What Printhead is Right For Your Application?

White paper

Introduction

Thermal printers have long been used with POS (Point Of Sale) systems, label printers, fax printers, and mobile printers. Today, however, they are an increasingly important support product for use in smart logistics. Electronic tags, date code information, barcode labels, cardboard labels, and high-quality labels are just a few of the critical logistics items that thermal printers can generate. However, it is important to choose the right printhead to reap the full benefits of a thermal printing system.

Why Printhead Selection is Important

Thermal printing is a type of contact printing that uses heat to transfer images and text to paper. The thermal printhead is responsible for energizing resistors mounted on a substrate to generate the necessary heat (referred to as joule heat).

Most thermal printheads fall into one of the following applications:

- Mobile printers, ideal for small labels and receipts
- Label writers, well adapted to generating labels for wrapping and organization
- High-speed receipt printers for POS, supporting fast, high-quality printing on a variety of media
- Receipt and label printers for POS, which offer multiple speeds for a range of applications
- Large, high-speed label printers, working well for applications demanding larger but highly accurate labels that can be printed quickly (and even continuously)
- Data code printers, great for electronic tags and date code information
- Facsimiles printers, with such excellent quality and performance they are commonly used for electrocardiogram machines

But choosing the right printhead goes far beyond what general category is needed.

Key Considerations When Choosing a Printhead

There are also different technologies for thermal printheads that need to be considered, namely:

- **Thick film formation** by screen printing
- **Thin film layer formation** by metal deposition or sputter
- Thick/thin film **hybrid** configurations

When choosing the best thermal printhead, the first consideration is two-fold: the characteristics (i.e., sensitivity) of the media used and the target print speed. The media's sensitivity is critical to obtain appropriate image quality, so it is necessary to understand the characteristics before selecting a thermal printhead.

Additionally, the balance between the desired image quality with cost and speed is key. In general, a slower speed means a much better print quality; however, there are applications where high print quality needs to go along with high print speed, especially in situations where time is critical to productivity. Some printhead manufacturers have developed the technology to close the gaps between cost, image quality, and print speed.

To obtain desired image quality, it is also important to check what kind of print pattern (i.e., character or graphic) will be printed. The number of dots that can be printed at the same time for each line is determined for each thermal print head, and this, in turn, affects both the printing speed and image quality.

In the context of thermal printheads, the heat elements are also important. Their size and configuration depend heavily on the intended usage conditions for the printer. Heat elements and heat structures also play a major part in the useful life of a printhead.

Printheads need to be durable and reliable. Without durability, two problems will arise: the replacement cost and the expensive downtime involved with physically replacing the printhead. The life of a thermal printhead has a very specific definition: its useful life is considered over then the resistance of the heat elements changes by more than 15% from their initial value.

Since the thermal print head comes into direct contact with the media and rubs against it, there is concern that the protective film may be damaged due to abrasion, even under normal use conditions. Printing conditions such as platen pressure and applied energy affect this type of wear, but the quality of thermal paper is the most influential item. It is very important to check the quality of the media used to ensure printhead reliability to meet the expected abrasion life.

The lifetime of a printhead is specified either by the running life, based on conditions when thermal paper is run using standard conditions for printing, or the pulse life, which represents the number of pulses applied (also under standard conditions for printing).

Applied energy, which is energy required by the heat elements for printing to take place, is also

critical. It accounts for everything that needs to be supplied to the thermal printhead, including the reactive energy that the drive circuit and other electrodes consume. Keeping in mind that changes in heat element resistance define the life of a printhead, then it becomes apparent that the applied energy is also a major factor in printhead life.

Finally, size and weight can figure in heavily for thermal printhead applications, especially in smart logistics. Small size, energy-efficient printers start with a printhead that reflects those qualities.

Common Printhead Problems

The most common problem with thermal printheads lies in the key to their functionality: heat. Overheating is not good for printers, can negatively impact the quality of a print, and does not contribute to energy efficiency.

One way to mitigate heat issues is through the use of **heat historical control**. When historical heat control is used, the printhead determines the heat generation time of each heating element based on a history of heat generation for that printhead.

Problems also arise when high-speed printing is needed, or a thermal printer must perform at multiple speeds. These problems manifest as a lack of continuity in image quality and a lack of energy efficiency. Both can be mitigated through a printhead heat-generating structure optimized for printing at either high or multiple speeds.

When using a thermal transfer printhead, users often encounter scratched ribbons that adversely affect print quality. However, printheads are available that are engineered to be scratch-resistant, even when using resin-based ink ribbons.

Conclusion

Choosing the right thermal printhead for a smart logistics application is key to its success. Beyond the category and type of printhead needed, there are also considerations such as striking the right balance between image quality, speed, and cost, as well as heat elements and their structures, reliability, applied energy, and both size and weight. In addition, it is important to keep in mind some of the more common problems encountered with thermal printheads, such as heat, energy efficiency, and scratched ribbons.

ROHM Semiconductor has an extensive line of thermal printheads suitable for any smart logistics printing application. Their printheads have succeeded in striking a balance between image quality, speed, and cost using cutting-edge technology.

Heat element structures have been optimized for energy efficiency and various application needs, including high-speed and multi-speed printing--and some printheads are available with heat historical control ICs. ROHM Semiconductor even has thermal transfer printheads with scratch resistance and corrosion control engineered in.

Whether you need highly accurate date code printers for complex logistics management or printing cardboard labels at high speed for the packaging phase of online order handling, ROHM has the thermal printheads you need. In fact, ROHM can even design and manufacture custom printheads that are tailored to your application needs.

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