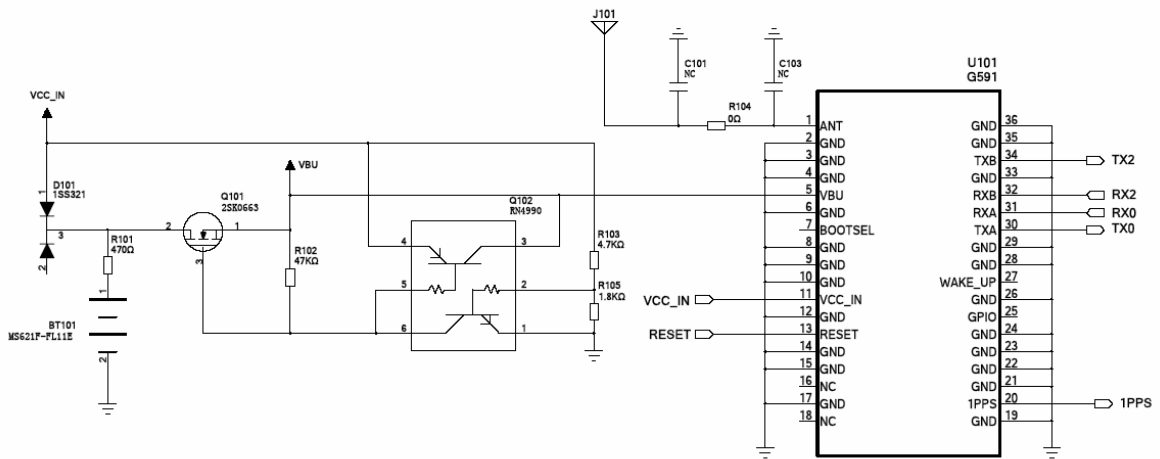


Figure 4

Layout note: Under the G591 GPS Module should be a ground with green solder mask on the PCB .otherwise will affect the function of the module.

7 Reference Design



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7.1 Reference BOM

| Description | Package | Manufacturer | Manufacturer P/N | Qty. | Location |
|--|------------|--------------|-------------------|------|----------|
| Chip Resistor, 0Ω,±5%,1/16W | 402 | Yageo | RC0402JR-07-0RL | 1 | R104 |
| Chip Resistor, 470Ω,±5%,1/16W | 402 | Yageo | RC0402JR-07-470RL | 1 | R105 |
| Chip Resistor, 1.8KΩ,±5%,1/16W | 402 | Yageo | RC0402JR-07-1K8L | 1 | R101 |
| Chip Resistor, 4.7KΩ,±5%,1/16W | 402 | Yageo | RC0402JR-07-4K7L | 1 | R103 |
| Chip Resistor, 47KΩ,±5%,1/16W | 402 | Yageo | RC0402JR-07-47KL | 1 | R102 |
| Silicon epitaxial planar type diode | SOT-23M OD | TOUSIBA | 1SS321 | 1 | D101 |
| MS Lithium rechargeable battery | | SII | MS621F-FL11E | 1 | BT101 |
| Silicon N-Channel Junction FET | | TOUSIBA | 2SK880_E | 1 | Q101 |
| Silicon epitaxial planar type transistor | | TOUSIBA | RN4990 | 1 | Q102 |
| GPS module | | JRC/CRT | G591 | 1 | U101 |

8 NMEA output Sentence

The table 2 lists the each of the NMEA output sentence specifically developed and defined by JRC for users within JRC/CRT GPS module.

| Option | Description |
|--------|---|
| GGA | Global Position System Fix Data.Time.Position and fix related data for a GPS receiver |
| GSA | GNSS DOP and Active Satellites |
| GSV | GNSS Satellites in view |
| RMC | Recommended Minimum Navigation Information |
| VTG | Course and speed information relative to the ground |

Table 2

8.1 .GGA

The GGA contains following information example below:

\$GPGGA,161229.487,3723.2475,N,12158.3416,W,1,07,1.0,9.0,M,17.806,M, ,*18

| Name | Example | Unit | Description |
|------------------------|------------|--------|--|
| Message ID | \$GPGGA | | GGA protocol header |
| UTC Time | 161229.487 | | hhmmss.sss |
| Latitude | 3723.2475 | | ddmm.mmmmmm |
| N/S Indicator | N | | N=north or S=south |
| Longitude | 12158.3416 | | dddmm.mmmmmm |
| E/W Indicator | W | | E=east or W=west |
| Position Fix Indicator | 1 | | 0:Fixnotavailable 1:GPSfix 2: Differential GPS fix |
| Satellites Used | 7 | | Range 0 to 14 |
| HDOP | 1 | | Horizontal Dilution of Precision |
| MSL Altitude | 9 | meters | Antenna Altitude above/ below mean -sae-level |
| Units | M | meters | Units of antenna altitude |
| Geoidal Separation | 17.806 | meters | |
| Units | M | meters | Units of geoidal separation |
| Age of Diff. Corr. | | | Null fields when DGPS is not used |
| Checksum | *18 | second | |
| <CR> <LF> | | | End of message termination |

8.2.GSA

The GSA contains following information example below:

\$GPGSA,A,3,29,21,26,15,18,09,06,10,,,,,2.32,0.95,2.11*00

| Name | Example | Unit | Description |
|----------------|---------|-------|---|
| Message ID | \$GPGSA | | GSA protocol header |
| Mode 1 | A | | M: Manual—forced to operate in 2D or 3D mode A: 2D Automatic—allowed to Automatically switch 2D/3D |
| Mode 2 | 3 | | 1: Fix not available. 2:2D 3:3D |
| Satellite Used | 29 | | SV on Channel 1 |
| Satellite Used | 21 | | SV on Channel 2 |
| ----- | ----- | ----- | ----- |
| Satellite Used | | | SV on Channel 12 |
| PDOP | 2.32 | | Position Dilution of Precision |
| HDOP | 0.95 | | Horizontal Dilution of Precision |
| VDOP | 2.11 | | Vertical Dilution of Precision |
| Checksum | *00 | | |
| <CR> <LF> | | | End of message termination |

8.3.GSV

The GSV contains following information example below:

\$GPGSV,3,1,09,29,36,029,42,21,46,314,43,26,44,020,43,15,21,321,39,*7D

\$GPGSV,3,2,09,18,26,314,40,09,57,170,44,06,20,229,37,10,26,084,37,*77

| Name | Example | Unit | Description |
|--------------------|---------|---------|--|
| Message ID | \$GPGSV | | GSV protocol header |
| Number of Messages | 3 | | Range 1 to 3 (Depending on the number of satellites tracked, multiple messages of GSV data may be required.) |
| Message Number1 | 1 | | Range 1 to 3 |
| Satellites in View | 9 | | |
| Satellite ID | 29 | | Channel 1 (Range 1 to 32) |
| Elevation | 36 | degrees | Channel 1 (Maximum 90) |
| Azimuth | 29 | degrees | Channel 1 (True, Range 0 to 359) |
| SNR (C/No) | 42 | dBHz | Range 0 to 99 |
| ----- | ----- | ----- | ----- |
| Satellite ID | 15 | | Channel 4 (Range 1 to 32) |
| Elevation | 21 | degrees | Channel 4 (Maximum 90) |
| Azimuth | 321 | degrees | Channel 4 (True, Range 0 to 359) |
| SNR (C/No) | 39 | dBHz | Range 0 to 99,(null when not tracking) |

| | | | |
|-----------|-----|--|----------------------------|
| Checksum | *7D | | |
| <CR> <LF> | | | End of message termination |

8.4.RMC

The RMC contains following information example below:

\$GPRMC,064951.000,A,2307.125647,N,12016.443856,E,0.036,165.48,260406, ,A,*
65

| Name | Example | Unit | Description |
|--------------------|-----------|---------|---|
| Message ID | \$GPRMC | | RMC protocol header |
| UTC Time | 64951 | | hhmmss.sss |
| Status | A | | A=data valid or V=data not valid |
| Latitude | 2307.1256 | | ddmm.mmmmmm |
| N/S Indicator | N | | N=north or S=south |
| Longitude | 12016.444 | | dddmm.mmmmmm |
| E/W Indicator | E | | E=east or W=west |
| Speed Over Ground | 0.036 | knots | |
| Course Over Ground | 165.48 | degrees | TRUE |
| Date | 260406 | | ddmmyy |
| Magnetic Variation | | degrees | E=east or W=west |
| Mode | A | | A= Autonomous mode D= Differential mode E= Estimated mode |
| Checksum | *65 | | |
| <CR> <LF> | | | End of message termination |

8.5.VTG

The VTG contains following information example below:

\$GPVTG,165.48,T, ,M,0.036,N,0.067,K,A,*37

| Name | Example | Unit | Description |
|------------|---------|---------|---------------------------|
| Message ID | \$GPVTG | | VTG protocol header |
| Course | 165.48 | degrees | Measured heading |
| Reference | T | | TRUE |
| Course | | degrees | Measured heading |
| Reference | M | | Magnetic |
| Speed | 0.036 | knots | Measured horizontal speed |
| Units | N | | Knots |
| Speed | 0.067 | km/hr | Measured horizontal speed |

| | | | |
|-----------|-----|--|---|
| Units | k | | Kilometers per hour |
| Mode | | | A= Autonomous mode D= Differential mode E= Estimated mode |
| Checksum | *06 | | |
| <CR> <LF> | | | End of message termination |

9 Supplier's Responsibility

9.1 Life Expectancy

The G591 has MTBF>100000 hrs with at least 90% confidence. A prediction of life expectancy will be made by JRC/CRT. The result will be discussed with customers.

9.2 Reliability

Design FMEA of the G591 at the part level will be made and documented by JRC/CRT. Design FMEA will include the function of the component, failure mode, failure cause, frequency of failure occurrence, and severity of failure.

To detect critical process risks, process FMEA will be made and documented by JRC/CRT. Process FMEA will include the function of the component, process stage, failure mode, failure cause, frequency of failure occurrence, severity of failure, and the ability of failure detection.

10 Notice for handling

10.1 Maximum Rating

Do not use over maximum rating because if use over maximum rating it is doubt become the fault.

Power Voltage: Vcc

Maximum voltage

It is regulated maximum voltage which conpermit input voltage between input terminal and GND.

Once over the maximum voltage is inputted, it is become the reason of faulty.

Input Voltage

It is regulated maximum voltage to input terminal.Once over the maximum voltage is inputted, it is become the reason of faulty.

Operating Temperature

It is the temperature rang which can have a guarantee for operating corestly.Once over the temperature rang it is become the reason of faulty or it is

doubt that can not have the satisfy of the function of GPS.

Storage Temperature

It is the temperature range which unit is strong in case storage temperature is over this temperature rang, it is become the reason of faulty or it can not have a satisfy of the function.

10.2 Caution for Installation

In case handle with this unit, be careful against a static electricity. It is not that unit will be damaged by a static electricity. Specially, handle with I/O connector, be careful against a static electricity. Do not touch the I/O connector dirty with hand.

Please mount within two weeks after opening the prevention-of-moisture packing. After the prevention-of-moisture packing is opened, it need be kepted in dry atmosphere.

10.3 Notice for Storage

Do not storage the place where corrosion gas will be generated or exist many dusts.

Do not storage the place where temperature rang will be change widely because the dewdrop will be formed therefore.

10.4 Transportation

Do not throw, do not drop, otherwise unit itself will be damaged.

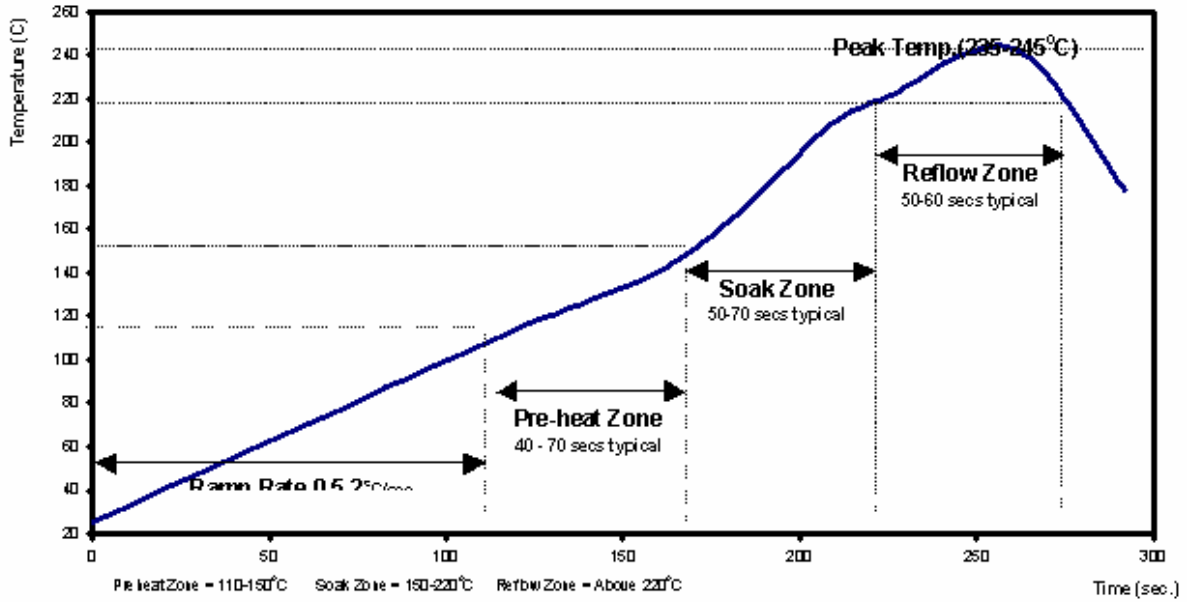
Protect from water, when transport in the rain/snow, protect from them.

10.5 Overcurrent Protection

The G591 dose not have a fuse for overcurrent protect.

Please put a fuse for overcurrent protect in your system because the prevention of danger.

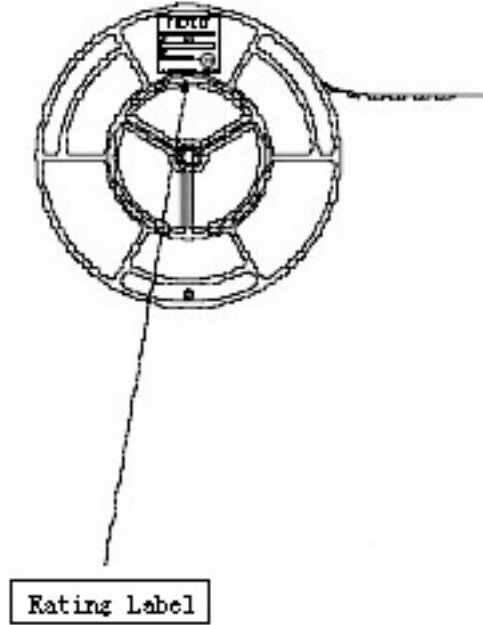
Appendix A Recommended Reflow Temperature Profile(Pb Free)



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Appendix B Package Specifications

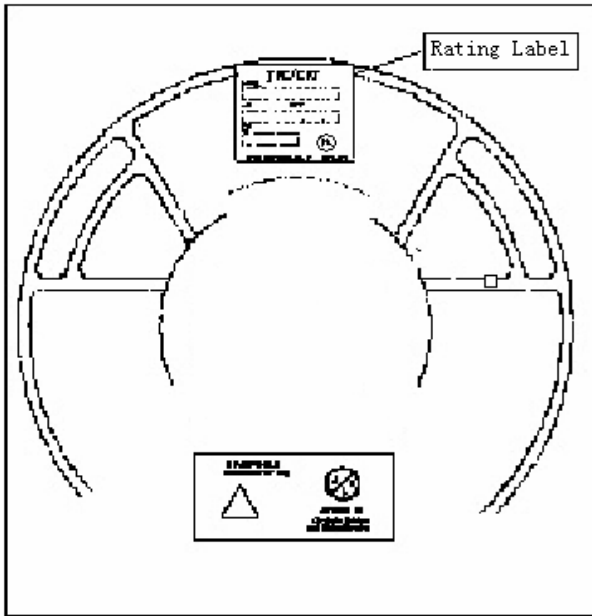
Appendix B-1. Reel packing method





| | | | |
|--------|---------|---|------------------------|
| | JRC/CRT | ← | LOGO |
| Model: | ← | | Product Code |
| LOT: | ← | | Product Lot No. / Date |
| QTY: | ← | | Quantity |
| | | | |

| |
|--------------------|
| Rating Label |
| - SIZE : 70mmX60mm |

Appendix B-2. The gist of a MSD/LSD label



| | LEVEL | Notice Mark | Attached |
|-----|----------|--|----------|
| ESD | Class 1C |  | Yes |
| MSL | 3 |  ATTENTION | Yes |

※ For Further Reference : EIA-481-C / EIA-541

NOTE: REEL AND TRAY PACKAGE CAN BE SELECTED

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