Safety

Reliability and Safety

All semiconductor devices have the potential of failing or degrading in ways that could impair the proper operation of safety systems. Well-known circuit techniques are available to protect against and minimize the effects of such occurrences. Examples of these techniques include redundant design, selfchecking systems and other fail-safe techniques. Fault analysis of systems relating to safety is recommended. Environmental factors should be analyzed in all circuit designs, particularly in safety-related applications.

If the system analysis indicates the need for the highest degree of reliability in the component used, it is recommended that Vishay Semiconductor be contacted for a customized reliability program.

Toxicity

Although gallium arsenide and gallium aluminium arsenide are both arsenic compounds, under normal use conditions they should be considered relatively benign. Both materials are listed by the 1980 NIOH “Toxicology of Materials” with LD50 values (Lethal Dosis, probability 50%) comparable to common table salt.

Accidental electrical or mechanical damage to the devices should not affect the toxic hazard, so the units can be applied, handled, etc. as any other semiconductor device. Although the chips are small, chemically stable and protected by the device package, conditions that could break these crystalline compounds down into elements or other compounds should be avoided.

Eye Safety of Diode Emitters

IEC and CENELEC, the International Electrotechnical Committee and the European Committee for Electrotechnical Standardization, included diode emitters as IREDs and LEDs into the laser safety standard as these devices are technologically similar to semiconductor lasers. In this first step, however, the fact that the radiances of diode emitters are different from those of lasers was not taken into account.

In the 1997 edition of the standard EN 60825-1 (and the IEC equivalent IEC 825-1), the basic errors were eliminated. However, it is the opinion of the experts _ also of those belonging to the standardization committees _ that the risk of retinal injuries due to the use of diode emitters is still overestimated. Therefore, the standard with respect to LEDs and IREDs will change in the future.

Worldwide, there is no report on eye injuries caused by incoherent diode emitters. Recent studies performed in the US showed that eye injuries (here: tests done on monkeys) due to even the brightest LEDs available are impossible. Nevertheless, the efficiency of diode emitters is increasing and, especially at shorter wavelengths, a certain risk due to the blue light effects may arise if systems are not designed carefully.

The eye safety standard describes the Maximum Possible Exposure (MPE) and the Accessible Emission Levels (AEL) for the human eye depending on exposure time, wavelength, and other parameters. For extended sources like emitter diodes, the so-called “apparent” or “virtual” source size is the key figure to assess the risk factors.

It must be stated here clearly that only a final product can and must be classified. Classifying an IRED or LED as a single device is impossible by definition. The operation of an IRED or LED within a complete application _ including optics, windows, power supplies and failure-protection electronics - has to be classified.

A standard application has to be classified under CLASS 1, which means it is safe under all reasonable conditions _ also in case of a single-failure event. For such a case, no labeling of CLASS 1 products is necessary. A CLASS 1 product must be declared in its manual as such a product. The single-failure philosophy must be applied in all classifications!

CLASS 3a means that this product is also safe for the unprotected eye. However, no optical instruments (e.g. magnifying glass) are allowed to view into such a source. The light collecting optics may increase the risk. Labeling with a CLASS 3a label, as described in the standard document, is necessary in this case.

The distribution organizations of the national standardization committees provide the text for the labels in the countries’ languages.

The Vishay Semiconductor devices designed for data transmission, remote-control applications and visual LED applications are CLASS 1 products when operated within the specified limits. The application, however, has to be designed to be within the safe field of operation _ also under single-fault conditions. The

component supplier as the diode emitter manufacturer cannot be responsible for the entire application where the diodes are implemented.

Vishay Semiconductor as a supplier of LEDs and IREDs is designing its products so as to minimize eye safety risks, and is providing all data necessary for classifying the “laser product”.

Table of Virtual Source Sizes

Part Number	Virtual Source Size (mm)	Part Number	Virtual Source Size (mm)
TLBR5410	3.6	TLHR52**	2.4
TLC.51	3.7	TLHR54**	3.7
TLC.52	2.4	TLHY42**	1.5
TLC.58	3.7	TLHY44**	2.1
TLCW51	3.7	TLHY46**	2.1
TLDR4400	2.1	TLHY4900	2
TLDR4900	2	TLHY52**	2.4
TLDR5400	3.7	TLHY54**	3.7
TLDR5800	3.7	TLHY5800	3.7
TLHE4900	2	TLLG44**	2.1
TLHE51**	3.7	TLLG54**	3.7
TLHE5800	3.7	TLLR44**	2.1
TLHF4900	2	TLLR54**	3.7
TLHF5800	3.7	TLLY44**	2.1
TLHG4200	2	TLLY54**	3.7
TLHG42**	1.5	TLM*31**	1.8
TLHG44**	2.1	TLM*2***	1.2
TLHG46**	2.1	TLMS/Y/O1***	0.25
TLHG4900	2	TLMG/P/B1***	0.3
TLHG51**	3.7	TLP*56**	2.8
TLHG52**	2.4	TLRG4420	2.1
TLHG54**	3.7	TLRG4450	2.1
TLHG5800	3.7	TLRG5420	2.1
TLHK4900	2	TLRG5450	3.6
TLHK51**	3.7	TLRH4420	2.1
TLHK5800	3.7	TLRH5420	2.1
TLHO4200	1.5	TLRH5450	3.6
TLHO4400	2.1	TLR*44**	2.1
TLHO4900	2	TLRY5420	2.1
TLHP4200	1.5	TLRY5450	3.6
TLHP4400	2.1	TLSV5100	2.9
TLHP51**	3.7	TLU*24**	1.5
TLHP5800	3.7	TLUR44**	2.1
TLHR42**	1.5	TLUR54**	3.7
TLHR44**	2.1	TLUV5300	3.6
TLHR46**	2.1	TLUY24**	1.5
TLHR4900	2.1	TLV*42**	3
		TLW*****	1.4