5. RECOMMENDED PACKAGING CONDITIONS AND HANDLING NOTES

PPMC-112 is a surface mounting type. In mounting on the printed circuit board, the biggest problems that affect the reliability of PPMC-112 are contamination by flux and thermal stress during package soldering. Explained in this section are the recommended temperature profiles and general notes to be observed in mounting the PPMC-112.

5-1. Temperature profile

5-1-1. Soldering iron

(1) The temperature at the lead must be kept at 260 degrees centigrade for no longer than 10 seconds or 350 degrees centigrade for no longer than 3 seconds.

5-1-2. Far and medium infrared reflow soldering

(1) Upper and lower heating by far and medium infrared reflow soldering is recommended.

(2) The temperature must be kept at not less than 210 degrees centigrade for 30 seconds or less while the package surface temperature must not go above 240 degrees centigrade. A recommended temperature profile is shown in Fig. 5-1.

(3) Note that near infrared reflow soldering produces thermal stress similar to that of dip soldering.

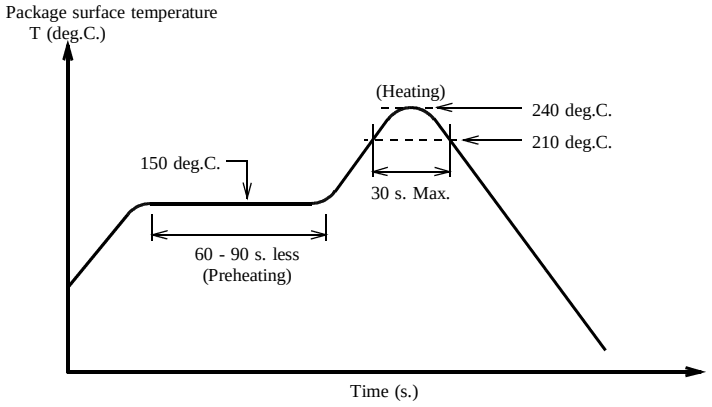

Fig.5-1. Temperature Profile

5-1-3. Case of hot air reflow soldering

(1) The temperature must be kept at not less than 210 degrees centigrade for 30 seconds or less while the package surface temperature must not go above 240 degrees centigrade.

(2) A recommended temperature profile is shown in Fig. 5-1.

5-1-4. Vapor phase reflow soldering

(1) The recommended solvent is Fluorinate FC-70 or the equivalent.

(2) The ambient temperature must be 215 degrees centigrade for no longer than 30 seconds or 200 degrees centigrade for no longer than 60 seconds.

(3) A recommended temperature profile for V.P.S. is shown in Fig. 5-2.

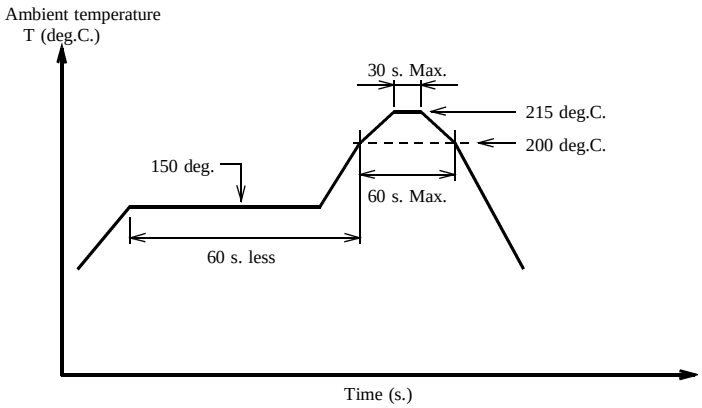

Fig.5-2. Temperature Profile

5-1-5. Dip soldering

(1) Preheating must be done at 150 degrees centigrade for at least 60 seconds.

(2) Solder flow must be done at a maximum temperature of 260 degrees centigrade for no longer than 10 seconds.

5-2. Flux cleaning (Ultrasonic cleaning)

(1) Carry out flux cleaning in such a way that no reactive ions of Na or Cl remain. An organic solvent, if used, may react with water to produce some corrosive gas like hydrogen chloride, thus degrading the PPMC-112 package.

(2) Do not rub the marking with a brush or your hand during the cleaning or with the cleaning solution still on PPMC-112. Such careless operation may erase the marking.

(3) In performing immersion cleaning, shower cleaning or steam cleaning, take great care in selecting the solvent to prevent unwanted reactions. The immersion time in solvent or steam should be 1 minute or less at a liquid temperature not exceeding 50 degrees centigrade.

(4) For a highly efficient short time ultrasonic cleaning, the following basic conditions are recommended:

Frequency	: 27kHz to 29kHz
Ultrasonic output	: 300W or below (0.25W/sq.cm. or below)
Cleaning time	: 30 seconds or less

Perform this cleaning with the package suspended in the solvent, taking care that the ultrasonic vibrator does not come into direct contact with the printed circuit board or PPMC-112.

5-3. Coating of board

When your equipment requires high reliability or when it is used in an unfavorable environment (with humidity, corrosive gas, dust, etc.), consider the use of a damp proof coating for the printed circuit board while taking into account the expected stress, the effect of impurities, etc.

There are a great variety of coating resins, and selection is generally made by experience. Therefore, in selecting your coating resin, make a close study of the thermal and mechanical stresses that may act on PPMC-112.

5-4. Degradation and breakdown by static charge

When handling PPMC-112 alone, do it in an environment free from static electricity and wear antistatic clothing. Also, use antistatic material for the vessel or like object with which PPMC-112 comes into contact and ground it through a protective resistance of 0.5Mohm to 1Mohm.

5-4-1. Control of working environment

(1) As the humidity lowers in your working environment, human bodies and insulators may be more easily charged with static electricity through friction. The recommended humidity is therefore 40 to 60% with moisture absorption by PPMC-112 taken into consideration.

(2) Ground the equipment, jigs, etc. in the work area.

(3) Provide some antistatic means, such as laying a conductive mat, on the floor of the work area and ground it.

(4) Place a conductive mat on the worktable to disperse static electricity and ground it. Never use a metallic surface for the worktable that can cause a sudden charging at low resistance when a charged PPMC-112 is brought into contact with it.

(5) When automated equipment is used, observe the following instructions:

a. When the PPMC-112 package is picked up with vacuum, provide an antistatic means, such as conductive rubber, on the end of the pickup arm.

b. Take care to minimize friction at the PPMC-112 package surface. When friction can not be reduced structurally, make the frictional surface smaller, employ material with smaller friction coefficient or electrical resistance or use an ionizer.

c. Use a static extinguishing material for the part coming into contact with the lead terminals of PPMC -112.

d. Do not allow any charged body (clothing, body, etc.) to touch PPMC-112.

e. Do not allow the jigs used in the process to touch PPMC-112.

f. Carry out ion neutralization by an ionizer in the process where the PPMC-112 package can be charged.

(6) Provide a VDT filter or other antistatic means on the surface of CRTs in the work area, and do not turn them on and off during operation as far as practicable. Otherwise electrical induction to PPMC-112 may occur.

(7) Cover the work chair with antistatic cloth and ground it with an grounding chain to the floor.

(8) Place antistatic mats on the PPMC-112 storage shelves.

(9) Use static extinguishing material or antistatic material for the containers used for transportation or temporary storage of PPMC-112s.

(10) Install antistatic grounding conductors in the static control area. You can also use the grounding conductor (Class 3) for transmission lines for this purpose, but do not share it with the grounding of other machinery.

5-4-2. Working notes

(1) Have the workers wear antistatic clothing and conductive shoes.

(2) Have the workers wear wrist straps, which are grounded through a resistance of about 1Mohm

(3) Use a low voltage type soldering iron and ground the end of it.

(4) Use antistatic pincers that may come into contact with the lead terminals of PPMC-112, and avoid use of metallic pincers as far as practicable. Otherwise the charged PPMC-112 may discharge suddenly at low resistance. When you use vacuum pincers, make certain that they have a conductive suction pad at the end and are grounded by antistatic earthing conductor.

(5) Do not place PPMC-112s and their containers close to objects with strong electrical fields (e.g., CRT).

(6) Place printed circuit boards with PPMC-112s on separate from each other in antistatic board containers. Also do not stack them touching each other. Frictional charging and discharging may occur.

(7) Put on antistatic finger sacks or gloves as far as practicable when you have to touch PPMC-112 directly.

(8) Use an ionizer when wrist straps are not available or when PPMC-112 is subject to friction.

5-5. Requirements for service environment

5-5-1. Temperature environment

Generally speaking, semiconductor parts are more sensitive to temperature than other component parts. Since electrical characteristics can be restricted by operating temperatures, your design must take into account the temperature characteristics involved. Exceeding the specified operating temperature range may not only result in the loss of specified electric characteristics but also quicken the deterioration of PPMC-112 and shorten its life.

Humidity environment

PPMC-112 is molded and thus does not provide perfect airtightness. Use in a high humidity environment over a long period may allow the entry of moisture, which in turn may cause degradation and other troubles with the semiconductor chips inside. Therefore, apply a moisture-proof treatment to the surface of PPMC-112. In a low-humidity environment, damage may result from discharging of static electricity, so make certain that the humidity is in a range of 40 to 60% unless you take some antistatic measures.

5-5-3. Corrosive gas

PPMC-112 can react to some corrosive gases and suffer a drop in performance. For example, sulfuric gas from rubber near PPMC-112 may corrode the lead terminals or cause a chemical reaction between lead terminals, thus forming foreign material there that will eventually cause leaks.

5-5-4. Radioactive rays / Cosmic rays

PPMC-112 is not designed for use with radioactive rays or cosmic rays. When it is used on space equipment or in an environment with radiation, it must be provided with a shield against the radioactive or cosmic rays.

5-5-5. Strong electric field / Strong magnetic field

If exposed to a strong electric field, the PPMC-112 may develop abnormal phenomena, such as change in impedance or increase of leakage current, due to polarization inside its plastic materials or IC chips. In such applications, therefore, you need to provide a shield against the electric field / magnetic field. Especially in an AC magnetic environment, an appropriate magnetic shield must be installed against the electromotive force.

5-5-6. Vibration / Shock / Stress

The plastic sealed PPMC-112 has wire connections locked with resin inside, so that it its structure has fairly strong resistance to vibration and shocks. In actuality, however, there can be cases of disconnection with vibration, shock or stress loosening the soldered parts. Therefore, do not use PPMC-112 in equipment exposed to heavy vibration. Also, stress that bears on the semiconductor chips through the package may cause changes in resistance inside the chip due to a piezo-electric effect. Strong vibration, shock or stress may even crack the package or chips.

5-5-7. Dust / Oil

As with corrosive gas, PPMC-112 can react chemically with dust or oil. Therefore, do not use PPMC-112 in an environment where it may be exposed to dust or oil, which is capable of affecting its performance adversely.

5-5-8. Smoking / Ignition

PPMC-112 is not incombustible, so it can smoke or burn, emitting toxic gas in the process. Therefore, do not use it near fire or other heat sources, ignitable or flammable substances.

5-6. Requirements for design

Observe the specified maximum ratings and recommended operating conditions for PPMC-112 so that it can achieve its design reliability for your system. Also, pay attention to such environmental conditions as ambient temperature, transient noise and surge to maximize the performance of PPMC-112.

5-6-1. Observance of maximum ratings

A maximum rating is a standard which must never be exceeded. This applies to all of the maximum ratings. There are maximum ratings for the voltage and current at individual lead terminals, the storage temperature, the lead terminal temperature, etc.

If the voltage or current at any of the lead terminals rises above the maximum rating, then the PPMC-112 may suffer degradation due to over-voltage or over-current. In extreme cases, wire may melt away or the semiconductor chip may break down from heat generated inside the internal circuit.

If the storage temperature or soldering temperature exceeds the rating, the differences in the coefficient of thermal expansion between materials in the PPMC-112 may cause the failure of air-tightness or the opening of bonded joints.

5-6-2. Observance of guaranteed operation range

The recommended operating conditions guarantee the performance of PPMC-112.

5-6-3. Setting of unused I/O terminals

Unstable input may sometimes result from the use of PPMC-112 with unused input terminals in the open state. Also, output terminals must not be connected to the supply voltage (Vcc) or other output terminals.

As PPMC-112 with unused input terminals in the open state may be affected by external noise more easily and cause unstable operation, the input terminals should be pulled up to power supply (Vcc) or connected to the ground (GND) according to their functions.

5-6-4. Latch Up

As PPMC-112 has a CMOS structure, a latch up, in which a breakdown results from a large current of several hundred mA flowing between Vcc and GND, can occur.

A latch up occurs when a large current flow to the internal elements as a result of an input/output voltage exceeding the rating or when the internal elements break down with the voltage at the power supply terminal (Vcc) exceeding the rating. In this case, even if the voltage above the rating is instantaneous, the PPMC-112 in a latch up condition may retain the large current between Vcc and GND, thus causing heating or smoking. Therefore, be sure to observe the following instructions:

(1) Do not raise the voltage at the I/O terminals above Vcc, and do not lower it below GND. The machine must be switched at a proper timing.

(2) Do not allow abnormal noise to act on PPMC-112.

(3) Fix the unused input terminals to Vcc or GND.

(4) Do not short the output terminals together.

5-6-5. Input/Output protection

Never use a wired logic connection, in which output terminals are interconnected, for PPMC-112, because it will short the outputs. Also, do not connect the output terminals directly to Vcc or GND.

5-6-6. Interface

When a device with I/O conditions different from those of PPMC-112 is to be connected to PPMC-112, malfunction may result if there is disagreement in the levels of input VIL/VIH and output VOL/VOH.

5-6-7. External noise

When the signal lines of I/O signals to PPMC-112 mounted on a printed circuit board are long, noise or a surge applied to PPMC-112 from outside may cause malfunction or breakdown due to the over-current (over-voltage). Lower the signal line impedance or provide a noise removing circuit as protection against external noise. Also provide appropriate protective means against surges.

5-6-8. Other requirements

(1) When designing your system, make certain that all fail-safe means are provided and aging and other necessary treatments are done on the component parts.

(2) Do not place PPMC-112 in a place with strong electric fields; otherwise charge up may cause surface leaks and eventual malfunction. In such applications, protect the package surface with a conductive shield plate.

(3) Make arrangement so that if some conductive material (metal pin, etc.) should drop onto the terminal of the PPMC-112 on the board, it will not cause short-circuiting.

(4) PPMC-112 is not designed for use with systems whose failure or malfunction can directly threaten the lives of people or cause injuries to them (nuclear control, aircraft and space equipment, transportation equipment, combustion control, safety devices, etc.).
If you apply PPMC-112 to such systems, Ampere shall not be held responsible for any damages caused by such unwarranted use.