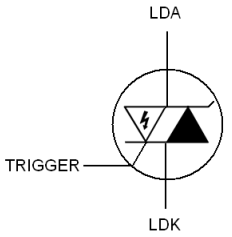
TSOP6/4G-20V Semiconductor Device

FEATURES

- Compact TSOP-6 SMT package
- Customized using passive external components
- Protects against both positive- and negative-ESD, in accordance with ESD standards such as:
  - ANSI/ESD STM5.1
  - MIL-STD 833-c
  - IEC 61340-2-1
  - IEC 61000-4-2
- Protects against reverse bias (reverse polarity)
- Lead (Pb)-free component in accordance with RoHS 2002/95/EC and WEEE 2002/96/EC



Electrical Symbol


Package photograph

APPLICATIONS

- Protecting laser diodes from direct and indirect ESD
- Protecting laser diodes from surges during power-up and power-down
- May be used to protect other optoelectronic devices such as Photodiodes and LEDs

GENERAL DESCRIPTION

The TSOP6/4G-20V is our fourth-generation LASORB Semiconductor Device. It serves as the heart of all of our encapsulated LASORB components, and it is also sold separately for direct integration into OEM products. When used along with two or three external passive components, the LASORB semiconductor device response can be customized to protect virtually any laser diode or series string of laser diodes. The LASORB Semiconductor Device provides protection against reverse bias as well as fast-changing forward bias conditions.

ORDERING INFORMATION

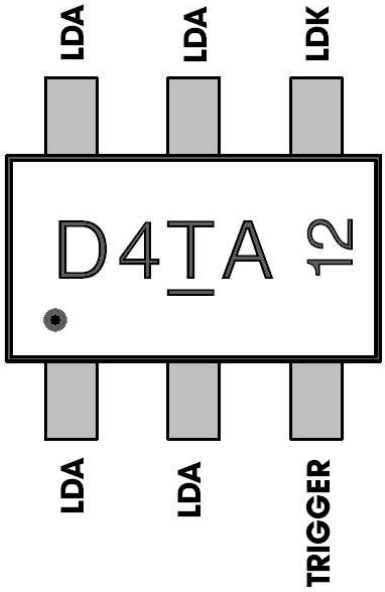
The part number provided below is for the standard LASORB TSOP6 Semiconductor Device, operable up to 20V. For other operating voltage levels, contact Pangolin.

Device part number	Comment
TSOP6/4G-20V	For applications up to 20 volts

ELECTRICAL CHARACTERISTICS @ T_J = 25° C

Parameter	Min.	Typ.	Max.	Units	Conditions
Maximum LDA to LDK Voltage			20	V	leakage current = 30mA
ESD Event Pulsed Current			50	A	Absolute Maximum
20 microsecond Pulsed Current			30	A	Absolute Maximum
Continuous Power Dissipation			2	W	25° C
Junction and Storage Temperature Range	-55		+150	°C	Absolute Maximum
LDA to LDK impedance when active			0.033	Ω	
LDA to LDK leakage current when inactive			10	uA	LDA to LDK = 15V
Continuous Reverse Bias Current			2.9	A	Absolute Maximum
Reverse Bias Recovery Time		22	29	nS	I = 8A

TSOP-6 PIN FUNCTIONS AND MARKING DESCRIPTION



Marking notes:

D4 = Fourth-generation LASORB device
TA12 = Manufacture Lot Number

GENERAL APPLICATION INFORMATION

LASORB is a patented product that is specifically designed and tested to protect laser diodes from ESD and power surges. Starting in the year 2008, LASORB has been sold as an encapsulated hybrid 2-pin through-hole component. The encapsulated component contains the LASORB semiconductor device along with three passive components. This method of packaging proved to be convenient for many applications, since it allows customers to easily retro-fit ESD protection by simply connecting the encapsulated LASORB in parallel with the existing laser diode. However, the encapsulated LASORB part is relatively large, making it difficult or impossible to fit within very compact customer products.

In 2014 we began selling the LASORB semiconductor device separately. The SMT package provides a much more convenient way for customers to implement ESD protection within their products.

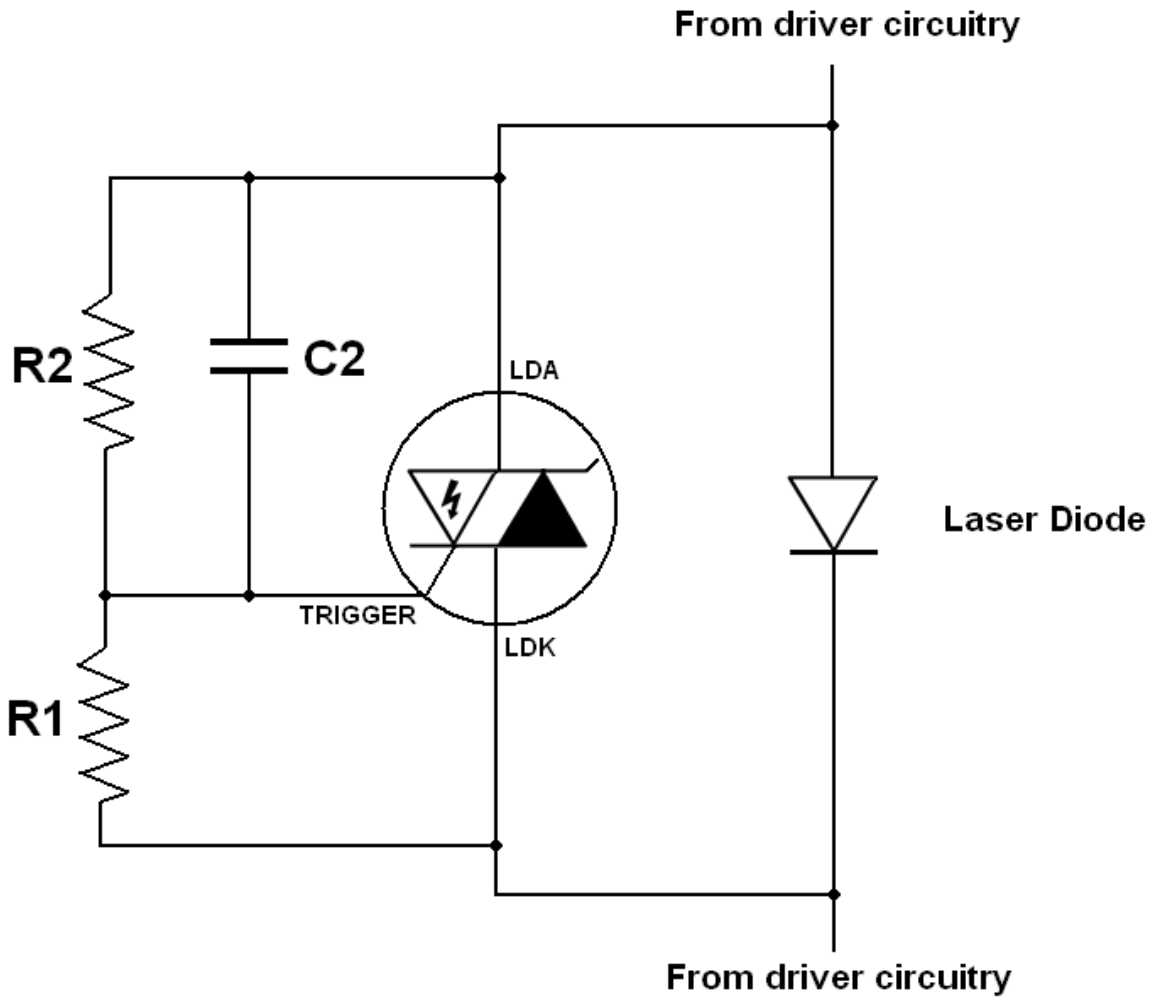
This datasheet discusses the LASORB TSOP6/4G-20V semiconductor device and provides basic implementation information. However, this datasheet does not cover all LASORB-related topics that are treated more thoroughly in the LASORB datasheets that cover the encapsulated LASORB parts. Therefore it is recommended that customers also review the relevant LASORB datasheet part formulation that corresponds with the laser diode they want to protect. For example, for in-depth LASORB information about protecting green laser diodes, refer to the LASORB datasheet for part number L44-47-121-916-X.

2-PIN ENCAPSULATED LASORB PART NUMBER FORMULATIONS

L44-47-122-208-X – optimized for very low power, single-mode red laser diodes (10mW or lower)
L44-47-122-228-X – optimized for low power IR and red laser diodes
L44-47-121-228-X – optimized for medium power red laser diodes
L44-47-121-392-X – optimized for high power red laser diodes
L44-47-121-683-X – optimized for blue laser diodes
L44-47-122-833-X – optimized for low power BLU-RAY and blue-violet laser diodes (100mW or lower)
L44-47-121-833-X – optimized for moderate-to-high power BLU-RAY and blue-violet laser diodes
L44-47-121-916-X – optimized for direct diode green laser diodes
L44-47-121-2000-X – optimized for quantum cascade laser diodes, and series strings of other diodes

IMPLEMENTING LASORB USING THE TSOP6/4G-20V LASORB SEMICONDUCTOR DEVICE

To implement LASORB functionality within a customer's product or application, the LASORB semiconductor device must be used along with two or three external passive components. The basic circuit configuration is shown below:



In the circuit diagram, the terminals labeled "From driver circuitry" and the component labeled "Laser Diode" are found in every laser diode application. The LASORB semiconductor device is shown with the LDA, LDK and TRIGGER pins. The components labeled R1, R2 and C2 are the external passive components needed to bias and trigger the LASORB semiconductor device. (The designations R1, R2 and C2 can be found in the "SMALL SIGNAL SPICE MODELS" section of standard encapsulated LASORB part datasheets. C1 is not a separate component, but rather is the internal LASORB TSOP6 trigger capacitance.)

PASSIVE COMPONENTS TO BE USED WITH THE LASORB SEMICONDUCTOR

The passive components that are external to the TSOP6 device provide several degrees of freedom. By customizing the values of the passive components, the LASORB response can be optimized for particular laser diodes and applications. The degrees of freedom allow the user to adjust the maximum and typical operating voltage of the laser diode, as well as modulation rate, surge-conduction time, device capacitance and inactive leakage current.

The following table shows the component values used within the LASORB part formulations. This should be used as a starting point for customer implementation.

LASORB Part Formulation	R1	R2	C2	Comments
L44-47-122-208-X	1.2K	2.5K	4.7nF	IR and some low power red
L44-47-122-228-X	1.2K	2.7K	4.7nF	Low power and medium power red
L44-47-121-228-X	120	270	4.7nF	Medium power red
L44-47-121-392-X	120	470	4.7nF	High power red
L44-47-121-683-X	120	820	4.7nF	Blue
L44-47-122-833-X	1.2K	10K	4.7nF	Low-to-medium Bluray (UV)
L44-47-121-833-X	120	1K	4.7nF	High power Bluray (UV)
L44-47-121-916-X	120	1.1K	4.7nF	Green
L44-47-121-2000-X	120	2.4K	4.7nF	QCL and series-connected strings of diodes

GENERAL COMMENTS ABOUT THE QUALITY OF PASSIVE COMPONENTS

ESD is characterized by an initial spike having a rise time as fast as 1 nanosecond, followed by a much longer pulse lasting 20 to 50 nanoseconds. As such, all components in the circuit will experience RF and sub-microwave frequency levels. For best ESD protection, the passive components must therefore be RF-quality components having low equivalent series inductance (ESL), typically 0603 or 0402 in size.

COMMENTS ABOUT THE ROLE OF R2

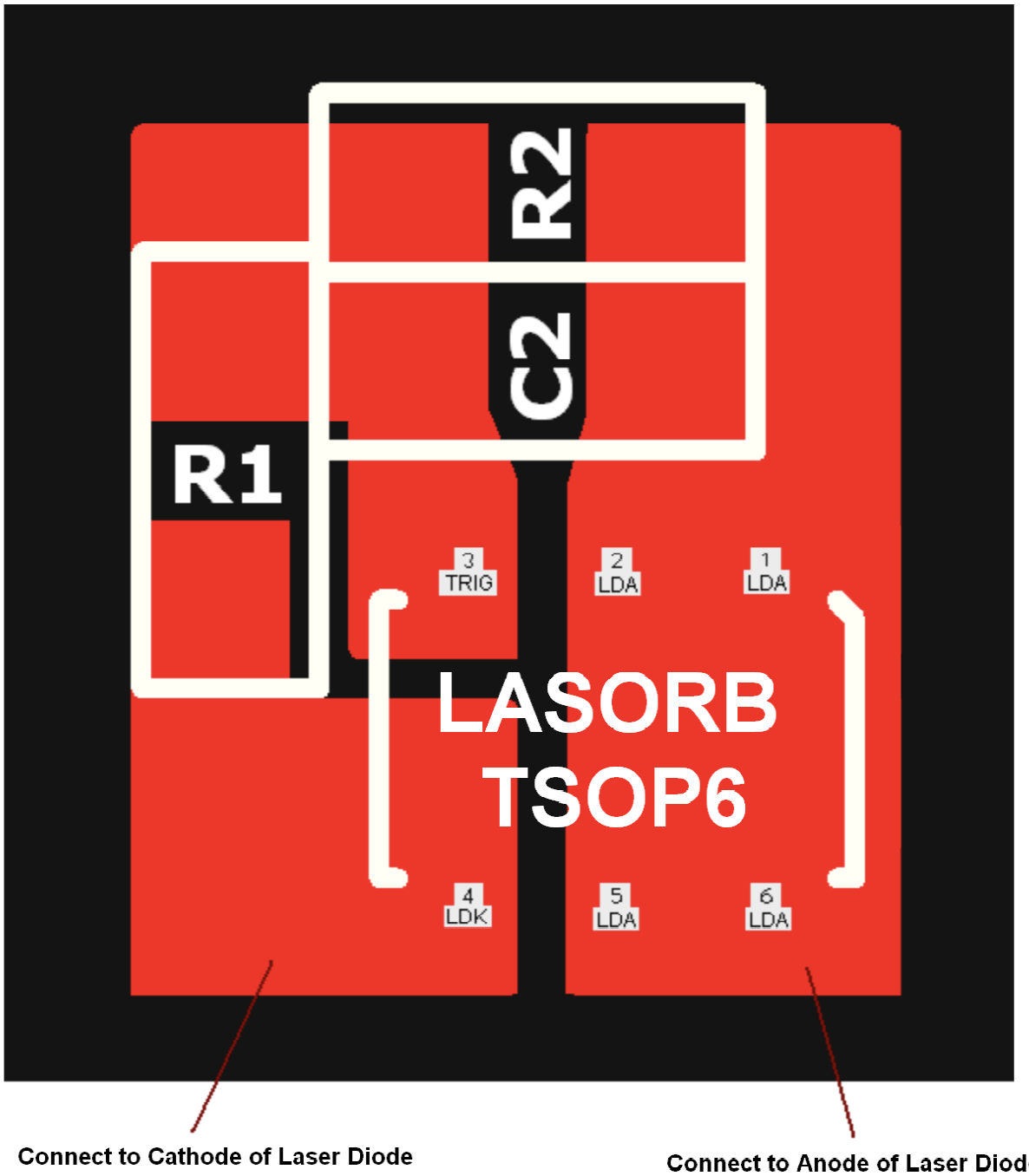
The use of R2 establishes a bias on the trigger pin of the LASORB Semiconductor Device, thus enhancing the state of readiness (decreasing reaction time) of LASORB while the laser is lasing. Note that if the laser diode is not lasing, then the absence or presence of R2 makes no difference.

The “cost” of R2 is increased overall circuit current flow, since R1 and R2 are effectively connected in series, which are then connected directly across the laser diode terminals – effectively acting as “leakage current”. This “leakage current” can be reduced by a factor of 10 by increasing resistor values proportionally by a factor of 10. This is seen in the “122” versions of LASORB part formulations. R2 can also be completely eliminated, which will reduce the “leakage current” to around 5 nanoamps.

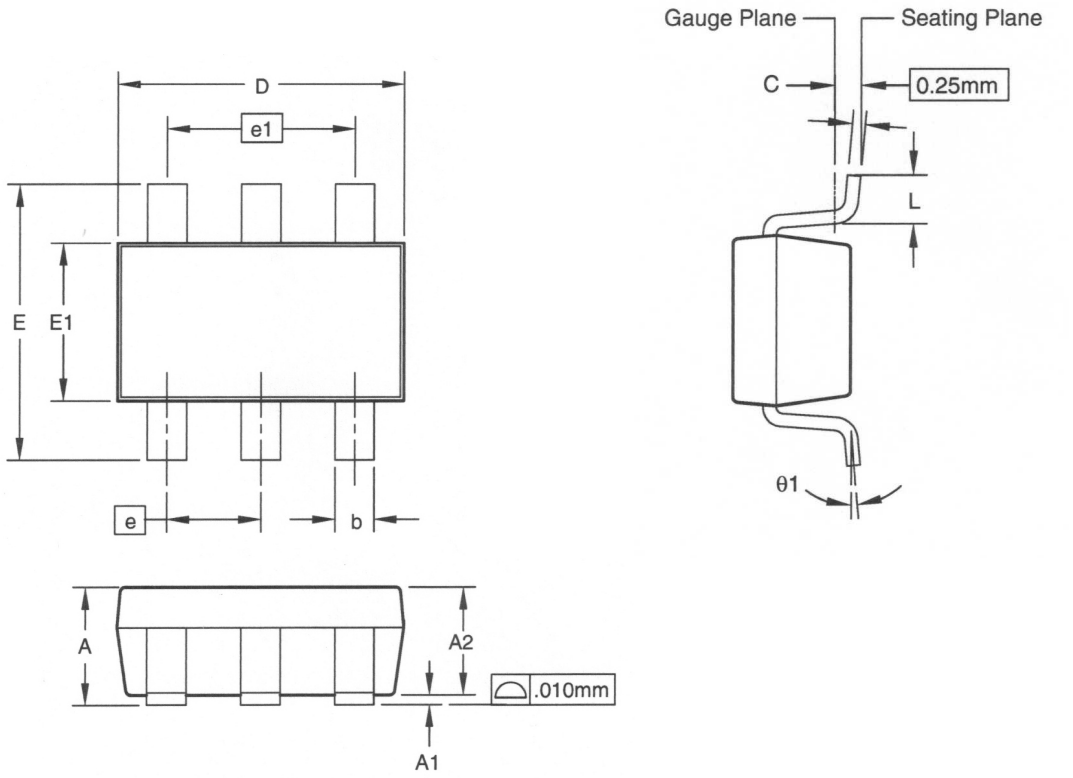
The component values shown in the table above have been used in LASORB part formulations for years. They are time-proven values, generally good for protecting the kind of laser diode noted in the “comments” section. Nevertheless, customers may have specific applications with specific needs that may benefit from altered component values. For example, when customers expect to operate the circuit in environments of elevated temperatures, it is necessary to increase the value of R2, to prevent biasing the LASORB semiconductor into a non-linear region where it will begin to draw current itself. Feel free to contact Pangolin to discuss your application and to ensure that the best components are chosen.

EXAMPLE COMPONENT PLACEMENT

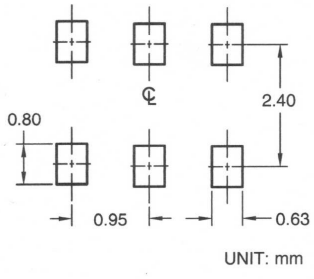
Below you will see how the components are arranged within the through-hole version of LASORB. Large copper pours are used rather than thin traces, because ESD extends into the GHz frequency range.



TSOP-6 Package Dimensions



RECOMMENDED LAND PATTERN



Dimensions in Milimiters and Inches

Millimeters	Min.	Nom.	Max.	Inches	Min.	Nom.	Max.
A	0.90	--	1.25	**A**	0.035	--	0.049
A1	0.00	--	0.15	**A1**	0.00	--	0.006
A2	0.70	1.10	1.20	**A2**	0.028	0.043	0.047
b	0.30	0.40	0.50	**b**	0.012	0.016	0.020
C	0.08	0.13	0.20	**C**	0.003	0.005	0.008
D	2.70	2.90	3.10	**D**	0.106	0.114	0.122
E	2.50	2.80	3.10	**E**	0.098	0.110	0.122
E1	1.50	1.60	1.70	**E1**	0.059	0.063	0.067
e	0.95 BSC			**e**	0.037 BSC		
e1	1.90 BSC			**e1**	0.075 BSC		
L	0.30	--	0.60	**L**	0.012	--	0.024
Θ1	0°	--	8°	**Θ1**	0°	--	8°

Notes:
1. Package body sizes exclude mold flash and gate burrs. Mold flash at the non-lead sides should be less than 0.1 mm [0.004 inches].
2. Dimension L is measured in gauge plane.
3. Tolerance =/- 0.1mm [0.004 inches] unless otherwise specified.
4. Followed from JEDEC MO-178C & MO-193C.

Controlling dimension is in millimeters, converted inch dimensions are not necessarily exact.

MORE INFORMATION

More information about LASORB, including additional application hints and tips can be found on the LASORB web site at www.lasorb.com.

In addition to the information found in this datasheet, OEMs are strongly encouraged to work with Pangolin to make sure that the most appropriate LASORB part formulation is chosen and designed-in.

PATENT AND TRADEMARK INFORMATION

Australia Patent Number: 2009268619
Chinese Patent Number: ZL200980126761.9
United States Patent Number: 8,902,557
International Patent Application Number: PCT/US2009/049999

LASORB is a trademark of Pangolin Laser Systems, Inc.

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