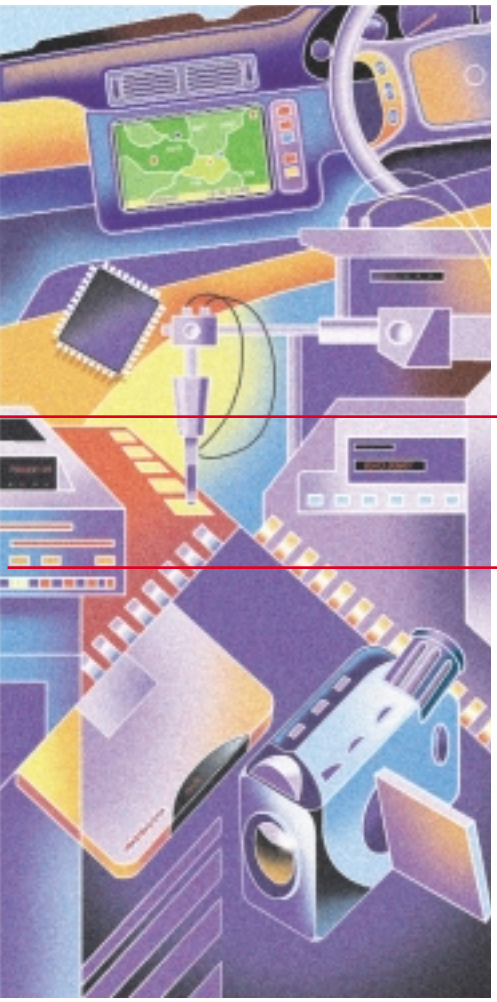
THE POSSIBILITIES ARE INFINITE

FUJITSU



GRAPHIC CONTROLLERS

PRODUCT OVERVIEW

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Designed in the UK. Printed in the USA.

INTRODUCTION TO GRAPHIC DISPLAY CONTROLLERS

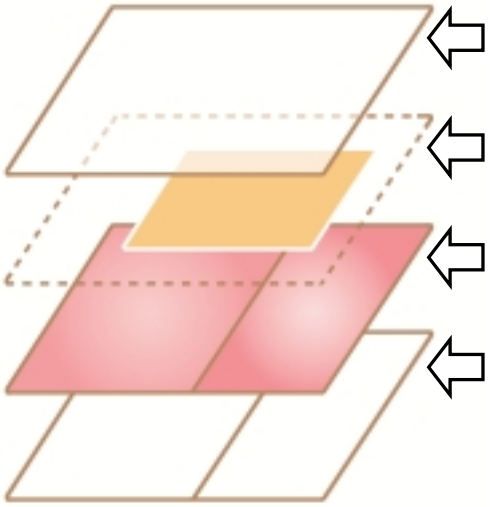
Fujitsu's new family of graphic display controllers will optimise solutions for embedded graphic applications, such as car navigation and mobile information terminals. The products in this family have numerous functions which are state-of-the-art to graphic controllers today, but have been specially optimised for the embedded systems area. This means that, in addition to many 2D and 3D rendering functions, there is a flexible layer concept, support for screen resolution of up to XGA (1024x768), plus further features which are of particular interest in the area of navigation, such as alpha-blending and anti-aliasing. All derivatives have a CPU interface to enable the direct connection of embedded CPUs and MCUs. Fujitsu offers a range of graphic display controllers with different levels of integration for various applications.

In-car navigation is a key target application for the Cremson graphic display controller.

MB86290A ‘CREMSON’

MB86290A ‘Cremson’ is a 2D/3D graphics controller, optimised for applications in car navigation systems and mobile information processing terminals. Adopting various sophisticated functions, such as flat or Gouraud shading, bilinear texture mapping, and Z-buffering, Cremson offers a high-speed, superior-performance 3D graphics functionality. Moreover, anti-aliasing, concaved polygon rendering and fast line draw features are also included, allowing smooth and sophisticated-quality rendering. As a result, Cremson performs high-quality rendering operations, with similar quality to leading-edge PC graphics, but with lower power dissipation. Cremson supports a 64 bit wide external memory interface. This interface is driven at the same 100MHz frequency as its internal operation, to support the large-memory bus bandwidth that is needed to perform the high-performance graphics operations described above. Also, in order to support various kinds of system configurations, Cremson offers a configurable host interface for four types of CPUs (Fujitsu FR30, Hitachi SH3/4, and NEC V832) without external glue logic.

To address the especially complex Window configurations of car navigation systems, Cremson offers 4 layers of overlay planes. These layers are (from top to bottom): C (console) layer, W (window) layer, M (middle) layer and B (base) layer. All layers can be rendered in 16 bit/pixel colour (65,536 colours displayed at a time) or rendered in 8 bit indirect colour mode (256 selected out of 262,144 colours). The colour palette can be defined separately to the C layer and B and M layers. A transparent colour option is used to blend the layers directly.



C (Console) layer
- 8, 16 bit/pixel
- Applied to show switches and panel displays

W (Window) layer
- 16 bit/pixel (Y:U:V = 2:1:1)*
- Applied to overlay input video image

M (Middle) layer
- 8, 16 bit/pixel
- Supplement for Base, can be divided into two zones

B (Base) layer
- 8, 16 bit/pixel
- Fundamental map display layer, can be divided into two zones

* To be supplied by 2nd generation product with embedded DRAM. This layer can be adopted as a 3rd graphics layer as well.

An important feature of Cremson and all subsequent members of the family is that graphical information can be displayed on four overlapping, independent layers.

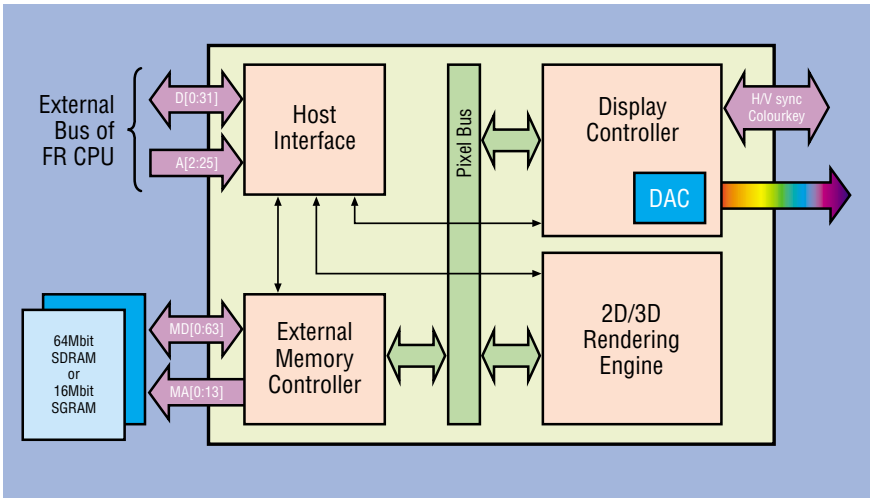
The new GDC’s support for 3D graphics makes possible features such as ‘bird-view’ perspectives.

MB86290A ‘CREMSON’

Layer Concept

For screen separation in wide-screen displays, the M and B layers can be split into two separate segments (left and right). This feature is useful when two different reduced map scales are displayed side by side. Of course, all these layers and segments can be scrolled independently. Two hardware cursors are supported in addition.

An ‘alpha-flag’ per pixel is supported for the C-layer. This feature is useful for blending the C layer colour with all the layer contents below, providing a variable transparent colour effect (‘alpha-blending’). Cremson consists of 4 block modules: host interface block, external memory interface block, display control block, and 2D/3D rendering block. An internal 64 bit bus called Pixel bus connects these modules. Also, the host interface block is connected to each of the other 3 blocks independently to avoid display and/or rendering operations when the host CPU attempts to access these modules.



MB86290A ‘Cremson’ block diagram.

Key Features

- CMOS 0.25µm technology
- Display resolutions up to 1024x768
- 4 layers of overlay display (bottom 2 layers are both split into separate segments)
- RGB analogue output (high speed DAC)
- Includes various kinds of 2D/3D graphic acceleration functions
- Built-in alpha-blending, anti-aliasing and chroma-keying
- Up to 32MB external graphic memory (SDRAM) 64 bit wide @ 100MHz
- Configurable CPU-interface for FR30, SH3, SH4, V83x CPUs
- Supply voltage 3.3V (I/O), 2.5V (Internal)
- QFP-240 Package
- Temperature range -40 to +85°C

MB86291 ‘SCARLET’

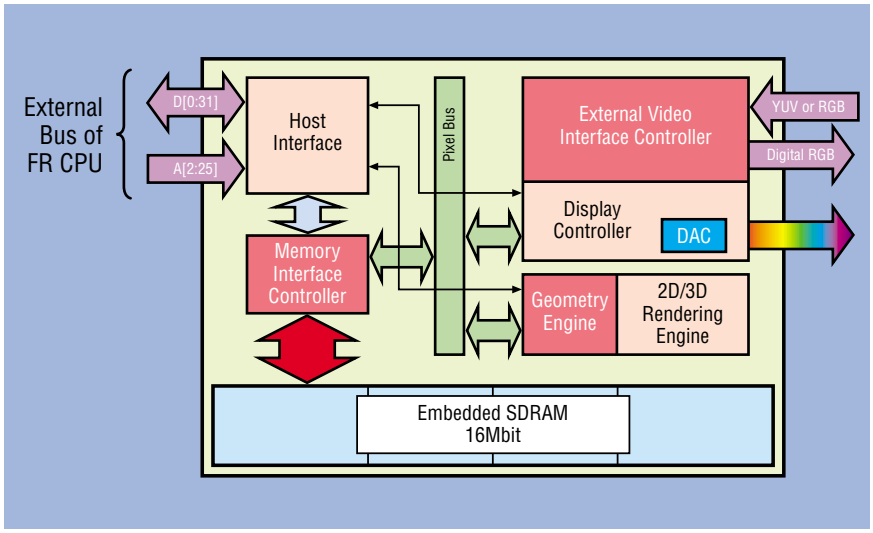
MB86291 ‘Scarlet’ is an enhanced version of MB86290A ‘Cremson’ which adds 16Mbit embedded SDRAM, video input functions and a geometry processor. The concept of display layers, 2D/3D rendering functions and the display controller features are taken from ‘Cremson’ MB86290A.

Scarlet is optimised for applications in car navigation systems, which require video-input features, consumer information processing systems and arcade game applications.

Scarlet has 16Mbit of embedded SDRAM with high bandwidth (100MHz). No external SDRAM devices are required for graphic memory. The external video input can be used to capture video signals according to the standard RBT-ITU656 YUV4:2:2 format. Picture-in-picture functions are supported to display the video image (the W-layer is dedicated for that purpose). To adjust the dimensions of the video-input format, a flexible video scaler is integrated.

A geometry processor, capable of performing numeric calculations for graphical operations in included. Supported functions are Affin-conversions, model-view-projections, 3D-clipping operations and others. All drawing functions, display list-formats and software functions are compatible to the ‘Cremson’ MB86290A.

An additional RGB digital interface offers flexible display connections.



Scarlet offers some of the most advanced functionality yet developed for use in automotive navigation and multimedia information terminals.

Key Features

- CMOS 0.25µm technology
- Display resolutions up to 1024x768
- 4 layers of overlay display (bottom 2 layers are both split into separate segments)
- Digital video input
- Video scaler
- I²C interface
- Geometry processor
- RGB analogue output (high speed DAC)
- RGB digital output (8 bit x 3)
- Includes various kinds of 2D/3D graphic acceleration functions
- Built-in alpha blending, anti-aliasing and chroma-keying
- Embedded 16Mbit SDRAM graphic memory
- Configurable CPU-interface for FR30, SH3, SH4, V83x CPUs
- Supply voltage 3.3V (I/O), 2.5V (Internal)
- QFP-208 Package
- Temperature range -40 to +85°C

MB87J2120 ‘LAVENDER’

MB87J2120 ‘Lavender’ is another new member of the Fujitsu graphic controller family but with a different set of features dedicated for graphical applications that require no 3D-rendering functions and use low-resolution displays such as dashboards, user interfaces in consumer applications or control panels.

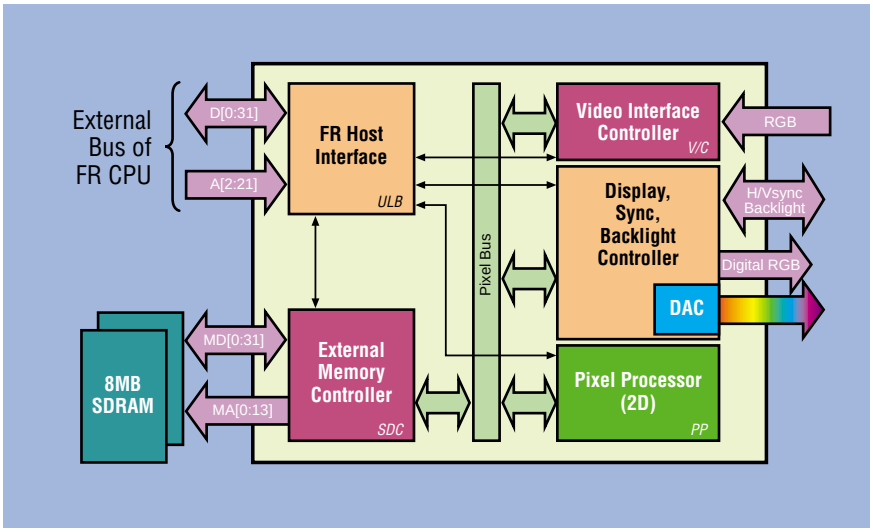
The MB87J2120 supports almost all LCD panel types (digital or analogue interface), and CRTs or other progressive scanned monitors/displays, which can be connected via the analogue RGB output.

MB87J2120 ‘Lavender’ is optimised to work with the Fujitsu MB91360 series RISC-controllers (e.g. MB91F361A) and will be clocked at 64MHz (internal frequency). The device has a 32 bit SDRAM interface (graphic memory).

The 2D rendering functions are composed out of standard primitives such as lines, polygons, rectangles, etc., as well as some special functions like decompression of RLE-bitmaps and text display. 4 layers of overlay can be displayed simultaneously.

The graphic output is an RGB analogue or digital interface for a great variety of LCD displays (programmable sync and scan behaviour).

MB87J2120 also has a digital video input being an RGB 555/888 interface.



MB87J2120 ‘Lavender’ block diagram.

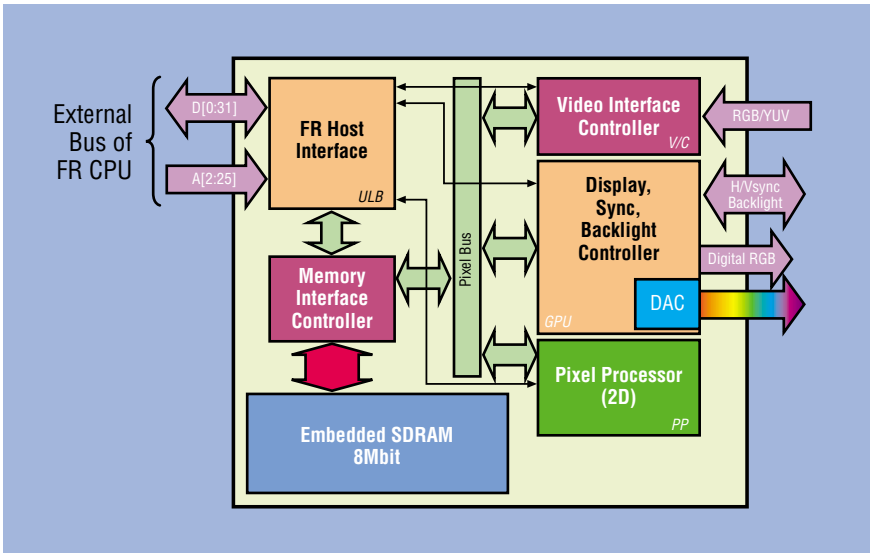
Key Features

- CMOS 0.25µm technology
- Flexible display controller for almost all standard LCD panels
- 4 layers of overlay display (out of 16 logical layers)
- RGB analogue output (DAC)
- RGB digital output
- Includes 2D graphic acceleration functions
- external SDRAM graphic memory 32 bit
- Digital video input (RGB555 or RGB888 format)
- CPU-interface for FR30
- Supply voltage 3.3V (I/O), 2.5V (Internal)
- BGA-256P-M01 Package
- Temperature range -40 to +85°C

MB87P2020 ‘JASMINE’

MB87P2020 ‘Jasmine’ is an enhanced version of MB87J2120 ‘Lavender’ which adds 8Mbit embedded SDRAM, and some more improved features. The device is fully compatible to the Lavender chip and uses the same internal architecture, the same layer and interface concept. No external memory devices are required for graphic memory because of the 8Mbit embedded SDRAM. As a consequence, the package could be reduced to QFP208. Therefore, Jasmine is optimised for compact automotive or consumer applications where a high integration of functions is required. Like Lavender, the Jasmine is optimised to work as a companion chip for the Fujitsu 32 bit RISC devices MB91F36x.

As a successive product to Lavender, the new device has a number of enhancements which allows there to be more flexibility in the application area. First of all, a new video input interface was developed which allows acceptance of more formats (including YUV) and which is compatible to a wider range of video decoder chips. A new programmable converter matrix (YUV to RGB) allows writing of these YUV formats to layers and to convert back to RGB for scanning.



MB87P2020 ‘Jasmine’ block diagram.

In addition, a gamma correction table was added to allow adjustment of the picture characteristics according to the connected display requirements and the colour look-up table that can now hold up to 512 entries.

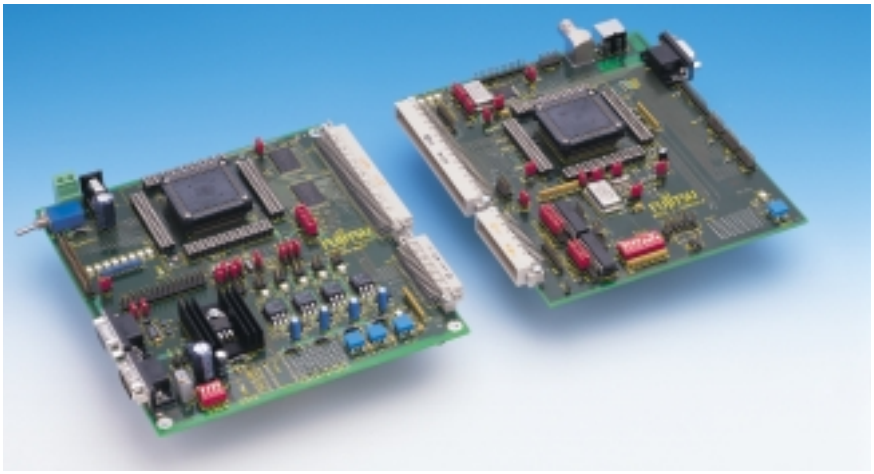
EVALUATION BOARDS

For application development support and functional evaluation, a number of evaluation boards are available from Fujitsu:

PCI Evaluation Board
MB86290-EB01 and MB86291-EB01

A PCI adapter card with a 'Cremson' MB86290A or a 'Scarlet' MB8629 is available which allows the evaluation of the features of the device directly from a Windows PC. For this, a Windows NT driver and a map driver are bundled with this adapter card in order to get started, enabling easy programming of the Cremson from a Windows NT based development environment. Also, the source code of various application examples is included. In addition, the card can be directly mounted to an embedded system, however the main purpose is software development.
Note: A PCI adapter card equipped with 'Orchid' MB86292 is under development.

MB86290A-EB01 Cremson Evaluation Board.



A Starterkit will be available for the GDCs, enabling designers to build up specific embedded applications with the targeted processor and GDC together.

Cremson Starterkit Series

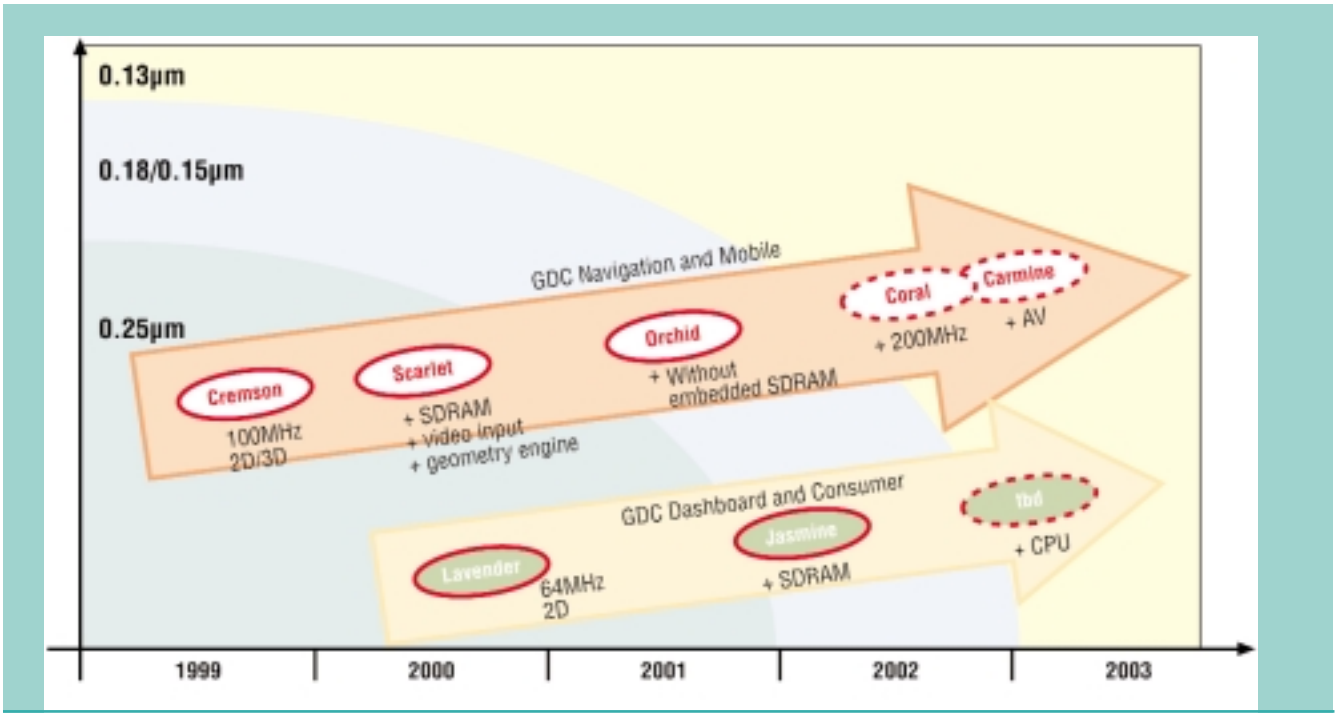
The Cremson Starterkit is a modular evaluation board, which provides a standalone embedded environment. The kit hardware consists of two parts, a CPU module, which carries the Fujitsu 32 bit RISC MCU MB91F36X and a set of sub-boards for the graphic controllers Cremson, Scarlet and Lavender.

In order to have the appropriate configuration for the application requirements, the system allows the CPU type or the graphic controller to be easily changed.

The interconnection between both module boards is the host-CPU bus interface. All functions of the graphic devices and the CPU are present on pin headers, jumpers or switches, which allows the addition of hardware extensions.

In combination with the PCI adapter MB8629X-EB01, the software modules developed under Windows NT can then also be used directly in the standalone environment.

EVALUATION BOARDS



Roadmap of graphic controller development.

Under development

New enhanced graphic-display controllers for various kinds of digital audio/video applications, in which MPEG decoder functions will be integrated together, are planned as successive products.

In addition, we plan to integrate the CPU core and various I/O functions and define a single-chip solution for car navigation applications.

Device	Name	2D	3D analogue	RGB digital	RGB input	Video	Graphic memory processor	Geometry	CPU interface	Package
MB86290A	Cremson	✓	✓	✓			external (up to 32MByte)		FR,SH3/4,V83x	QFP240
MB86291	Scarlet	✓	✓	✓	✓	✓	Embedded (2MByte)	✓	FR,SH3/4,V83x	QFP208
MB86292	Orchid	✓	✓		✓	✓	external (up to 32MByte)	✓	FR,SH3/4,V83x	QFP256
MB87J2120	Lavender	✓		✓	✓	✓	external (up to 8MByte)		FR	BGA256
MB87P2020	Jasmine	✓		✓	✓	✓	Embedded (1MByte)		FR	QFP208

Evaluation Board	Description	Device
MB86290-EB01	PCI board for standard PCs (Windows NT)	MB86290A 'Cremson'
MB86291-EB01	PCI board for standard PCs (Windows NT)	MB86291 'Scarlet'
GrfxStart-CPU	CPU module for the Cremson Starterkit	MB91F361 as Host CPU
GrfxStart-Cremson	Cremson sub-board for the Starterkit	MB86290A 'Cremson'
GrfxStart-Scarlet	Scarlet sub-board for the Starterkit	MB86291 'Scarlet'
GrfxStart-Lavender	Lavender sub-board for the Starterkit	MB87J2120 "Lavender'
GrfxStart-Jasmine	Jasmine sub-board for the Starterkit	MB87P2020 "Jasmine'

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