UNLOCKING BETTER DIGITAL EXPERIENCES:

TCL NXTPAPER as an Eye Care Solution in the Digital Age

TCL NXTPAPER
Full-color Electronic Paper Display

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Introduction

In an era of constant screen exposure, digital eye strain has emerged as a pervasive challenge, affecting productivity, focus, and long-term visual health. As our reliance on digital devices grows, so does the need for a solution that protects our vision without sacrificing the benefits of technology.

Rooted in the commitment to “Make Technology More Human,” TCL developed NXTPAPER, a groundbreaking display innovation designed to provide comprehensive eye care viewing experience. This whitepaper offers an in-depth examination of NXTPAPER technology, its evolution, and why it represents an unmatched option for those who prioritize eye health and seek a digital detox. Backed by robust TÜV, SGS, and Eye-safe certifications, NXTPAPER delivers a healthier, more natural viewing experience, reshaping the landscape of mobile displays for those who prioritize eye health.

Evolution of TCL NXTPAPER Technology from 1.0 to 4.0

TCL's NXTPAPER technology has undergone significant transformations since its inception, continuously integrating advanced features to enhance user experience and environmental sustainability. From its inception to its latest iteration, NXTPAPER has upgraded into a comprehensive solution that delivers all day long and day-to-night eye comfort in various dimensions.

NXTPAPER 1.0

In 2021, TCL introduced its innovative NXTPAPER technology, launching the first NXTPAPER tablet that marked a new era of eye-comfort displays. This milestone device is characterized by its low blue light emission, full color display for rich visuals, and an effective anti-glare feature, ensuring a comfortable viewing experience.

NXTPAPER 2.0

In 2023 IFA, TCL launched world’s first smartphones featuring NXTPAPER technology.This iteration incorporates cutting-edge hardware developments that increased the device’s display brightness by 150%, ensuring a clear and vibrant display while simultaneously introducing the adaptive colour temperature. This new feature automatically adjusted the screen's white balance to match the surrounding light environment, further enhancing visual comfort.

Importantly, the technology in TCL NXTPAPER 2.0 provides enhanced blue light reduction, surpassing standard TÜV levels. This advanced blue light management offers robust eye protection without causing any unwanted screen yellowing or distortion. Thus, TCL NXTPAPER 2.0 delivers improved visual comfort while preserving the authenticity of the display.

NXTPAPER 3.0

Building upon its predecessors, in 2024, TCL launched NXTPAPER 3.0 that represented a big leap in display technology, integrating sophisticated hardware and intelligent software to create a truly paper-like and eye-conscious experience. On the hardware level, it introduced Circularly Polarized Light (CPL) technology to mimic the diffuse quality of natural light and an RGB sensor for dynamic color temperature adjustment aligned with the user's circadian rhythm. This was paired with a peak brightness up to 650 nits and advanced anti-glare for superior readability in any light.

The software level was equally robust, featuring the innovative physical NXTPAPER Key for seamless switching between different modes, including Ink Paper Mode, Color Paper Mode, and Max Ink Mode. Its Eye Care Assistant proactively combatted fatigue with intelligent reminders for posture, breaks, and ambient light, even pausing usage to prompt eye-relaxation exercises. The Night Light Mode provided a gentle, low-lux flashlight to avoid blinding glare in the dark. Together, these innovations established NXTPAPER 3.0 as a multi-faceted solution dedicated to sustained visual comfort and health.

NXTPAPER 4.0

With NXTPAPER 4.0 announced at CES 2025, TCL transcends the concept of a display technology to introduce its most comprehensive eye-care solution. Evolving from the strong foundation of NXTPAPER 3.0, this latest iteration features seven core eye-care technologies, engineered for all day long and day-to-night eye care viewing.

TCL NXTPAPER 4.0: An Eye-Care Solution in the Digital Age

Today, people spend hours switching between emails, messages, videos, and endless social feeds without regard for their eye health. Recognizing this critical issue, TCL has pioneered to introduce NXTPAPER Technology—a revolutionary display innovation designed not only to enhance visual performance but also to provide holistic eye protection across diverse usage scenarios.

Building upon NXTPAPER 3.0, dynamic lighting effects and customization of your tablet has also been added alongside the NXTPAPER key. At the heart of NXTPAPER lies an integration of both hardware and software level eye-care technologies, engineered to optimize screen performance, providing unparalleled visual comfort during prolonged use.

Seven Core Eye-care Technologies

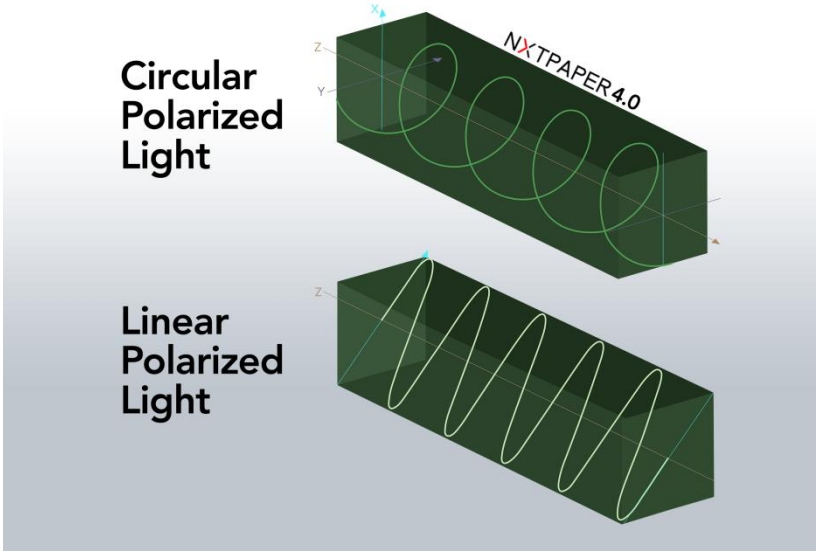
TCL NXTPAPER 4.0 represents a holistic reimagining of mobile display technology, engineered to prioritize visual health without compromising performance. At its core

are seven advanced eye-care technologies, addressing specific challenges associated with extended screen use. Together, they form a multi-layered protective system that adapts to various lighting conditions, usage scenarios, and individual circadian rhythms, delivering an unprecedented balance of comfort and care.

1. Natural Light Display

The way light is polarized plays a critical role in visual comfort. Most electronic displays use Linear Polarized Light (LPL), where the electric field of light is confined to a single plane along the direction of propagation. It can make visuals appear harsh and cause additional eye strain over time.

Natural Light Display, which utilizes Circular Polarized Light (CPL) technology to simulate the diffuse quality of natural sunlight. Unlike linear polarized light, CPL rotates in a spiraling motion, offering more dynamic and diverse oscillation directions that reduces the strain caused by single-direction light waves.



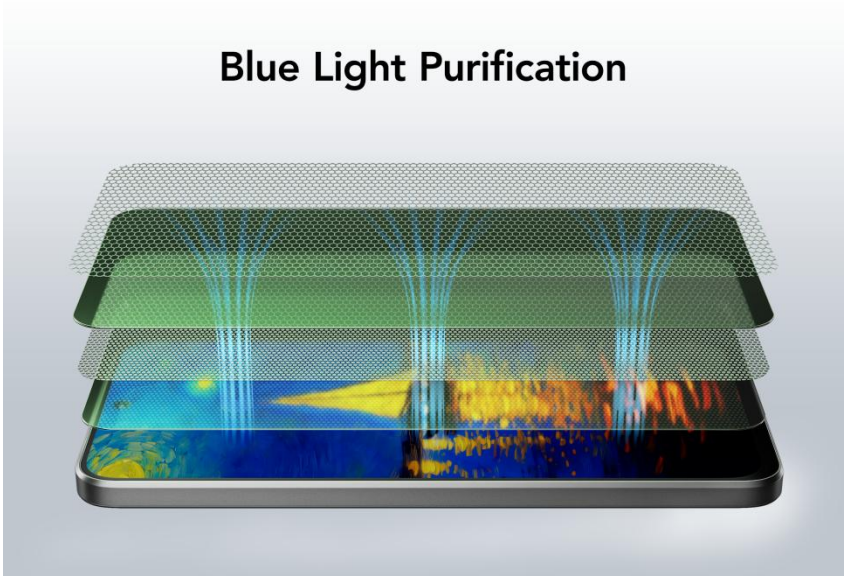
This results in less visual adaptation stress, decreased fatigue, and improved viewing consistency, even when wearing polarized sunglasses. By bringing the qualities of natural light to the screen, TCL ensures a more comfortable and sustainable viewing experience from all angles, whether indoors or outside.

2. **Zero Flickering Technology**

Screen flicker is a major contributor to eye strain and headaches, especially under PWM dimming used in many displays. NXTPAPER 4.0 employs DC dimming, completely eliminating flicker. This ensures a stable and consistent image at all brightness levels, providing a smoother, vibration-free visual experience that allows users to read, work, or create for extended periods without subconscious visual irritation.

3. Blue Light Purification

One of the most pressing challenges is exposure to harmful blue light. As a combined hardware and software solution, the TCL NXTPAPER introduces an innovative Blue Light Purification to managing harmful blue light emissions in electronic displays. Its goal is to enhance safety and comfort during prolonged screen use without compromising the user experience.



The core of TCL NXTPAPER technology is that it fine-tunes the LED blue light spectrum, shifting the blue light peak to the safe band of 457~462.5 nm. As shown in the ratio of the orange area to the blue area, within the harmful blue light band (415nm ~ 455 nm), the proportion of harmful blue light in TCL NXTPAPER 4.0 has been reduced to as low as 3.41%[1] compared to traditional LCDs (Liquid-Crystal Displays). This technology not only effectively avoids the ocular hazards brought by short-wave blue light (415nm ~ 455 nm) but also ensures that colors are not distorted.

More importantly, this reduction does not impact the beneficial blue light that is essential for human circadian rhythm regulation, thus ensuring a balance between user safety and comfort.

4. Reflection-Free & Anti-Glare Viewing

TCL NXTPAPER also incorporates Anti-Glare Nano-Etching Technology which produces a paper-like matte effect texture to the device and provides resistance. The process scatters the internal light source and diffuses reflected light, ensuring optimal readability even under bright outdoor lighting.

[1] Testing data is from TCL internal lab. The ratio 3.41% is that the proportion of harmful blue light (415-455nm band) in the entire visible light spectrum (380-780nm band). The data test scenario for 3.41% is in the Reading mode, when the color temperature is the warmest, we can reduce the harmful light to 3.41%.

NXTPAPER 4.0 applies a more sophisticated Nano-Matrix Lithography technology in anti-glare treatment which eliminates glare through its physical structure, rather than chemical coatings, achieving a 97%[2] anti-glare rate. It also diffuses reflection to soften light emissions with the lowest specular reflection rate of nearly 0%[3] in the industry.

Nano-Matrix Lithography Technology

Building upon its robust Anti-Glare capabilities, the TCL NXTPAPER technology excels in bright outdoor environments. This nano-level surface roughness generates a matte-like texture, akin to traditional paper, allowing the device to ensure the integrity of clear and comfortable visuals, regardless of any external environmental factors.

Consider this scenario: An individual is reading an e-book in a sunlit park. With conventional displays, intense sunlight would cause significant screen glare, making it

[2] Testing data is from TCL internal lab. In the test of anti-glare, the central brightness of the latest NXTPAPER 4.0 display is around 3%, which means the screen eliminates glare up to 97% through its physical structure, and finally drops to only 3%.

[3] Testing data is from TCL internal lab. The testing angle is 30°.

difficult for the user to engage comfortably with the content. However, TCL's NXTPAPER technology adjusts the display properties to reduce this glare, thereby enabling a comfortable reading experience without undue eye strain.

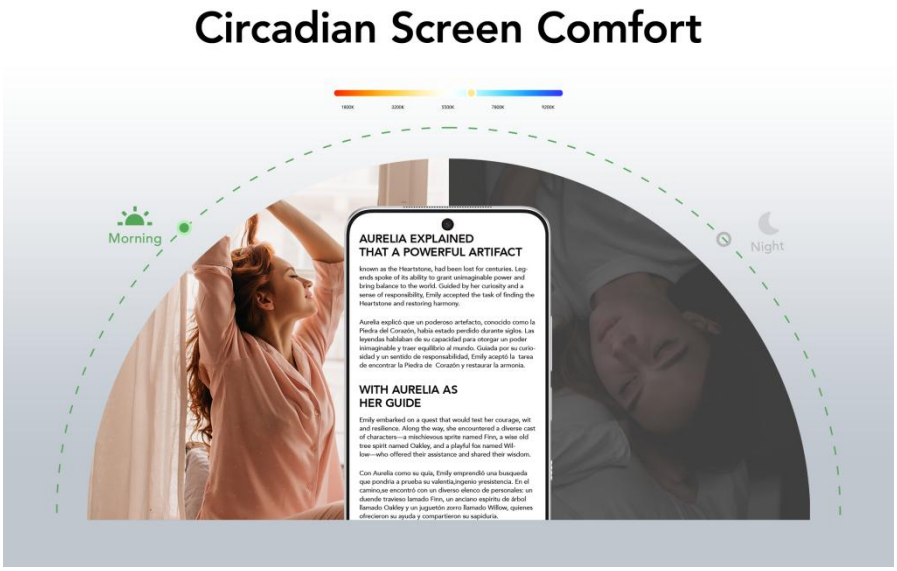
Moreover, similar to real paper, this nano-level uneven surface increases the friction of the nib of a stylus, making the writing experience feel much more realistic. And with that surface, the NXTPAPER display delivers a matte tactile feel protecting against smudges or fingerprints.

5. Dim-Light Eye Protection

Certified by SGS for dim-light protection, this feature automatically detects ambient light levels as soon as the screen is turned on and adjusts screen brightness down to 2 nits. In dark environments, it prevents excessive contrast and pupil contraction, two major causes of night-time eye fatigue. This allows for comfortable nighttime reading or browsing without disrupting sleep readiness or causing discomfort.

6. Circadian Screen Comfort

The display intelligently synchronizes with the user's circadian rhythm through adaptive color temperature and brightness adjustments. Using built-in RGB and ambient light sensors, it shifts from cooler, vivid tones during the day to warmer, softer hues at night. This alignment with the body's internal clock helps maintain energy and focus throughout the day while supporting melatonin production in the evening—promoting not only visual comfort but overall well-being.



7. TruePaper Restoration Technology

Rounding out the seven technologies is TruePaper Restoration. Using nano-matrix lithography, the screen's nano-scale texture achieves a paper-like index of 70.4[4], leading among smartphones. Certified by TÜV Rheinland for paper-like visuals and SGS for stylus accuracy, TruePape Restoration Technology delivers a natural, comfortable experience.

The innovation of NXTPAPER 4.0 goes far beyond addressing the major causes of eye strain, offering a truly holistic and human-centric solution. It combines seven core technologies with intelligent features, including smart eye comfort mode and personalized eye comfort mode, to deliver a comprehensive eye-care ecosystem. The result is an adaptive and intelligent system that is deeply attuned to user needs. This approach reflects TCL's core value proposition of "Make Technology More Human," demonstrating that high performance and exceptional eye comfort can not only coexist but actively thrive together in a modern smartphone.

NXTPAPER Portfolio

TCL has been a pioneer in NXTPAPER technology, launching the first tablet of its kind in 2021 and heralding the age of eye-comfort displays. To date, the company has introduced 20 variants of NXTPAPER across multiple markets, encompassing both tablets and smartphones. This demonstrates TCL's commitment to making NXTPAPER technology more user-friendly and widely accessible through a range of innovative products.

[4] Source: Data from TÜV Rheinland, paper index is 100. Tested from adaptability to environmental conditions, consistent contrast ratio, resistance to ambient light interference and reflection, and eye health protection features.

- Tablets : TCL NXTPAPER 10S, TCL NXTPAPER 11, TCL NXTPAPER 14, TCL NXTPAPER 14 Pro, TCL TAB 10 NXTPAPER 5G, TCL NXTPAPER 12 Pro, TCL BOOK X12 Go, TCL NXTPAPER 11 Plus, TCL NXTPAPER 11 Gen 2

- Smartphones: TCL 40 NXTPAPER, TCL 40 NXTPAPER 5G, TCL 50 XE NXTPAPER, TCL50 XL NXTPAPER 5G, TCL 50 NXTPAPER 5G, TCL 50 PRO NXTPAPER 5G, TCL 60 XE NXTPAPER 5G, TCL 60 NXTPAPER, TCL 60 SE NXTPAPER 5G, TCL NXTPAPER 60 Ultra, TCL NXTPAPER Junior 5G

Certifications

TÜV Certifications

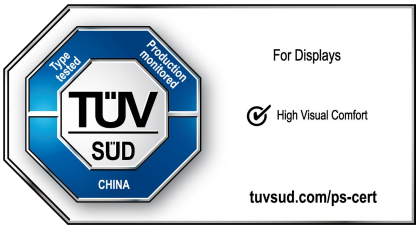
TÜV Rheinland, originating from late 19th-century Germany, is known for its rigorous safety and quality standards in technology, including consumer electronics. Earning its certification, a comprehensive process, ensures a product's safety, efficiency, and superior quality. It is not merely a stamp of approval; it is a testament to a product's commitment to safety, efficiency, and superior quality. The process involves meticulous inspection and testing[5].

This certification is essential for TCL NXTPAPER, proving its commitment to user safety by easing eyes strain and deliver eye comfort, while also meeting global safety standards. The display is certified by TÜV Rheinland for Circular Polarization Light (CPL) and reflection free, validating its natural light-like quality and glare reduction capabilities. It has also earned TÜV Rheinland certification for paper-like visuals and low blue light, affirming its authentic, eye-friendly reading and writing experience, as well as capabilities to reduce harmful blue light emissions to protect eyes.

[5] Source: Product certification: Product testing and test mark as proof of quality: https://www.tuv.com/world/en/product-certification.html

TÜV SÜD Certification

TÜV SÜD powers progress through testing, certification, auditing and advisory services. Since 1866, TÜV SÜD has inspired trust in technology through its testing, certification, auditing and advisory services and become the trusted partner of choice for safety, security and sustainability solutions.



TCL has obtained this certification of High Visual Comfort for its NXTPAPER products, which is a powerful testament of TCL's commitment to innovations and user well-being and validates TCL's dedication to developing technology that prioritizes user well-being.

Eyesafe Certification

Eyesafe is a trusted company that specializes in developing and certifying display technologies to minimize harmful blue light emissions, prioritizing user eye safety during extended screen time. Its stringent standards have established it as a leader in the digital eye health industry.

Achieving Eyesafe certification is beneficial for devices, indicating effective reduction of harmful blue light emissions without compromising visual quality. This certification ensures consumers can use their devices without worrying about potential harm to their eyes, while also enhancing brand reputation for manufacturers. TCL has obtained this certification for its NXTPAPER products, demonstrating its commitment to protecting user eyes and meeting global safety standards, which differentiates it in the competitive market.

SGS Certification

SGS, founded in 1878, a global leader in inspection, verification, testing, and certification services, offers comprehensive quality and compliance solutions. Earning an SGS certification ensures products meet high international standards, providing market access and enhancing competitiveness.

TCL has obtained the SGS Paper-Display Certification and SGS Dim-Light Eye Protection for its NXTPAPER products, proving they significantly enhance eye comfort by offering paper-like display effects and superior protection for nighttime viewing, significantly reducing eye fatigue and enabling comfortable browsing in low light. This certification highlights TCL's commitment to innovation and user well-being, making its products stand out in the market.

The above awards and certifications, prestigious in digital screen safety, validate TCL NXTPAPER's eye protection measures, underscoring its commitment to user health.

Conclusion

The realm of digital display technology is experiencing significant advancements, with TCL NXTPAPER standing out as a prime example. TCL NXTPAPER presents a compelling alternative in the display technology market by integrating features typically found in separate devices into one unified product.

By establishing a new category of display, NXTPAPER addresses the critical need for sustainable digital wellness. Its evolution, culminating in the seven-core-technology system of NXTPAPER 4.0, demonstrates a deep understanding of the physiological causes of eye strain. Independently certified and proven across a growing portfolio of devices, NXTPAPER is not merely an alternative but a superior solution, redefining the user experience for work, study, and leisure in our screen-dominated world.