



**Is Now Part of**



**ON Semiconductor®**

**To learn more about ON Semiconductor, please visit our website at  
[www.onsemi.com](http://www.onsemi.com)**

ON Semiconductor and the ON Semiconductor logo are trademarks of Semiconductor Components Industries, LLC dba ON Semiconductor or its subsidiaries in the United States and/or other countries. ON Semiconductor owns the rights to a number of patents, trademarks, copyrights, trade secrets, and other intellectual property. A listing of ON Semiconductor's product/patent coverage may be accessed at [www.onsemi.com/site/pdf/Patent-Marking.pdf](http://www.onsemi.com/site/pdf/Patent-Marking.pdf). ON Semiconductor reserves the right to make changes without further notice to any products herein. ON Semiconductor makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does ON Semiconductor assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages. Buyer is responsible for its products and applications using ON Semiconductor products, including compliance with all laws, regulations and safety requirements or standards, regardless of any support or applications information provided by ON Semiconductor. "Typical" parameters which may be provided in ON Semiconductor data sheets and/or specifications can and do vary in different applications and actual performance may vary over time. All operating parameters, including "Typicals" must be validated for each customer application by customer's technical experts. ON Semiconductor does not convey any license under its patent rights nor the rights of others. ON Semiconductor products are not designed, intended, or authorized for use as a critical component in life support systems or any FDA Class 3 medical devices or medical devices with a same or similar classification in a foreign jurisdiction or any devices intended for implantation in the human body. Should Buyer purchase or use ON Semiconductor products for any such unintended or unauthorized application, Buyer shall indemnify and hold ON Semiconductor and its officers, employees, subsidiaries, affiliates, and distributors harmless against all claims, costs, damages, and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if such claim alleges that ON Semiconductor was negligent regarding the design or manufacture of the part. ON Semiconductor is an Equal Opportunity/Affirmative Action Employer. This literature is subject to all applicable copyright laws and is not for resale in any manner.



# AN-5058



## µSerDes™ Family Frequently Asked Questions (FAQs)

### Summary

The following questions are typical of Fairchild's µSerDes™ application support team answers the µSerDes family. If you have a question not addressed here, please contact your local Fairchild representative or email to [interface@fairchildsemi.com](mailto:interface@fairchildsemi.com).

#### What is a µSerDes™?

The µSerDes is a low-cost, ultra-low EMI, very small device that allows large amounts of data to flow between points such as displays, cameras, and controllers. This is achieved through a parallel-to-serial (serializer) conversion at the source and serial-to-parallel (deserializer) conversion at the destination.

#### Why is a Fairchild µSerDes™ serial interface better than a parallel interface solution?

- Significantly reduced EMI over single-ended technology solutions.
- No power-up sequencing required. No change needed for controller software.
- Functions well where single-ended, current-mode technology fails.
- Can provide a greater than 25 to 4 wire reduction.
- Can provide a greater than 50 to 7 wire reduction in bi-directional interfaces.
- Can provide a lower-cost, more reliable interface solution.
- Can reduce overall component count over existing LVCMOS technology.
- Can use less board space over LVCMOS technologies.

## What are the differences among the $\mu$ SerDes™ devices?

Each device in the Fairchild  $\mu$ SerDes family has been designed for specific architectures as shown in Table 1.

**Table 1.  $\mu$ SerDes™ Family Comparisons**

|                                         | FIN12AC                                                                            | FIN24AC                                                                           | FIN24C                                                                | FIN212AC                                                                           | FIN224AC                                                                          | FIN324C                                                              |
|-----------------------------------------|------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------|------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|----------------------------------------------------------------------|
| Function                                | Serializer / Deserializer                                                          | Serializer / Deserializer                                                         | Serializer / Deserializer                                             | Serializer / Deserializer                                                          | Serializer / Deserializer                                                         | Serializer / Deserializer                                            |
| Number of Bits                          | 12                                                                                 | 22                                                                                | 24                                                                    | 12                                                                                 | 22                                                                                | 24                                                                   |
| Max Frequency                           | 40MHz                                                                              | 20MHz                                                                             | 20MHz                                                                 | 40MHz                                                                              | 26MHz                                                                             | 15MHz                                                                |
| Factory Options<br>(***Contact Factory) |                                                                                    |                                                                                   | 26MHz                                                                 | 48MHz & 2.5x2.5 package                                                            |                                                                                   | Higher frequency version                                             |
| Dynamic Current (Serializer)            | 8.5mA @ 5MHz                                                                       | 9.5mA @ 5MHz                                                                      | 11mA @ 10MHz                                                          | 9.5mA @ 5MHz                                                                       | 9mA @ 5MHz                                                                        | 4mA @ 5.44MHz                                                        |
| VDDA/S                                  | 2.5 to 3.3V                                                                        | 2.5 to 2.9V                                                                       | 2.5 to 2.9V                                                           | 2.5 to 3.6V                                                                        | 2.5 to 3.3V                                                                       | 2.5 to 3.0V                                                          |
| VDDP                                    | 1.65 to 3.6V                                                                       | 1.65 to 3.6V                                                                      | 1.65 to 3.6V                                                          | 1.65 to 3.6V                                                                       | 1.65 to 3.6V                                                                      | 1.6 to VDDA/S                                                        |
| Read / Write                            | Write                                                                              | Write                                                                             | Write                                                                 | Write                                                                              | Write                                                                             | Read / Write                                                         |
| Ideal Application                       | Camera                                                                             | Small LCD                                                                         | Small LCD                                                             | Camera<br>Small LCD                                                                | Small LCD                                                                         | Small LCD                                                            |
| Recommended Interface                   | RGB                                                                                | $\mu$ Controller                                                                  | RGB                                                                   | $\mu$ Controller / RGB                                                             | $\mu$ Controller                                                                  | $\mu$ Controller / RGB / SPI                                         |
| Selectable LVCMOS Edge Rates            | No                                                                                 | No                                                                                | No                                                                    | Yes                                                                                | Yes                                                                               | Yes                                                                  |
| Selectable LVCMOS Pulse Width           | No                                                                                 | No                                                                                | No                                                                    | Yes                                                                                | Yes                                                                               | Yes                                                                  |
| Output state                            | Tri-state                                                                          | Tri-state                                                                         | Tri-state                                                             | Tri-state                                                                          | Tri-state                                                                         | Known-state                                                          |
| External timing required                | Yes                                                                                | Yes                                                                               | Yes                                                                   | Yes                                                                                | Yes                                                                               | No                                                                   |
| Additional Features                     | Multiple frequency range                                                           | Multiple frequency range                                                          |                                                                       | Multiple frequency range; CTL Standard or High; PLL divide by 2 or 3               | Multiple frequency range                                                          | RT180                                                                |
| ESD in kV                               | 15                                                                                 | 8                                                                                 | 8                                                                     | 14                                                                                 | 15                                                                                | 15                                                                   |
| Package                                 | BGA, MLP                                                                           | BGA, MLP                                                                          | BGA, MLP                                                              | BGA, MLP                                                                           | BGA, MLP                                                                          | BGA, MLP                                                             |
| Modes                                   | 0-Power Down; 1-CKREF 20Mhz to 40MHz; 2-CKREF 5MHz to 14MHz; 3-CKREF 8MHz to 14MHz | 0-Power Down; 1-CKREF 2Mhz to 5MHz; 2-CKREF 5MHz to 15MHz; 3-CKREF 10MHz to 20MHz | 0-Power Down; 1-4-bit control; 2-4-bit control latch; 3-2-bit control | 0-Power Down; 1-CKREF 20Mhz to 40MHz; 2-CKREF 5MHz to 14MHz; 3-CKREF 8MHz to 28MHz | 0-Power Down; 1-CKREF 2Mhz to 5MHz; 2-CKREF 5MHz to 15MHz; 3-CKREF 10MHz to 26MHz | Master/slave; PAR/SPI; Strobe selection; Reset/standby; Slew control |

## $\mu$ SerDes™ Family Similarities and Features

### Similarities across FIN24AC, FIN224AC, and FIN224C

- Same Package
- Same Pinout
- Same Voltage Range
- Same Voltage Translation Range
- Same CTL Drive

### New Features

- Rolled LVCMOS Deserializer Edge Rates
- More ESD Protection
- More Wide CKP Pulse Width (FIN224AC)
- Less Power (FIN224AC)

## Implementation

### What distance can a $\mu$ SerDes™ drive?

The distance that can be driven depends on the data rates involved, acceptable bit error rate, and the transmission medium. The maximum distance in ANSI/TIA/EIA-644-A, the LVDS standard, is 10 meters. This distance is entirely application dependent.

### Should special transmission mediums be used?

The  $\mu$ SerDes can be used with any typical differential transmission medium, including flex circuits, PC board, and cables.

### What impedance should the transmission cable/flex be?

The transmission line should be 100 $\Omega$  differential.

### Is a termination resistor needed at the inputs to the deserializer?

No. The 100 $\Omega$  termination resistor is integrated into the deserializer, so an external resistor is not necessary for either clock or data lines.

### Do trace lengths need to be matched?

Yes. Trace lengths need to be matched like any bus architecture. However, since the serializer and deserializer have a flow-through design (traces do not need to cross to connect devices), the effort to achieve this is minimal.

### Are there PCB layout guidelines available?

Yes. This can be downloaded from the Fairchild website or may be obtained from [interface@fairchildsemi.com](mailto:interface@fairchildsemi.com)

### What is the typical common-mode voltage of the $\mu$ SerDes™?

Typical common-mode voltage is approximately 700mV.

### Are there actual Gerber files available to download to simplify or as an example of design?

Yes, please contact Fairchild Interface Group at [interface@fairchildsemi.com](mailto:interface@fairchildsemi.com).

### Is there a special power-down sequence between serializer and deserializer?

There is no required power-down sequence.

### Is there a special power-up sequence between supplies for either a serializer or deserializer?

There is no required power-up sequence for either serializer or deserializer.

### Are there special settings or switches for the PLL (S1, S2) on the FIN24 serializer?

No. The PLL has a very wide range of operation.

### When is CTL™ technology better than single-ended, current-mode technology?

In applications where a transmission line must be AC coupled or when DC line balancing is necessary, single-ended, current-mode technology is usually inadequate. LVDS is superior because DC bias can be restored on the deserializer side of the solution by using only resistors. In addition, differential technologies offer better EMI than single-ended technologies.

### How much is EMI reduced using a $\mu$ SerDes™?

$\mu$ SerDes provides ultra-low EMI as compared to legacy single-ended technologies. The actual amount of EMI reduction varies per application; however, Fairchild's EMI lab has documented cases of greater than -106.1dB reduction over legacy single-ended technologies.

### Is there special grounding scheme required for $\mu$ SerDes™?

No special ground wire is required. The ground wire can be subject to interference, as with single-ended, current-mode technologies.

### How low is the power in power-down mode?

The  $\mu$ SerDes device is specified to use less than 10 $\mu$ A in power-down mode.

### Are EMI filters necessary on the serial link?

Many applications no longer require EMI filters. If additional filtering is required, Fairchild suggests implementing a shielded flex of ribbon cable for the following reasons:

- Saves space on the PCB.
- Makes a solid ground between board assemblies (no ground bounce).
- Sideband signals in flex, not through  $\mu$ SerDes, can radiate; shielding helps reduce this phenomenon.
- ESD/EMI arrays are expensive.

## Test and Diagnostics

### Bits 21 and 22 on the FIN24A don't seem to work on the deserializer. Why?

Data input to pin 21 on the FIN24A serializer is output from the deserializer on pin 23. Data input to pin 22 on the FIN24A serializer is output at the deserializer on pin 24.

### Why does the serial clock appear intermittent?

This is normal as a word boundary is embedded into the serial stream. Please refer to the datasheet for a more in-depth description.

### When I examine either the serial data path or the serial clock path, the signal is distorted. Why?

Using a 50Ω high-speed terminated oscilloscope with the probe ground to one side of an LVDS signal forces the 1.0V bias to ground, resulting in a very incorrect signal. Use high-impedance probes or, alternatively, a board ground may be offset to accommodate the ground of an oscilloscope. Contact a Fairchild μSerDes representative for assistance.

### How should the serial clock or data stream look?

The clock or data stream is approximately a 225mV peak-to-peak, roughly square, wave differential signal at approximately 700mV bias with respect to ground.

### Where is the ground for μSerDes™ devices?

All device grounds are connected to the ground slug, underneath the μSerDes device. Care should be taken when designing the board containing the μSerDes so that the solder mask is pulled back from this slug.

### Do S1 and S2 control the frequency range for the FIN24?

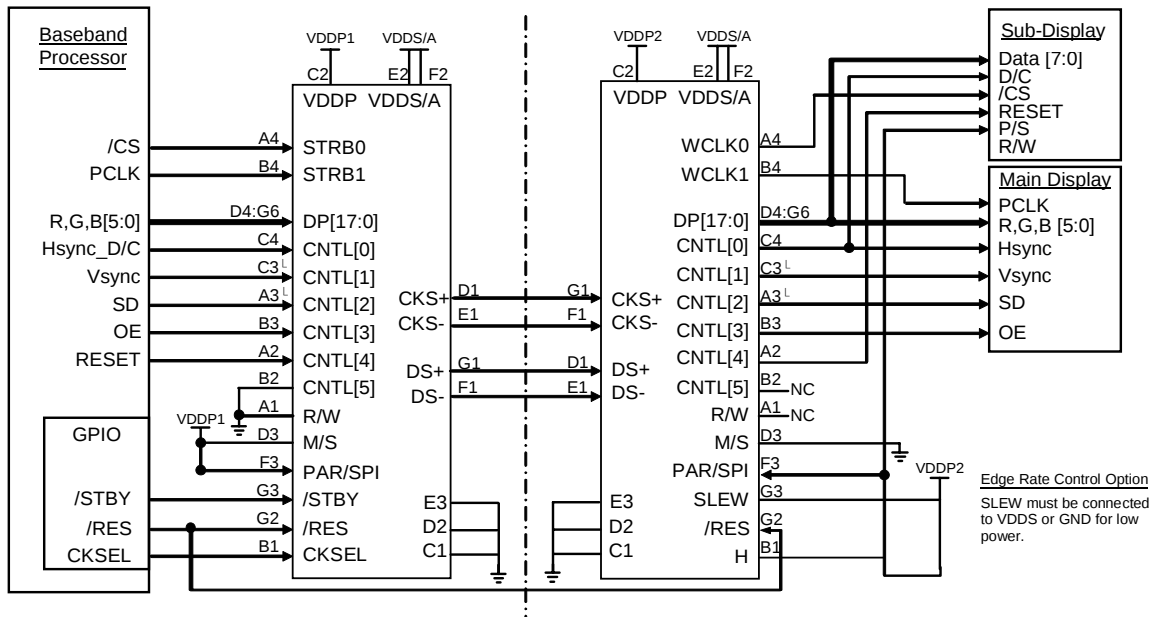
The FIN24 has a set frequency range, where S1 and S2 control the directionality of data bits [21:24].

### What does a typical implementation look like for an RGB interface?

Please see Figure 1 for a typical implementation.

### Where can I get more information on how to use a μSerDes™ with more complex architectures, such as microcontroller interface or for a bi-directional configuration?

Contact your local Fairchild representative or at [interface@fairchildsemi.com](mailto:interface@fairchildsemi.com).



Notes:

1. Write-only Interface.
2. Assumes BGA die on display.
3. /CS used to strobe sub-display data.
4. PCLK used for RGB mode.
5. Pin numbers for BGA package.

Figure 1. FIN324C RGB Application Example

## Related Datasheets

FIN12AC  
FIN12AC  
FIN24AC  
FIN24C  
FIN224AC  
FIN224C  
FIN324C



μSerDes™ is a trademark of Fairchild Semiconductor Corporation.

---

### DISCLAIMER

FAIRCHILD SEMICONDUCTOR RESERVES THE RIGHT TO MAKE CHANGES WITHOUT FURTHER NOTICE TO ANY PRODUCTS HEREIN TO IMPROVE RELIABILITY, FUNCTION, OR DESIGN. FAIRCHILD DOES NOT ASSUME ANY LIABILITY ARISING OUT OF THE APPLICATION OR USE OF ANY PRODUCT OR CIRCUIT DESCRIBED HEREIN; NEITHER DOES IT CONVEY ANY LICENSE UNDER ITS PATENT RIGHTS, NOR THE RIGHTS OF OTHERS.

### LIFE SUPPORT POLICY

FAIRCHILD'S PRODUCTS ARE NOT AUTHORIZED FOR USE AS CRITICAL COMPONENTS IN LIFE SUPPORT DEVICES OR SYSTEMS WITHOUT THE EXPRESS WRITTEN APPROVAL OF THE PRESIDENT OF FAIRCHILD SEMICONDUCTOR CORPORATION.

As used herein:

1. Life support devices or systems are devices or systems which, (a) are intended for surgical implant into the body, or (b) support or sustain life, or (c) whose failure to perform when properly used in accordance with instructions for use provided in the labeling, can be reasonably expected to result in significant injury to the user.
2. A critical component is any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.

ON Semiconductor and  are trademarks of Semiconductor Components Industries, LLC dba ON Semiconductor or its subsidiaries in the United States and/or other countries. ON Semiconductor owns the rights to a number of patents, trademarks, copyrights, trade secrets, and other intellectual property. A listing of ON Semiconductor's product/patent coverage may be accessed at [www.onsemi.com/site/pdf/Patent-Marking.pdf](http://www.onsemi.com/site/pdf/Patent-Marking.pdf). ON Semiconductor reserves the right to make changes without further notice to any products herein. ON Semiconductor makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does ON Semiconductor assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages. Buyer is responsible for its products and applications using ON Semiconductor products, including compliance with all laws, regulations and safety requirements or standards, regardless of any support or applications information provided by ON Semiconductor. "Typical" parameters which may be provided in ON Semiconductor data sheets and/or specifications can and do vary in different applications and actual performance may vary over time. All operating parameters, including "Typicals" must be validated for each customer application by customer's technical experts. ON Semiconductor does not convey any license under its patent rights nor the rights of others. ON Semiconductor products are not designed, intended, or authorized for use as a critical component in life support systems or any FDA Class 3 medical devices or medical devices with a same or similar classification in a foreign jurisdiction or any devices intended for implantation in the human body. Should Buyer purchase or use ON Semiconductor products for any such unintended or unauthorized application, Buyer shall indemnify and hold ON Semiconductor and its officers, employees, subsidiaries, affiliates, and distributors harmless against all claims, costs, damages, and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if such claim alleges that ON Semiconductor was negligent regarding the design or manufacture of the part. ON Semiconductor is an Equal Opportunity/Affirmative Action Employer. This literature is subject to all applicable copyright laws and is not for resale in any manner.

## PUBLICATION ORDERING INFORMATION

### LITERATURE FULFILLMENT:

Literature Distribution Center for ON Semiconductor  
19521 E. 32nd Pkwy, Aurora, Colorado 80011 USA  
**Phone:** 303-675-2175 or 800-344-3860 Toll Free USA/Canada  
**Fax:** 303-675-2176 or 800-344-3867 Toll Free USA/Canada  
**Email:** [orderlit@onsemi.com](mailto:orderlit@onsemi.com)

**N. American Technical Support:** 800-282-9855 Toll Free  
USA/Canada

**Europe, Middle East and Africa Technical Support:**  
Phone: 421 33 790 2910

**Japan Customer Focus Center**  
Phone: 81-3-5817-1050

**ON Semiconductor Website:** [www.onsemi.com](http://www.onsemi.com)

**Order Literature:** <http://www.onsemi.com/orderlit>

For additional information, please contact your local  
Sales Representative