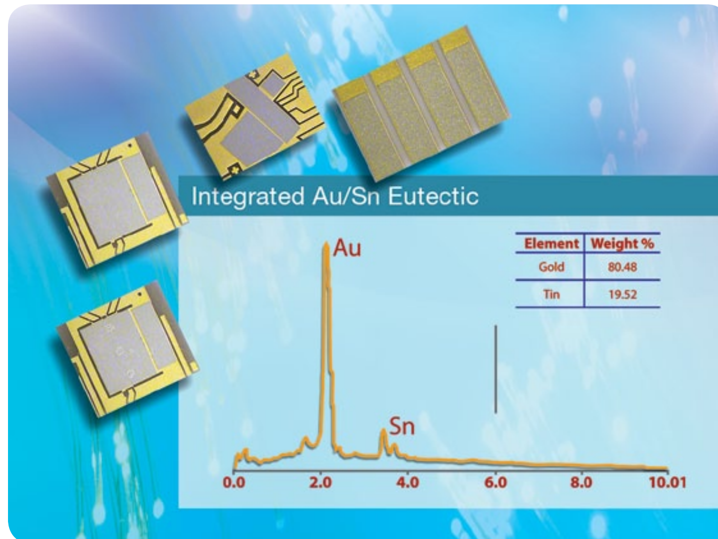
DIODE SUBMOUNT CAPABILITIES

Using Thin Film Substrates

LED Submounts



INTRODUCTION

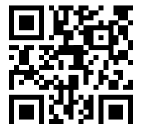
Vishay Electro-Films, with its complete in-house capability, offers a wide variety of solutions for matching the best substrate materials and metal schemes to achieve optimum thermal and mechanical performance.

Vishay Electro-Films, an RoHS-compliant facility and ISO 9001/2000-registered company, provides thermal management submount solutions for all optoelectronics applications.

RESOURCES

- For technical questions contact efi@vishay.com
- General Product Tech Notes:
  - HDI Design Guidelines: http://www.vishay.com/doc?49387
  - Integrated Microelectronic Interconnect Circuitry: http://www.vishay.com/doc?61082
  - Layout Guidelines: http:/www.vishay.com/doc?61081
  - Standard Metal Thickness: http://www.vishay.com/doc?49387
  - Application and Design of Plated and Filled Via Circuits: http://www.vishay.com/doc?61084
- Sales Contacts: http://www.vishay.com/doc?99914

One of the World's Largest Manufacturers of
Discrete Semiconductors and Passive Components



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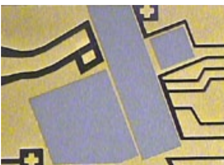
DIODE SUBMOUNT CAPABILITIES

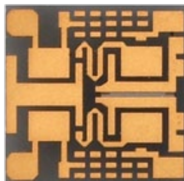
Using Thin Film Substrates

Typical Applications Using Vishay Electro-Films Substrate Submounts

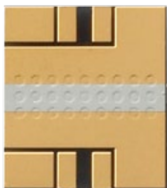
25 Gbit/s to 40 Gbit/s TOSA and ROSA transceiver / receiver optical sub submount



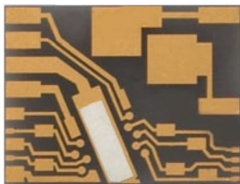
Tunable laser submount



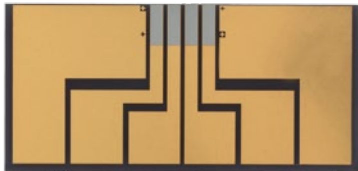
CATV submount



Semiconductor laser diode submount



Single-emitter semiconductor laser



High Power Laser Bar

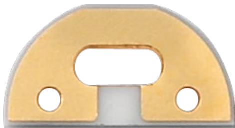
Applications

- Laser diode submounts
- Fiber optic pump lasers
- Optical transmitters
- Optical receivers
- Optical transceivers
- Optical TOSA/ROSA packages

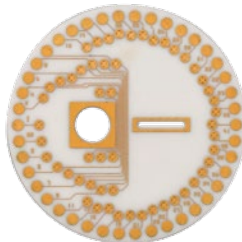
Machined Shapes

Vishay EFI's in-house CO_2 laser machining of ceramics provides the ability to offer custom-shaped substrates, cut outs, and holes for special applications. CO_2 machining can be applied to Al_2O_3, AlN and BeO substrates.

Cut out Tosa Rosa



10 G Submount



Custom Round with Filled Vias

Custom Submounts

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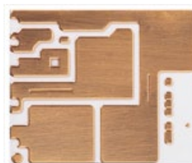
DIODE SUBMOUNT CAPABILITIES

Using Thin Film Substrates

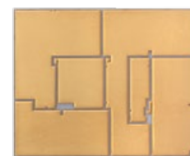
High-Power Conductor Lines

Special process capabilities allow Vishay EFI to provide power lines with up to 0.006 in thick copper. A copper conductor to 0.002 in (0.05 mm) thickness can be integrated on one substrate in relatively close proximity to the fine-line patterns without degradation of the patterning capability. The copper lines are isolated with nickel barrier layers to prevent copper oxidation and intermetalic diffusion during high-temperature processing and operation.

Copper/gold



Thick copper



Thick copper / Nickel / Gold

See datasheet 61053 at http://www.vishay.com/doc?61053

General Product Tech Notes:

HDI Design Guidelines: http://www.vishay.com/doc?49387
Integrated Microelectronic Interconnect Circuitry: http://www.vishay.com/doc?61082

If your design is complete and you would like us to use your files, or if you would like us to help finalize your application design, please contact: Vishay Electro-Films, Inc., 111 Gilbane Street, Warwick, RI 02886, USA, Ph: +1-401-738-9150, Fax: +1-401-738-4389, Email: EFI@Vishay.com

Design Guidelines – Materials

Vishay offers a variety of material choices for submounts with a wide range of thicknesses to help designers meet their specific application requirements.

Material	Surface finish µ" CLA (micro inch)	Standard thickness mils (mm)	Available thickness mils (mm)	Dielectric constant ε at 1 MHz	Thermal conductivity (W/m°C) 25 °C/100 °C	Coefficient thermal expansion (ppm)	Tanδ 1 MHz 10 GHz
Quartz	60/40 optical	10, 20 (0.25, 0.5)	10 to 40 (0.25 to 1.0)	3.82	5 / 2	0.55	0.00002 0.0001
Al_2O_3	< 1 polished < 3 as-fired	10, 15, 25 (0.25, 0.38, 0.63)	5 to 90 (0.12 to 2.3)	9.9	35 / 27	7.4	0.0001 0.0003
AlN	< 2 polished < 24 as-fired	20, 25, 51 (0.5, 0.63, 1.3)	10 to 90 0.25 to 2.3)	8.6	170 / 130 200 / 230	4.6	0.001 0.002
BeO	< 4 polished < 15 as-fired	15, 25 (0.38, 0.63)	10 to 60 (0.25 to 1.5)	6.5	300 / 240	9	0.0004
Zirconia	< 4 polished	Special order	10 to 25 (0.25 to 0.63)	20 to 33	2 to 3	10 to 11	~

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DIODE SUBMOUNT CAPABILITIES

Using Thin Film Substrates

Metalization Guidelines

For applications incorporating resistors, or for conductors only, Vishay provides designers with a wide range of metal combinations to meet their needs.

Metal stack resistor	Vishay EFI STD	Wire bondable	Solderable		Vishay EFI STD
			Gold	Solder	
Ta_2N/TiW/Au	Yes	Yes	~	~	TiW (500 to 1 kA)
Ta_2N/TiW/Au/Ni/Au	Yes	Yes	Yes	Yes	TiW (500 to 1 kA)
Ta_2N/TiW/Pd/Au	Yes	Yes	Yes	Yes	TiW (500 to 1 kA)
Ta_2N/TiW/Au/Cu/Au		Yes	~	~	TiW (500 to 1 kA)
Ta_2N/TiW/Au/Cu/Ni/Au		Yes	Yes	Yes	TiW (500 to 1 kA)
NiCr/TiW/Au	Yes	Yes	~	~	TiW (500 to 1 kA)
NiCr/Au/Ni/Au		Yes	Yes	Yes	
Conductor Only					
TiW/Au	Yes	Yes	~	~	TiW (500 to 1 kA)
TiW/Au/Ni/Au		Yes	Yes	Yes	TiW (500 to 1 kA)
TiW/Pd/Au	Yes	Yes	Yes	Yes	TiW (500 to 1 kA)
Ti/Pd/Au		Yes	Yes	Yes	Ti (500 to 1 kA)
Conductor Only - High Power					
TiW/Cu/Ni/Au	Yes	Yes	Yes	Yes	TiW (500 to 1 kA)
NiCr/Cu/Ni/Au		Yes	Yes	Yes	NiCr (500 to 1 kA)
AuSn 80/20	Yes		Yes	Yes	4, 6, 8 micron

Refer to technical note for recommended standard metal thickness http://www.vishay.com/doc?49387

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DIODE SUBMOUNT CAPABILITIES

Using Thin Film Substrates

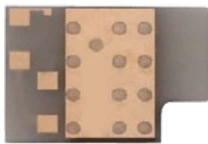
Thermal Management – Solid Filled Vias

Vishay EFI Products Feature Unique Capabilities for Improved Thermal Performance

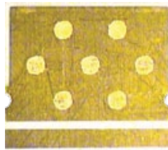
- Solid-filled vias — Gold or copper vias are available in AlN, BeO, Al_2O_3, and quartz.
- Key benefits:
  - High-reliability, low-resistance paths to ground (less than 10 mΩ)
  - Enhanced thermal conductivity
  - Low thermal paths to rear of the substrate

Design Parameters	
Material Thickness	**Min Via Diameter (max = 2x min)**
0.010 in (0.245 mm)	0.006 in (0.152 mm)
0.015 in (0.381 mm)	0.008 in (0.203 mm)
0.020 in (0.51 mm)	0.010 in (0.254 mm)
0.025 in (0.635 mm)	0.012 in (0.305 mm)
0.050 in (1.27 mm)	0.020 in (0.51 mm)
Min Via Centers	**Min Via Center to Die Edge**
2x via diameter Al_2O_3 3x via diameter AIN	1.5x via diameter

See technical note 61084, “Application and Design of Plated & Filled Via Circuits”at http:/www.vishay.com/doc?61084



Cu filled 8 mil (0.2 mm) diameter vias on a 15 mil thick (0.38 mm) aluminum nitride substrate



Custom gold filled 10 mil (0.25 mm) diameter vias on a 20 mil (0.51 mm) thick alumina substrate

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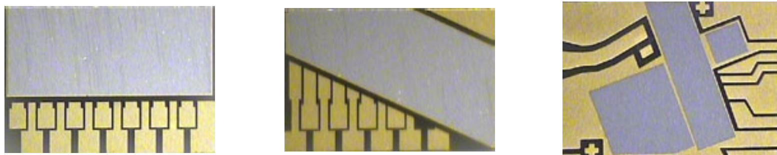
DIODE SUBMOUNT CAPABILITIES

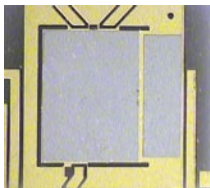
Using Thin Film Substrates

Thermal Management – AuSn

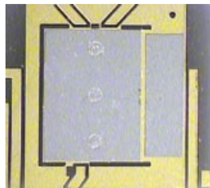
- Gold/tin pre-deposited pads — Vishay Electro-Films offers a robust selective-patterned 80/20 gold/tin for solder applications.
- Key benefits:
  - 2 µm to 8 µm thickness available at ± 1 µm tolerance
  - Eliminates need for soldering preforms — AuSn is pre-deposited onto submount
  - Available on simple to complex designs
  - AuSn pad placement accuracy to 0.0005 in. (0.0127 mm)
  - Allows accurate laser alignment to ± 0.005 in. (0.127 mm)
  - Pad tolerance to ± 0.0002 in (0.005 mm)
  - Freeze time: 120 s at 320 °C
  - Excellent reflow stability — does not migrate outside borders of defined area



AuSn pad custom designs

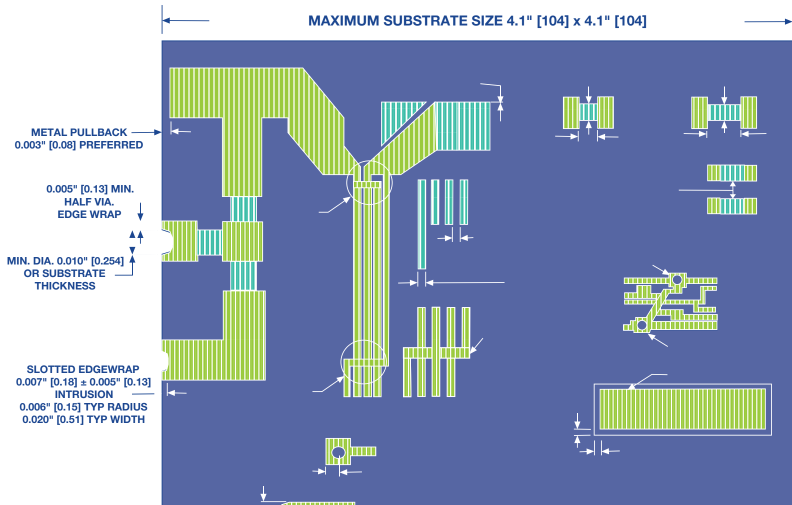


AuSn pad with no vias



AuSn pad with vias

Layout Guidelines



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