Product Overview

Industry's First High-Speed Mux With 1.2 V I/O Control Logic: TMUXHS221LV

Texas Instruments

Smaller size. Better performance. Lower power consumption. As semiconductor technologies evolve, developers cannot and will not compromise these characteristics. The industry desire for smaller size, better performance, and lower power consumption has particularly motivated the trend towards deep sub-micron process nodes commonly seen in many advanced system-on-chips (SoCs) today. While process nodes were in the range of 10 µm in 1971, today's most advanced process nodes are approaching 3 nm in 2024, which results in incredibly high-performance processing at a fraction of the power and size.

The migration to finer geometry, deep sub-micron process nodes has resulted in necessary modifications to various electrical standards. For example, all processes smaller than 7 nm commonly seen in many SoCs support a maximum of 1.2 V or lower I/O control logic and do not support 1.8 V or 3.3 V I/O control natively. While today 3.3 V I/O control is the most widely used I/O control voltage logic level, the migration of SoCs to 1.2 V or lower I/O control has become inevitable to achieve smaller size, better performance, and lower power.

The transition to finer geometry process nodes also resulted in the development and adoption of embedded USB 2.0 (eUSB2). The eUSB2 specification enables "USB 2.0 interfaces to operate at I/O voltages of 1 V or 1.2 V instead of 3.3 V". For more information, see Understanding the embedded USB2 (eUSB2) standard. Naturally, as the adoption of finer geometry process nodes grows, the need to support eUSB2 signaling levels alongside 1.2 V I/O control logic also increases.

To address these needs in USB 2.0 and eUSB2 interfaces, in November 2022, TI released TMUXHS221, a USB 2.0 2:1 mux/demux with low Ron of 3 Ω, high bandwidth of 3.3 GHz, high data pin tolerance of 5 V, and minimal propagation delay of 60 ps. TMUXHS221 performs signal routing for devices requiring 3.3 V or 1.8 V I/O control, and TMUXHS221 is pin-to-pin and BOM-to-BOM compatible with multiple IC vendors, offering customers a drop-in replacement for robust supply continuity.

In August 2023, TI released TMUXHS221LV, industry's first USB 2:1 mux/demux with 1.2 V I/O control logic. TMUXHS221LV has the equivalent top performance, diverse compatibility, and low cost of TMUXHS221 but uniquely, performs signal routing for finer geometry node SoCs requiring 1.2 V I/O control and low power consumption. TMUXHS221LV also simplifies circuitry and reduces cost by removing the need for a level-shifter. TMUXHS221/LV's high bandwidth complements any design which requires up to 3.3 GHz. To view a complete list of protocols TMUXHS221/LV supports, see the *Application Information* section in the *TMUXHS221USB 2.0 480 Mbps2:1/1:2 Multiplexer/Demultiplexer Switch Data Sheet*. Table 1 distinguishes TMUXHS221LV, TMUXHS221, and alternatives in the market today.

Table 1. High-Speed Multiplexer Comparison

	TI TMUXHS221LV NKG	TI TMUXHS221 NKG	Existing Alternatives	Unit
Ron	**3**		4	Ω
-3dB Bandwidth	**3.3**		1.4	GHz
Propagation delay	**60**		200	ps
Intra-pair skew (max)	**10**		20	ps
Supply voltage	**1.8**	3.3	3.3	V
Control-signal	**1.2, 1.8, or 3.3**	1.8 or 3.3	1.8 or 3.3	V
Temperature range	**-40 to 125**		-40 to 85	°C

Whether your design requires 3.3 V, 1.8 V, or 1.2 V I/O control, TI provides both confidence in supply and confidence in cost savings with TMUXHS221 and TMUXHS221LV!

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