

A4 Monochrome LED Printer & MFP developed with Common Platform

-B400/B500 series & MB400/MB500 series-

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The newly developed A4 monochrome LED printer (B400/500 series) and MFP (MB400/500 series) described in this article are targeted at the Desktop and Small Work Group segments. They share a common platform, which improves development efficiency and enables multiple models to be developed within a short delivery time.



Photo 1. A4 Monochrome LED Printer B432dn



Photo 2. A4 Monochrome LED MFP MB562dnw

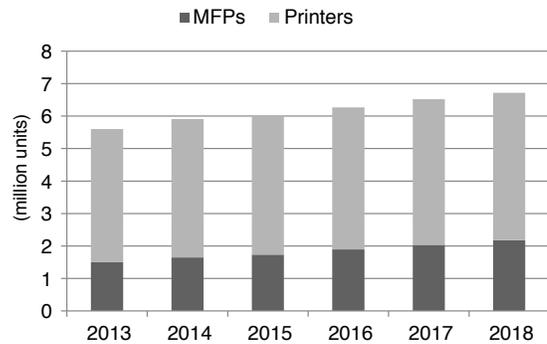
Target Markets and Product Concepts

(1) Target Market Trend

The target markets of the new printer/MFP are the Desktop segment in which 20 or less users share equipment and the Small Work Group where equipment is shared by 20 to 50 users. The market trends for printers/

MFPs (31-44ppm) in these segments are shown in **Figure 1**.

Although the market growth rate to the year 2018 for printers is predicted to be flat, an 8% per year expansion is expected for MFPs.



Source: IDC, Worldwide Quarterly Hardcopy Peripherals Tracker 2014Q4

Figure 1. Worldwide Shipment Forecast for A4 Monochrome Printers/MFPs (31-44ppm)

(2) Product Concepts

The product concepts for the printer/MFP are “improved operability,” “high speed/high-performance,” and “eco-friendly.”

For “improved operability,” the MFP has been equipped with a 7-inch color touch panel, largest in the Desktop segment, to allow simple, intuitive operation. Paper setting has also been improved to simplify use of the multi-purpose tray (MPT).

To fulfill the “high-speed/high-performance” concept, the printing speed of the top models was sped up to 45ppm, and the standard paper tray capacity was increased from the previous models’ 250 sheets to 530 sheets to handle mass printing. The warmup time is also faster than previous models reducing the waiting time before printing starts. Additionally, Wi-Fi capability was added to allow printing from mobile devices.

Under the “eco-friendly” concept, the printer/MFP was made to comply with the Energy Star and Blue Angel international environmental standards.

(3) Product Specifications

Product specifications are shown in **Table 1** and **2**.

Table 1. B412dn/B432dn/B512dn Printer Specifications

| Model | B412dn | B432dn | B512dn |
|--------------------------------|----------------|----------------|--------|
| Print Speed (A4) | 33ppm | 40ppm | 45ppm |
| Print Resolution | 1200dpi | | |
| Warmup Time | 17 seconds | | |
| Duplex Printing | Yes | | |
| Standard Tray Capacity | 250 sheets | 530 sheets | |
| MPT Capacity | 100 sheets | | |
| Ethernet | Yes | | |
| Wireless | Yes (optional) | | |
| Dimensions (WxDxH) | 387x364x245 mm | 387x394x286 mm | |
| Weight (excluding consumables) | Approx. 12kg | Approx. 13kg | |

Table 2. MB472dnw/MB492dn/MB562dnw MFP Specifications

| Model | MB472dnw | MB492dn | MB562dnw |
|--------------------------------|---------------------|--------------------------|----------------|
| Print Speed (A4) | 33ppm | 40ppm | 45ppm |
| Copy Speed (A4) | 33cpm | 37.5cpm | |
| Print Resolution | 1200dpi | | |
| Duplex Printing | Yes | | |
| Standard Tray Capacity | 250 sheets | 530 sheets | |
| MPT Capacity | 100 sheets | | |
| Ethernet | Yes | | |
| Wireless | Yes | No | Yes |
| Control Panel | 3.5 inch monochrome | 7 inch color touch panel | |
| Dimensions (WxDxH) | 427x425x455 mm | 427x478x455 mm | 427x478x496 mm |
| Weight (excluding consumables) | Approx. 20kg | Approx. 21kg | Approx. 22kg |

Benefits of a Common Platform

Past development of worldwide products involved hardware development that was tailored to the needs of each region. Moreover, since the MFPs were developed after the printers, components with different specifications needed to be adopted to meet the additional functionality resulting in an increase of new components.

In development of the new printer/MFP, design using a common platform was made a prerequisite. Multiple models of the printer/MFP were to be developed simultaneously with common hardware/firmware for the control board and mechanical components. Commonality was goal for other components as well in an effort to unify specifications.

The following benefits can be expected with the adoption of a common platform.

- Reduction of factory management workload due to integration of various components
- Reduction of lost sales opportunities due to ease of production increases

- Cost reduction resulting from increase in quantity due to component aggregation
- Reduction of management workload due to reduction in the variety of components
- Improvement of assembly efficiency due to reduction of derived products
- Reduction of management cost due to reduction in types of maintenance components
- Ease of reselling distributor stock from one region to another
- Improvement of design efficiency due to shorter development time

The printer/MFP models introduced here are the first series of products developed under the common platform strategy aimed at reducing development time and cost. Significant reduction in development time was achieved by simultaneously developing multiple models using common hardware/firmware. In the future, the common platform strategy will be applied to product development of other models for further improvement in design efficiency and cost reduction.

Key Technologies for a Common Platform

(1) Hardware

(a) Mechanisms

In simultaneously developing three models each of both the monochrome printer and MFP, the aim was to reduce development time and cost using common hardware for such components as the printer engine and scanner unit.

Improvements based upon the results of customer surveys done on previous models were to be implemented in the printer engine components while retaining commonality with the previous models. The use of multi-purpose tray (**Photo 3**) was a double action process of setting the paper and pushing the set button. However, it was pointed out that the button operation was difficult to understand. Therefore, it was modified to a single action of setting the paper. Additionally, for a more easy-to-use product, the multi-purpose tray was equipped with a sensor to detect the presence of paper automatically, and this feature was added to all six models for commonality. As for the paper tray, there was word it lacks capacity. For this, in addition to previous 250-sheet tray, the top-end models have been equipped with a large 530-sheet capacity tray. Functionalities to satisfy customer requests have been added without changing the size of the printer engine component, thus retaining commonality.



Photo 3. Multi-purpose tray

Similarly, the scanner unit development proceeded with improvements to satisfy requests made in the customer surveys. The control panel of previous models used a 3.5-inch graphics display, but there were complaints it was difficult to comprehend during operation. To remedy the problem, the top-end models were equipped with a 7-inch touch panel. In implementing the control panel unit, the unit was designed to accommodate different sized panels allowing the unit to be fitted with either the 3.5-inch graphics panel or the 7-inch touch panel. Hence, commonality of the scanner unit was possible. The 7-inch touch panel models were equipped with a mechanism to tilt the screen toward the user when the scanner unit was lifted. This feature made the products easier to use by allowing the user to view the guidance screen while replacing the image drum/toner or removing paper during a paper jam.

(b) Electronics

At the electronics department, common platform was the basis for the system design in order to balance the achievement of high-speed/high-performance with the shortened development time. With the platforming of the control board, commonality exists across the entire printer/MFP line.

Although the newly designed board configuration, functional partitions and inter-board connection interfaces differ greatly from past models, the common platform enabled simultaneous development of multiple models significantly reducing development time.

To realize the above, a new SoC was developed for the control board. Previously, control of the printer and scanner sections were each processed separately with its own onboard CPU. Now, control has been consolidated to a single SoC, and while individual processing capabilities were increased, it is more energy efficient. With the new SoC, performance of the control board was improved and at the same time, commonality of the printer/MFP was realized.

Power supply board was also newly developed. In addition to the printer/MFP sharing the same board, input voltage (100V/200V systems) was implemented using the same board. Power saving has also been carried. Common platform was pursued for other boards as well, such as the operations and FAX boards, so that the six models can be configured using a minimum number of board combinations.

For operability improvement, the 7-inch touch panel needed to be newly developed. Common platform was applied to the panel design to ensure the entire panel can be utilized in future models and not limited to the current series.

One of the challenges faced in the use of a common board was the need to downsize each board. It was necessary to implement all the functions of the fully equipped model into the volume of the least equipped model. The task was highly difficult, but with the improvement of the individual board design and careful implementation of the mechanical components, the goal was accomplished.

With the completion of a common hardware platform, the work turned towards the achievement of a common firmware platform, and it called for drastic changes in the design approach. In addition, not only was the development time shortened, but also there were major effects on the manufacturing process and maintenance/operation.

(2) Firmware

The firmware department approached the common platform with development of future products in mind. Variations in hardware configuration of the planned products were extremely numerous. For example, varieties include printer/MFP, color/monochrome, A4/A3, and one control board (1SoC board configuration)/two control boards (2SoC board configuration) to operate the printer and scanner sections. Additionally, for MFPs, there is the choice of whether to adopt a monochrome graphics display or a touch panel. Therefore, the controller and scanner firmware operating over the common platform was given a structure that had the flexibility to be separated or combined depending on the hardware configuration. As a result, the human resources that would be required if firmware was developed for each model and the time required for development were reduced. The five specific approaches taken for achieving the common platform are described below (**Figure 2**).

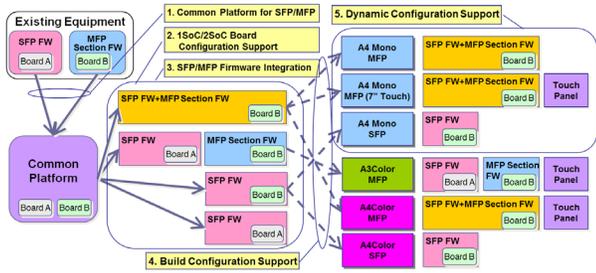


Figure 2. Software Configuration for Each Product

(a) Common Platform for SFP/MFP

Printer and MFP source codes that became separated in the course of past development have all been integrated, and the platform has been restructured to absorb differences in hardware configuration between models. The controller and scanner firmware were implemented on top of the common platform in a form that allows re-separation.

(b) 1SoC/2SoC Board Configuration Support

Coupling relationships and dependencies of each component in the source code were reviewed and restructured to allow generation of firmware for both 1SoC and 2SoC board configurations from one platform.

(c) SFP/MFP Firmware Integration

While maintaining inheritance from existing products, the specifications of the printer and MFP behaviors were reviewed and commonized. Then, source codes of the printer and MFP were integrated.

(d) Build Configuration Support

A mechanism was constructed to generate the required execution object for each model from one platform by specifying the hardware configuration (board configuration, existence of a scanner/control panel and type) that will be implemented at build time.

(e) Dynamic Configuration Support

A mechanism was implemented to check the hardware configuration at startup and continue the startup using the appropriate firmware. This allows the production of printers/MFPs using a single control board (one component number) even when peripheral hardware configuration is different.

This time around, the common firmware platform allowed the production of ten A4 monochrome LED printer/MFP models, including printers/MFPs with different specifications, using a single control board (Figure 3).

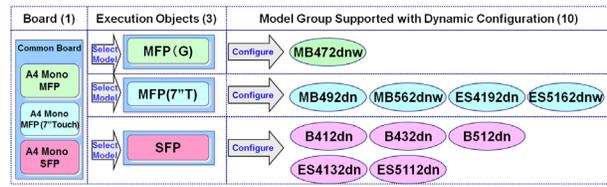


Figure 3. Model Group Covered by Single Board

Conclusion

The printers/MFPs described here are the first products to employ a common platform. Through the adoption of a common platform in future developments, OKI plans to develop products that meet customer needs in a timely manner. ◆◆

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TIPCO [Glossary]

ppm (page per minute)

Number of pages that can be printed in one minute.

dpi (dots per inch)

Number of dots that can be placed within a one-inch span.

cpm (copy per minute)

Number of pages that can be copied in one minute.

SoC (System-on-a-Chip)

Integration of all functions necessary for an equipment or system onto a single semiconductor chip.