



PRESS RELEASE

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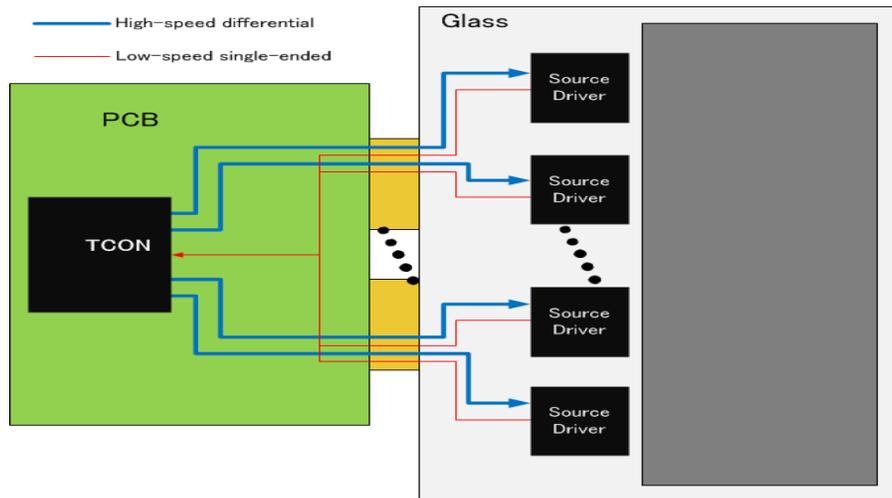
CerebrEX Announces Completion of Development for *Cool Pepper*[®] High-Speed Display Panel Internal Interface

*Innovative Cool Pepper[®] technology enables higher pixel density and higher performance
while reducing heat generation and power consumption*

Osaka, JAPAN (October 22, 2013) — CerebrEX, Inc., a vanguard fabless semiconductor manufacturer with focus on developing innovative and unique display controller LSI devices for the touch-sensitive displays used on tablet and mobile PCs, has announced that it has just completed development of *Cool Pepper*[®] display panel source driver interface technology¹. *Cool Pepper*[®] technology provides significant advancement in high-speed data transmission, low power consumption, higher device density and significant space savings, all highly sought-after attributes in the mobile communication and computing device industry where vigorous adoption of higher definition displays is underway.

Cool Pepper[®] is a novel interface for flat-panel display source drivers, developed by CerebrEX through fusion of advanced display system control and high-speed transmission technologies. *Cool Pepper*[®] simultaneously enables high-speed data transmission and low power consumption with its innovative design incorporating an optimum mix of digital and analog circuitry. The obstacles of COG² mounting and transparent circuitry technologies necessary in advanced display panel manufacturing – heat-induced increase, fluctuations and temporal variations in electrical resistance – are overcome by making automatic, individually-tailored process adjustments for each data path for signal correction, signal strength control and timing optimization. Furthermore, with power savings mode utilizing intermittent data transmission schemes and interrupt transmission of source driver control commands using original information encoding techniques, *Cool Pepper*[®] enables creation of highly power efficient systems with more flexible control structure.

Cool Pepper® System Configuration



A pair of differential signals from TCON to the Source Drivers and single-ended signal from the Source Drivers to TCON are shown above.

High-speed serial interfaces such as mini-LVDS have been used as source driver interface for medium and small-sized display panels to date. Recently however, especially in the case of high definition display panels such as the *Retina*® display³, skew in data transmission, which are caused by timing variances in the transmission lanes resulting from separate delivery of the clock and data signals, are preventing the use of these previously prevailing methods. Therefore, such transmission methods as CDR⁴, where clock and data signals are superimposed, are becoming popular.

Undesirable but unavoidable aspects of COG mounting technology and increased pixel density, such as increased electrical resistance in the transmission lanes and their unpredictable variances, have improved but not greatly so, and there are no effective methods to control their negative effects on performance. Consequently, interface transmission speed has stayed at around 1.2Gbps, a modest increase of about 50% over mini-LVDS.

The newly developed *Cool Pepper*® interface technology makes it possible to compensate for the signal degradation which occur in high-frequency signal transmission lanes. When transmitting data, information about internal circuitry signal conditions on the receiver side is provided to the transmitter side. Using this information, transmitter signal strength, transmitter waveform, receiver signal waveform formation and timing control are automatically and individually adjusted

for each transmission lane. This not only solves the challenges of COG mounting technology, but also enables signal transmission at minimal power consumption. More than 60% increase in speed compared to the CDR method has been achieved and a high-speed transmission rate of 2.0Gbps per transmission lane has been attained with the new automatic adjustment functionality. This in turn allows for reduction of the number of effective lanes and added flexibility in circuitry layout, both contributing to cost reduction and more forgiving design parameters.

The power savings mode with intermittent operation has also succeeded in achieving 40% reduction in power consumption compared to the CDR method. Furthermore, the proprietary data encoding used for data transmission allows for source driver command interrupts and controls at will. This makes customized system configurations and control methods possible in order to enhance each panel vendor's product characteristics, leading to additional energy savings, product differentiation and simplification of the manufacturing process.

Cool Pepper[®] is currently scheduled for evaluation by a major panel vendor with intent of selection for actual production. CerebrEX will also be developing a series of advanced display controller products using *Cool Pepper*[®] technology, looking ahead to future functionality demands. Additionally, *Cool Pepper*[®] specifications are being prepared for official release, in anticipation for licensing to LSI vendors, especially those manufacturing display source drivers, and to display panel vendors. In fact, CerebrEX is already in discussion with multiple LSI vendors both within Japan as well as abroad and press releases are being planned.

CerebrEX will continue to provide value to its customers through low-cost, total-system solutions, and continue to make products and technologies available to the market with high functional and cost performance.

About CrebrEX, Inc

CerebrEX, Inc. is a venture-backed semiconductor start-up in the business of developing proprietary display technologies for the flat panel display market. Founded in 2012 and headquartered in Osaka, the company directly addresses the challenges posed by conventional

design, small pixels and high resolution. The company has an additional office in Tokyo, Japan and in Taipei, Taiwan.

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¹ **Cool Pepper[®]** is a registered trademark of CerebrEX, Inc.

² **COG: Chip On Glass** – An electronic circuitry manufacturing technique where IC chips are mounted directly onto a glass substrate. Mostly used in order to mount source driver ICs onto glass substrates during the manufacture process of medium to small-sized liquid crystal displays. The technique commonly utilizes Au film 15 to 20 μ m in thickness, formed through an Au plating process, as conductive bumps. An adhesive material containing conductive particles, ACF (anisotropic conductive film) is used to bond the bumps to the circuitry pattern. Electrical signal must travel through the small surface area provided by the conductive particles in ACF. Performance challenges include the fact that bump pitches narrower than 30 μ m remain difficult to achieve, and that electrical resistance at the contact areas increase significantly when subjected to elevated temperatures.

³ **Retina[®] Display:** First used on iPhone4 by Apple, Retina[®] Display is a brand name for Apple's own high definition display with high enough pixel density that the unaided human eye is unable to detect the pixels. Retina[®] is a registered trademark of Apple Inc.

⁴ **CDR: Clock and Data Recovery** – A technique in digital data communication used to separate the clock and data signals when they are received superimposed.