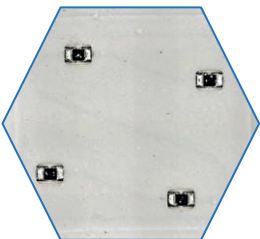
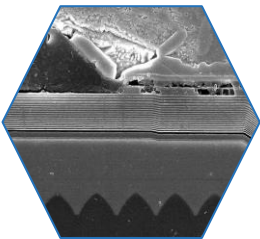


MiniLED Backlight Unit in the 2021 Apple iPad Pro

In-depth technical and cost analysis of the first consumer miniLED backlight unit and its assembly.



Title: MiniLED backlight unit in the 2021 Apple iPad Pro

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After more than three years of hype, excitement, and unfulfilled promises, miniLED backlights are finally ready for prime time. MiniLED monitors and laptops have been available since late 2020 and most leading TV brands are adopting miniLED backlights in their 2021 flagship models. The highly anticipated miniLED Apple iPad pro was officially announced in April 2021.

Properly designed miniLED backlights allow LCD displays to reach contrast performance close to that of OLEDs, while maintaining the high brightness characteristics of LCDs. All of this while offering reduced power consumption, a very thin form factor (thickness), and cost/price competitiveness with OLED. With this newest iPad Pro, Apple is really bringing this newer display technology to the consumer. As many different supply chain and technology choices are not settled yet, this System Plus Consulting teardown report provides great insights into the choices Apple is bringing to the table.

In this report, System Plus Consulting provides a full reverse costing study of the miniLEDs and their assembly in the backlight unit of the display in the 12.9-inch 2021 iPad Pro.

The new backlighting system is composed of 10,384 miniLEDs divided into 2,596 local dimming zones.

- The miniLEDs, which are GaN-based dies on patterned sapphire substrate, have an engineered light-emission pattern using dedicated top and back dielectric reflectors. We estimate that they are manufactured by Epistar in Taiwan.
- The chip-on-board assembly of the more than 10,000 miniLEDs is believed to be done by TSMC in Taiwan. The miniLEDs are mounted in flip-chip configuration.
- The miniLEDs are driven by nine drivers from STMicroelectronics. These drivers are wafer-level chip-scale packaged.

This report provides insights regarding technology data, manufacturing cost, and selling price of the BLU, with a focus on the miniLEDs and their drivers. Also included is an estimated manufacturing cost of all the BLU's components and a selling price analysis.

COMPLETE TEARDOWN WITH

- Detailed optical and SEM photos
- Precise measurements
- Materials analysis
- Manufacturing process flow
- Supply chain evaluation
- Manufacturing cost analysis
- Estimated selling price

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RELATED ANALYSES



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Teardown analysis of the second generation of Apple iPad Pro 11inch.

March 2020 – EUR 3,990*

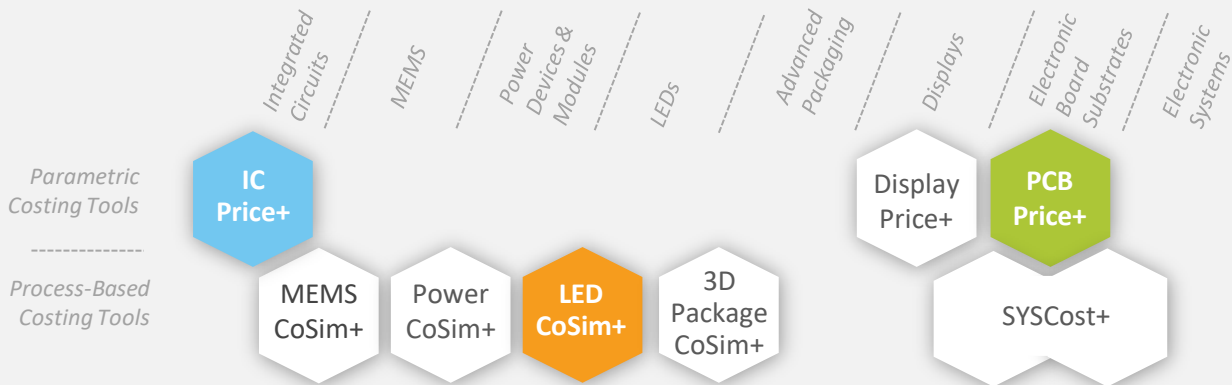


MicroLED Displays – Market, Industry and Technology Trends 2021

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August 2021 - EUR 6,490*

COSTING TOOLS



Our analysis is performed with our costing tools IC Price+, PCB Price+ and LED CoSim+.

System Plus Consulting offers powerful costing tools to evaluate any process or device, the production cost and selling price, from single chip to complex structures. All these tools are on sale under corporate license.

IC Price+

The tool performs the necessary cost simulation of any Integrated Circuit: ASICs, microcontrollers, DSP, memories, smartpower...

LED CoSim+

Process-based costing tool to design and evaluate the cost of any LED process flow.

PCB Price+

Calculation of the real price impacts. From layer count, copper thickness, to change of manufacturing country, or the increasing of raw material costs.

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Reverse Costing® is the process of disassembling a device (or a system) in order to identify its technology and calculate its manufacturing cost, using in-house models and tools.



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System Plus Consulting is specialized in the cost analysis of electronics from semiconductor devices to electronic systems.

A complete range of services and costing tools to provide in-depth production cost studies and to estimate the objective selling price of a product is available.

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