

Handling Guide
for
Thermal Print Head

Preface

Thank you for choosing TOSHIBA HOKUTO ELECTRONICS CORP. Thermal Print Head.

This guide is designed to be easily understood by engineers who are designing TOSHIBA HOKUTO ELECTRONICS CORP. Thermal Print Head into their products for the first time. No special knowledge of these devices is assumed – the contents includes basic information about the devices, a discussion of the application fields in which they are used, an overview of design methods employing the devices, and in particular discussion of the various precautions which must be observed when handling the devices, both during assembly and while the devices are in service.

TOSHIBA HOKUTO ELECTRONICS CORP. is continually updating technical publications. Any comments and suggestions regarding any TOSHIBA HOKUTO ELECTRONICS CORP. document are most welcome and will be taken into account when subsequent editions are prepared. To receive updates to information in this guide, or for additional information about the products described in it, please contact TOSHIBA HOKUTO ELECTRONICS CORP. or authorized dealers.

Composition and Utilization on This Brochure

General precautions and usage considerations to be observed at each stage of device handling are stipulated first in section 2. General Precautions and Usage Considerations.

Matters related to protection from bodily injury and prevention of property damage when handling Thermal Print Head are stipulated in section 3. Safety Precautions.

The precautions described here are not just those related to design, but cover all stages of handling, from reception of an incoming shipment to device inspection and mounting.

Designers of systems incorporating Thermal Print Head are requested to ensure that the contents of this brochure are fully understood by all relevant personnel, so that devices can be used safely and in the correct manner. It is also requested that relevant precautions be stipulated in the user's manuals for systems comprising Thermal Print Head.

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[1] Using Thermal Print Head Safely

TOSHIBA HOKUTO ELECTRONICS CORP. is continually working to improve the quality and reliability of its products. Nevertheless, Thermal Print Head in general can malfunction or fail due to their inherent electrical sensitivity and vulnerability to physical stress. It is the responsibility of the buyer, when utilizing TOSHIBA HOKUTO ELECTRONICS CORP. products, to comply with the standards of safety in making a safe design for the entire system, and to avoid situations in which a malfunction or failure of such TOSHIBA HOKUTO ELECTRONICS CORP. products could cause loss of human life, bodily injury or damage to property. In developing your designs, please ensure that TOSHIBA HOKUTO ELECTRONICS CORP. products are used within specified operating ranges as set forth in the most recent TOSHIBA HOKUTO ELECTRONICS CORP. products specifications and " Handling Guide for Thermal Print Head " .

The TOSHIBA HOKUTO ELECTRONICS CORP. products listed in this document are intended for usage in general electronics applications (printers, personal equipment, office equipment, measuring equipment, industrial robotics, domestic appliance, etc.). TOSHIBA HOKUTO ELECTRONICS CORP. products are neither intended nor warranted for usage in equipment that requires extraordinarily high quality and/or reliability or a malfunction or failure of which may cause loss of human life or bodily injury (" Unintended Usage "). Unintended Usage include atomic energy control instruments, airplane or spaceship instruments, transportation instruments, traffic signal instruments, combustion control instruments, medical instruments, all types of safety devices, etc.. Unintended Usage of TOSHIBA HOKUTO ELECTRONICS CORP. products listed in this document shall be made at the customer' s own risk.

[2] General Precautions and Usage Considerations

When handling TOSHIBA HOKUTO ELECTRONICS Corp. thermal print head (: TPH), please observe the following precautions to ensure the quality and reliability of the devices which you incorporate into your designs.

A. Handling of TPH

Handle TPH with care. Wear gloves or fingertips, do not touch ceramic substrate, connector pins, and IC cover of TPH with your bare hands.

1. Mechanical vibration or shock

To avoid damage to TPH, do not toss or drop them. Ensure that the devices are not subjected to excessive mechanical vibration or shock.

Do not damage to the protective layer or leads. TPH may break down or its performance may be degraded.

Also, to avoid damage to bonding wires, ensure that not to add excessive force (over 60N) or loads at print circuit board (:PCB) through connectors. Do not make an excessive impact to the IC cover.

2. Electrical breakdown

To prevent electrostatic breakdown of ICs and heat elements, do not touch the connector pins with bare hands or other charged bodies. Withstanding electrostatic value is $V=±200V$ under the conditions of $C=200pF$, $R=0ohm$.

3. Cleaning

Be sure to control dust and keep the heat element surface clean. Dust on the surface may cause scratches, which damage to the leads of TPH.

When the surfaces need to be cleaned up, wipe them softly with gauze, a cotton-swab or a tipped stick at dry without using acids, alkalis or any other liquid which may corrode the TPH.

Also, if the medium-residue, which eluted from printing mediums and adhered on TPH surface, causes negative effects on the printing conditions, TOSHIBA HOKUTO ELECTRONICS CORP. recommends such ways as follows to improve the situation: Please take (1) or (2) method for thin-film TPH.

(1) Polish the surface with polishing tapes equivalent to #10000 (Recommendation : produced by Nihon Micro Coating Co., Ltd.)

Do not use the polishing tapes over #10000 roughness.

The way to polish the surface should be chosen between alternatives as follows:

- a. Cut the polishing tapes to approximately 30cm and pass it through the set once instead of the medium without operating the TPH.
 - b. Cut the polishing tapes into a small piece. Loop it around a finger with a cotton glove and polish the surface along the TPH heater line 5 times back and forth at a time. 300 times in sum total (to and fro) are allowed in this way. Polishing tape make clogging. Polishing efficiency get better if new polishing tape would be used on each 5 times back and forth.
- (2) Wipe the TPH surface softly with gauze, a cotton-swab or a tipped stick dipped in ethanol.

Additionally, when wiping or polishing the surface, be sure to target at heaters area only. If another parts (e.g. near IC cover, IC mold resin) are wiped or polished, unwanted over loads may be forced on there, which cause damage to the bonding wires. Also, be aware that ethanol soluble matter from mediums may corrode the TPH components, though pure ethanol does not corrode them. So keep the ethanol use to the minimum and do not reuse the cleaning items. TOSHIBA HOKUTO ELECTRONICS CORP. does not any guarantee the defects due to corrosion caused by ethanol soluble matter from mediums.

B. Storage

Follow the instructions printed on the TPH packing box regarding transportation and storage.

1. Temperature and Humidity

Avoid storage locations where the temperature variation is appreciable or TPH will be exposed to moisture.

The storage area temperature and relative humidity should be kept within the range prescribed in specifications.

2. Chemical or Salt injury

Do not use storage areas where may be damaged by salt or chemical injury.

3. Dust and Oil

Do not store TPH in dusty or oily environments.

4. External force or loads

Do not allow excessive forces or loads to be applied to TPH while they are in storage.

C. Design

1. Circuit design

To avoid damage to TPH due to noise or other causes, design the circuit to keep head power supply (VH) off when the device is on standby. Also, design power-supply circuits to discharge the electricity from the capacitor mounted on a TPH within a few minutes after the head power supply is turned off.

Additionally, printed circuit board with long I/O or signal pattern lines are vulnerable to induces noise or surges from outside sources. Consequently, malfunctions or breakdowns can result from overcurrent or overvoltage, depending on the devices. To protect against noise, lower and thicker the pattern line below 50cm in length and above AWG#28 line in the size of thickness, or insert a noise-canceling circuit. Protective measures must also be taken against surges.

2. Absolute maximum ratings

Absolute maximum rating is a necessary standard to maintain function of driver ICs and structure of the products. It does not guarantee product life such as pulse durability of heaters or abrasion durability of protective layers.

Do not use TPH under conditions in which their absolute maximum ratings (e.g. current, voltage, power dissipation, temperature) will be exceeded. TPH may break down or its performance may be degraded, causing it to catch fire or explode resulting in injury to the user.

The absolute maximum ratings of a product are rated value which must not be exceeded at any time even for an instant. If a product is used under conditions exceeding maximum ratings, its performances may be degraded, causing it to break down. When designing a circuit, therefore, be careful about ON/OFF control of power supply voltage fluctuation of supplied voltage, connecting parts' characteristics, I/O signal line surge, and ambient temperature.

3. Power sequence

At the power-on-sequence, Do not turn on head power supply (VH) before logic voltage (Vdd). Uncontrolled heating may damage heaters and/or medium. Also, at power-off-sequence, do not apply uncontrolled heating to heaters.

4. Latch-up

Latch-up is an abnormal condition inherent in driver IC mounted on a TPH, in which Vdd gets shorted to ground.

This happens when a parasitic PN-PN junction (thyristor structure) internal to the IC chip is turned on, causing a large current of the order of several hundred mA or more to flow between Vdd and GND L, eventually causing the device to break down.

Latch-up occurs when the input or output voltage exceeds the rated value, causing a large current to flow in the internal chip, or when the voltage on the Vdd pin exceeds its rated value, forcing the internal chip into a breakdown condition. Once the chip falls into the latch-up state, even though the excess voltage may have been applied only for an instant, the large current continues to flow between Vdd and GND L. This causes the device to heat up and, in extreme cases, to emit gas fumes as well. To avoid this problem, observe the following precautions:

- (1) Do not allow voltage levels on the input and output pins either to rise above Vdd or to fall below GND L. Also, follow any prescribed power-on sequence, so that power is applied gradually or in steps rather abruptly.
- (2) Do not allow any abnormal noise signals to be applied to the device.
- (3) Set the voltage levels of unused input pins to Vdd or GND L.
- (4) Do not connect output pins to one another.

5. Unused pins

Be aware that if unused pins are left open, some ICs can exhibit input instability problems, resulting in malfunctions such as abrupt increase in current flow. Similarly, if the unused output pins on a device are connected to the power supply pin, the ground pin or to other pins, the IC may malfunction or break down.

6. Interfacing

ICs mounted on TPH are CMOS type. Therefore, caution is required when connecting inputs and outputs between devices and make sure input voltage (VIL/VIH) and output voltage (VOL/VOH) levels are matched. Otherwise, the devices may malfunction.

7. Peripheral circuit

TPH is ordinarily used with peripheral circuits and components. The input and output signal voltages and currents in these circuits must be chosen to match the device's specification. Inappropriate voltages or currents applied to a device's input pins may cause it to operate erratically. The following factors must be taken into account.

- (1) Some of TPH contain pull-up or pull-down resistors. When designing your system, remember to take the effect of this on the voltage and current levels into account.
- (2) The output pins on a device have a predetermined external circuit drive capability. If this drive capability is greater than that required, either incorporate a compensating circuit into your design or carefully select suitable components for use in external circuits.
- (3) Be sure all metal parts of TPH (heat sink and IC cover) are grounded to earth. Except the screw holes, the surface of heat sink is aluminized and insulative. So, ensure that the screw holes of heat

sink to be earthed with screws. If a conductive substance is used for the IC cover, follow the precautions described in “ 1 2. IC cover design and assembly ” .

8. Warming up

Do not apply power to heaters when there is no medium on the TPH heater surface. Heaters of TPH may be degraded, causing the devices' life to shorten.

In case users need to warm up TPH, use external heaters not TPH self-heating.

Also, when applying TPH self-heating for preheat, TPH must be operated under the conditions that not break them down or degrade its performance. If it is necessary to preheat, please consult us regarding the conditions.

9. Thermal design

The failure rate of TPH is greatly increased as operating temperatures increase. Therefore, to achieve optimum reliability, observe the following precautions concerning thermal design:

- (1) Keep the ambient temperature as low as possible.
- (2) If the device' s dynamic power dissipation is relatively large, select the most appropriate peripheral material, and consider the use of heat sinks or forced air cooling.
- (3) Derate the device' s absolute maximum ratings to minimize thermal stress from power dissipation.

10. Recording medium

Use a printing medium that is specified in Life test condition of specifications. The amount of abrasion of protective layer and the presence or absence of media residue vary depending on the recording medium.

If you use another medium, you cannot get any guarantee when TPH will be broken by operating condition.

Also, do not use the media which width is shorter than the recording width. Likewise do not mix format. In other words, do not use multiple recording media with different recording widths. These width differences may cause the partial stress concentration to the TPH surface layers (protective layer, antistatic layer), causing inhomogeneous wear-out of the surface, resulting in damage to the device' s performance. Failure that occurs in mixing format or at the edge of the media is not covered by the warranty.

In addition, following phenomena may occur depending on the compatibility of the medium you use. Remember this and design your system with a wide profit margin.

- (1) Friction of TPH surface layer and medium may make some noise or wrinkle the medium when they are operated.
- (2) Operated with the medium, TPH surface layers are subject to be worn out or stained with medium-residue. This may cause the surface flatness to be degraded, resulting in damage to the performance of TPH.
- (3) If any changes were made to the media materials or processes after the life test, please inform TOSHIBA HOKUTO ELECTRONICS CORP. about it. The compatibility between the medium and TPH should be verified again. If these changes of the medium are not informed, problems due to the medium are not guaranteed.
- (4) TOSHIBA HOKUTO ELECTRONICS CORP. can not guarantee the problems resulting from production lot variation of medium quality.

11. Medium-path design

Medium-path design may affect the TPH reliability. When designing them, be sure that medium does not touch and scratch the TPH encapsulation, IC mold resin or connector pins. This may cause damage to the TPH wires and malfunction of the ICs, which may not only destroy the TPH and deteriorate its performance, but also cause recording media to generate residue because of abrasion and to affect its print quality. Also, design them after due consideration of the effects stem from the tolerance of TPH (e.g., thickness tolerance of print circuit board) and assembly tolerance.

12. IC cover design and assembly

When users design an IC cover and assemble it, follow just like the precautions described above 10. Medium-path design. When designing and assembling an IC cover, follow the precautions described in "11. Medium-path design". If a conductive material such as metal is used for an IC cover, insulate the surface in contact with the PCB and design that isolation voltage between the IC cover and all signals including VH and GNDH can be maintained at 350V or more. In terms of burrs generated during the production of metal IC covers, completely remove them or design so that they will be generated on the opposite of the print circuit board.

Likewise, when using an IC cover as a paper-guide, pay attention to the same precautions described above.

13. Electromagnetic interference

Widespread use of electrical and electronic equipment in recent years has brought with it radio and TV reception problems due to electromagnetic interference. To use the radio spectrum effectively and to maintain radio communications quality, each country has formulated

regulations limiting the amount of electromagnetic interference which can be generated by individual products.

Electromagnetic interference includes conduction noise propagated through power supply and telephone lines, and noise from direct electromagnetic waves radiated by equipment. Different measurement methods and corrective measures are used to assess and counteract each specific type of noise.

Difficulties in controlling electromagnetic interference derive from the fact that there is no method available which allows designers to calculate, at the design stage, the strength of the electromagnetic waves which will emanate from each component in a piece of equipment. For this reason, it is only after the prototype equipment has been completed that the designer can take measurements using a dedicated instrument to determine the strength of electromagnetic interference waves.

For the prevention of electromagnetic interference, these methods are effective during system design:

- (1) Select condensers of appropriate capacitance value.
- (2) Lower and grower the pattern lines as much as possible.
- (3) Connect IC cover of TPH to ground.

14. Safety standards

Each country has safety standards which must be observed. These safety standards include requirements for quality assurance systems and design of device insulation. Such requirements must be fully taken into account to ensure that your design conform to the applicable safety standards.

D. Assembly

When attaching a part (e.g. mounting brackets, heat sinks, or other parts of your system which attach a TPH) to a TPH with screws, to prevent deterioration of heater flatness of TPH or damage to screws and screw holes, observe the following precautions. Damage or break down of screw holes in the cause of reckless handling will not be guaranteed.

- (1) When reversing TPH for assembly, ensure that not to damage the TPH surface layers (protective layer, antistatic layer). Also, do not make an excessive impact to the IC cover.

- (2) Make sure the screws are tightened with appropriate fastening torques and not to apply excessive force to the TPH in the process.
- (3) When attaching a TPH by fixing it at two or more locations, evenly tighten all the screws in stages. Do not fully tighten one screw while the rest are still only loosely tightened.
- (4) Screw holes of the part must be exactly fit for them of TPH heat sink specified. Smooth the surface by removing burrs and protrusions or indentations which might interfere with the installation of any part of TPH.
- (5) Do not allow a screwdriver to touch the body of TPH.

E. Operating environment

1. Temperature

Be sure to keep the operating temperature range prescribed in specifications. The various electrical characteristics of TPH are dependent on the ambient temperature at which the device is used. If TPH is used out of its maximum or minimum temperature rating, its deterioration is more rapid and it will reach the end of its usable life sooner than expected.

2. Humidity

Do not operate TPH under the dew condensation and be sure to keep the operating humidity range prescribed in specifications. Some of TPH components are sometimes improperly sealed. When these are used for an extended period of time in a high-humidity environment, moisture can penetrate into the device and cause it to break down or malfunction. On the other hand, operation under low-humidity conditions can damage TPH due to the occurrence of electrostatic discharge.

3. Chemical or Salt injury

Do not use TPH where may be damaged by salt or chemical injury especially in the presence of corrosive substances. For example, salt water or acids can corrode a TPH leads, resulting in damage to the performance.

4. Dust and Oil

Do not use TPH in dusty or oily conditions. Dust can scratch the protective layer or the leads of TPH and cause damage to them and oil can cause chemical reactions in TPH, resulting in malfunction.

5. Fire

Some components of TPH are not fireproof: they can emit smoke and catch fire if heated sufficiently. When this happens, some of the components may generate poisonous gases. TPH

should therefore never be used in close proximity to an open flame or a heat-generating body, or near flammable or combustible materials except media.

F. Other precautions

1. Modifying TPH

Do not modify TPH at all after shipping TOSHIBA HOKUTO ELECTRONICS CORP.

TPH may break down or its quality, performance and durability may be degraded, causing the safety hazard to the user.

If the user modifies TPH, TOSHIBA HOKUTO ELECTRONICS CORP. do not guarantee not only modified products but also all influence stem from modification. Example of modification: changing parts, after processing, adding and removing parts, changing circuit diagram, cut connector pins, polishing IC mold resin, etc.

G. Disposal of TPH and packing materials

When discarding unused devices and packing materials, follow all procedures specified by local regulations in order to protect the environment against contamination.

[3] Safety Precautions

This section lists important precautions which users of TPH should observe in order to avoid injury and damage to property, and to ensure safe and correct use of TPH.

Please be sure that you understand the meaning of the labels and the graphic symbol described below before you move on to the detailed description of the precautions.

Graphic symbol	Meaning
	Indicates an imminently hazardous situation which will result in death or serious injury(*1) if you do not follow instructions.
	Indicates a potentially hazardous situation which could result in death or serious injury(*1) if you do not follow instructions.
	Indicates a potentially hazardous situation which if not avoided, may result in minor injury(*2) or property damage(*3).

***1) Serious Injury:**

“ Serious Injury ” means as following levels.

To need to have inpatient hospital care.

And to have aftereffects of injury, such as the blindness, the burn, electric shock, and so on.

***2) Minor injury:**

“ Minor injury ” means as following levels.

To be treated at the hospital

***3) Property damage:**

“ Property damage ” means as following levels.

To be inflicted further damage on the devices, equipments, and so on.

 DANGER	
 Prohibited	Never touch a TPH while it is powered on. Also, after tuning off a power device, do not touch it until it has thoroughly discharged all remaining electrical charge. Touching a TPH while it is powered on or still charged could cause a severe electric shock, resulting in death or serious injury.
 Instructions	When conducting any kind of evaluation, inspection or testing, be sure to connect the testing equipment's electrode or probes to the device under test before powering it on. When you have finished, discharge any electrical charge remaining in the device. Connecting the electrodes or probes of testing equipment to a device while it is powered on may result in electric shock, causing injury. Additionally, some of products have an anti-static layer that is connected to VH. Therefore never touch a TPH through a conductive material.

 WARNING	
 Prohibited	Do not use TPH under conditions exceeding their absolute maximum ratings (e.g. current, voltage, power dissipation, temperature, pulse width or duty). This may cause the device to break down, degrade its performance, or cause it to catch fire or explode resulting in injury.
 Prohibited	Do not insert connectors in the wrong orientation. Make sure that the positive and negative terminals of power supplies are connected correctly. Otherwise the rated maximum current or power dissipation may be exceeded and the device may break down or undergo performance degradation, causing it to catch fire or explode and resulting injury.
 Prohibited	Do not modify TPH at all after shipping TOSHIBA HOKUTO ELECTRONICS CORP. TPH may break down or its quality, performance and durability may be degraded, causing the safety hazard to the user. If the user modifies TPH, TOSHIBA HOKUTO ELECTRONICS CORP. do not guarantee not only modified products but also all influence stem from modification. Example for modification: changing parts, after processing, adding and removing parts, changing circuit diagram, cut connector pins, polishing IC mold resin, etc.
 Instructions	Use a unit which can detect short -circuit currents and which will shut off the power supply if a short-circuit occurs. If the power supply is not shut off, a large short-circuit current will flow continuously, which may in turn cause the device to catch fire or explode, resulting in fire or injury.
 Instructions	When designing a case for enclosing your system, consider how best to protect the user from dispersal pieces in event of the device catching fire or exploding. Dispersal pieces can cause injury.
 Instructions	When conducting any kinds of evaluation, inspection or testing, always use protective safety tools such as a cover for the device. Otherwise you may sustain injury caused by the device catching fire or exploding.
 Instructions	Make sure that all metal parts of TPH (heat sink and IC cover) are grounded to earth. Electrical leakage may cause a device to break down or may result in electrical shock and injury to anyone touching it.
 Instructions	A design should ensure that, except when the main circuit of the devices is active, reversebias is applied to the device gate while electricity is conducted to control circuits, so that the main circuit will become inactive. Malfunction of the device may cause serious accidents or injuries.

 CAUTION	
 Prohibited	When power to a TPH is on, do not touch the TPH and wait until the device has cooled properly before handling it. TPH become hot when they are operated. Even after the power has been turned off, the device will retain residual heat, which may cause a burn to anyone touching it.
 Prohibited	Do not touch the tips of connector pins or the edge of TPH components (e.g., ceramic substrate, IC cover, and print circuit board). Connector pins may have pointed tips and some of TPH components have a sharp edge. You may prick or cut your fingers with them.
 Instructions	Also surely prepare the thermometer on your system to detect excess temperature. If temperature is over maximum rate, a design should ensure shut off power supply automatically.
 Instructions	Dropping TPH on your feet may cause unexpected injuries. Especially in case of Handling heavy TPH like of A0 or A1 size, take such safety measures as wearing protective shoes.
 Instructions	Please verify screw length carefully, which is used for TPH assembly. Overlong screw damages PC board layout pattern, therefore it sometime causes a short circuit and/or malfunction in your system.
 Instructions	Do not bring something to hard and conductive into contact with substrate. The lead pattern on the substrate may cause serious accidents or injuries because of short circuit. For example, please keep enough gap and/or insulation between SUS IC cover edge and substrate.
 Instructions	Do not use a platen roller that has conductive rubber when TPH has anti-static layer. It may cause short circuit between platen roller and anti-static layer. Additionally, do not touch anti-static layer though the conductive material at assembly process and/or maintenance so on. It may cause short circuit between anti-static layer and somewhere someone least expects by conductive dust so on.
 Instructions	At the power-on-sequence, Do not turn on head power supply (VH) before logic voltage (Vdd). Uncontrolled heating may damage heaters and/or medium. Also, at power-off-sequence, do not apply uncontrolled heating to heaters.

Cautions are also required to avoid other dangers not described above, which may cause injuries to **USERS**.

RESTRICTIONS ON PRODUCT USE

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