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VCSEL Chip With Dedicated Damage Monitoring Channel

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ABSTRACT

Virtual reality glasses use a projector that includes a VCSEL chip in combination with other optical components. Monitoring the back reflected light is useful to monitor any damage to the projector components. This disclosure provides VCSEL chip designs with a dedicated, low current channel for damage monitoring. The proposed chip provides a dedicated channel for damage monitoring, and enables performing damage monitoring operation with a narrow pulse with a lower current supply.

KEYWORDS

- Virtual reality
- Augmented reality
- Headset
- VR goggle
- Eye Safety
- VCSEL
- Damage monitoring

BACKGROUND

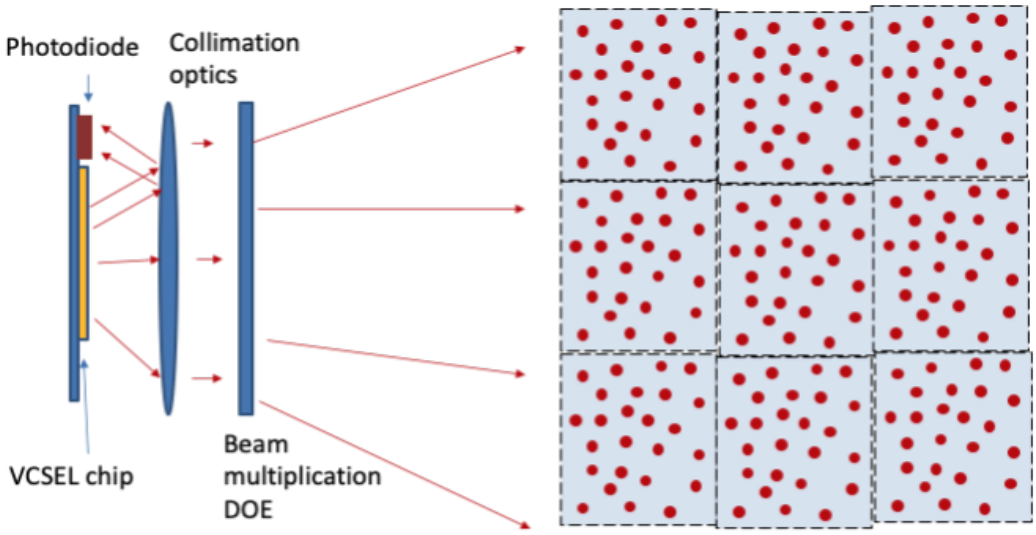

Fig. 1: Projector with VCSEL chip

Fig. 1 illustrates a schematic of a projector that uses a vertical cavity surface-emitting laser (VCSEL) chip. As seen in Fig. 1, light from the VCSEL chip passes through a collimator lens and beam multiplication diffractive optical elements (DOE). A photodiode is provided to capture back reflected light. Monitoring the back reflected light is useful to monitor any damage to the projector components such as the collimator lens, DOE, the housing, etc. Such a projector synchronized with a camera can be utilized in augmented reality or virtual reality headsets.

DESCRIPTION

To perform damage monitoring for a projector, it is useful to detect a short and/or weak laser pulse using the photodiode. It is also desirable to decouple the damage monitoring operation from regular operation of the projector, which is in synchronization with a camera or other system. Damage monitoring operation requires a very short and/or low power pulse which can be generated using a fast, accurate current supply or slow, accurate current supply respectively. Per techniques described herein, a specific channel for damage monitoring is

included in the VCSEL chip. From a laser design perspective, the use of such a channel dedicated for damage monitoring is easier than to use the main channel for damage monitoring purposes.

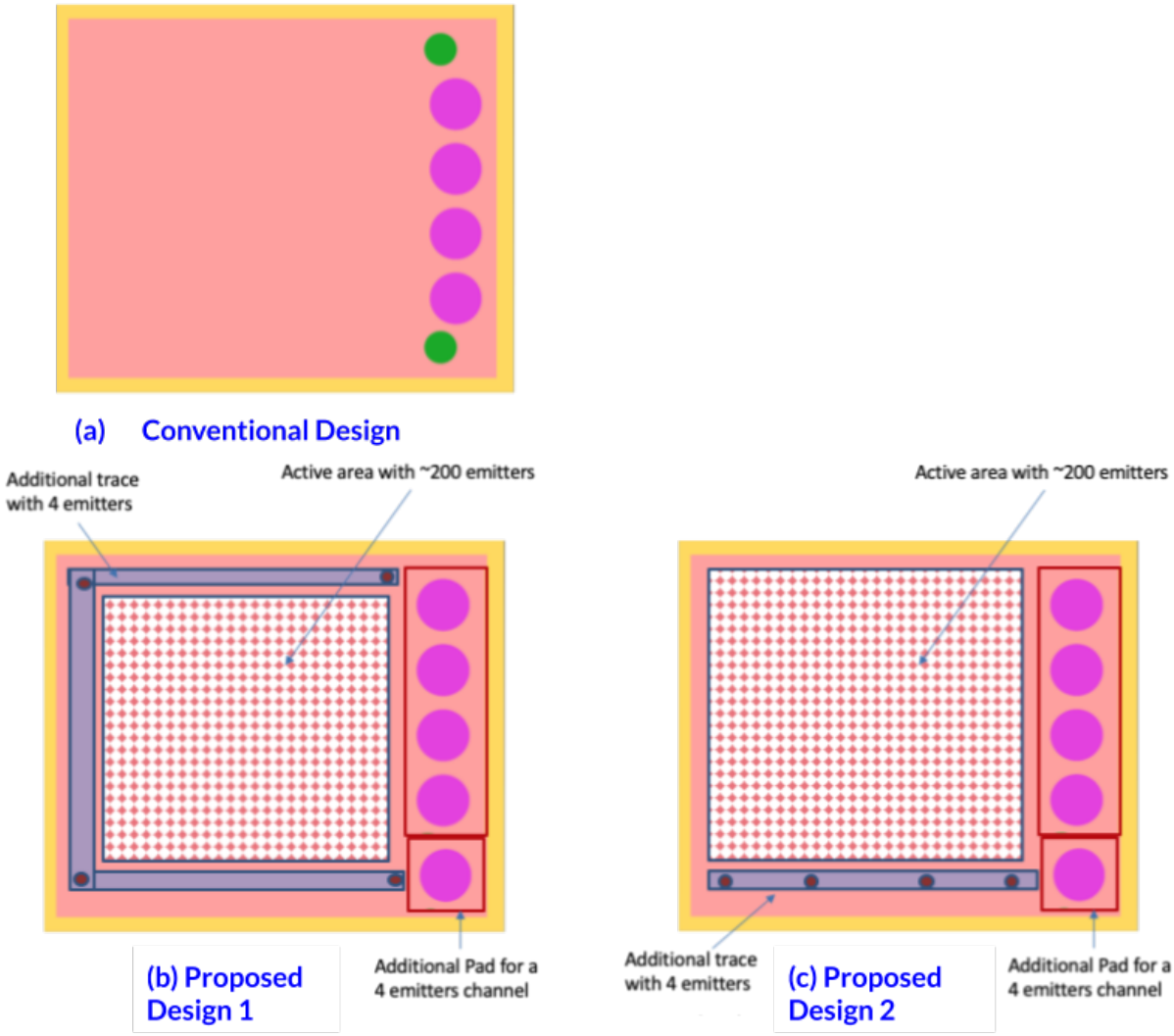

Fig. 2: VCSEL chip: (a) Conventional design; (b) Proposed design with dedicated channel (option 1); (c) Proposed design with dedicated channel (option 2)

Fig. 2(a) illustrates a VCSEL chip with an example conventional design. As can be seen in Fig. 2(a) no dedicated channel is provided in such a design.

Fig. 2(b) illustrates a VCSEL chip with a proposed design that provides a dedicated damage monitoring channel. As seen in Fig. 2(b), four additional emitters are provided

surrounding the active area that has about 200 emitters. An additional pad is provided for the four emitters channel. The design provides a low current channel for damage monitoring. This design increases the VCSEL die size by about 10%.

Fig. 2(c) illustrates a VCSEL chip with another proposed design that provides a dedicated damage monitoring channel. As seen in Fig. 2(c), four additional emitters are provided near the active area that has about 200 emitters. An additional pad is provided for the four emitters channel. The design provides a low current channel for damage monitoring. This design increases the VCSEL die size by about 4% and has a lower area coverage than the design of Fig. 2(b).

The proposed VCSEL design with damage monitoring enables monitoring the health of optics in VCSEL based laser projectors in virtual reality headsets or other projection systems.

CONCLUSION

Virtual reality glasses use a projector that includes a VCSEL chip in combination with other optical components. Monitoring the back reflected light is useful to monitor any damage to the projector components. This disclosure provides VCSEL chip designs with a dedicated, low current channel for damage monitoring. The proposed chip provides a dedicated channel for damage monitoring, and enables performing damage monitoring operation with a narrow pulse with a lower current supply.