ABOUT TTM

TTM Technologies, Inc. is a leading global manufacturer of technology products, including mission systems, radio frequency (“RF”) components, RF microwave/microelectronic assemblies, and technologically advanced interconnect products, including PCBs and substrates. TTM stands for time-to-market, representing how TTM’s time-critical, one-stop design, engineering and manufacturing services enable customers to reduce the time required to develop new products and bring them to market. Additional information can be found at www.ttm.com

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OUR WEBSITE WWW.TTM.COM

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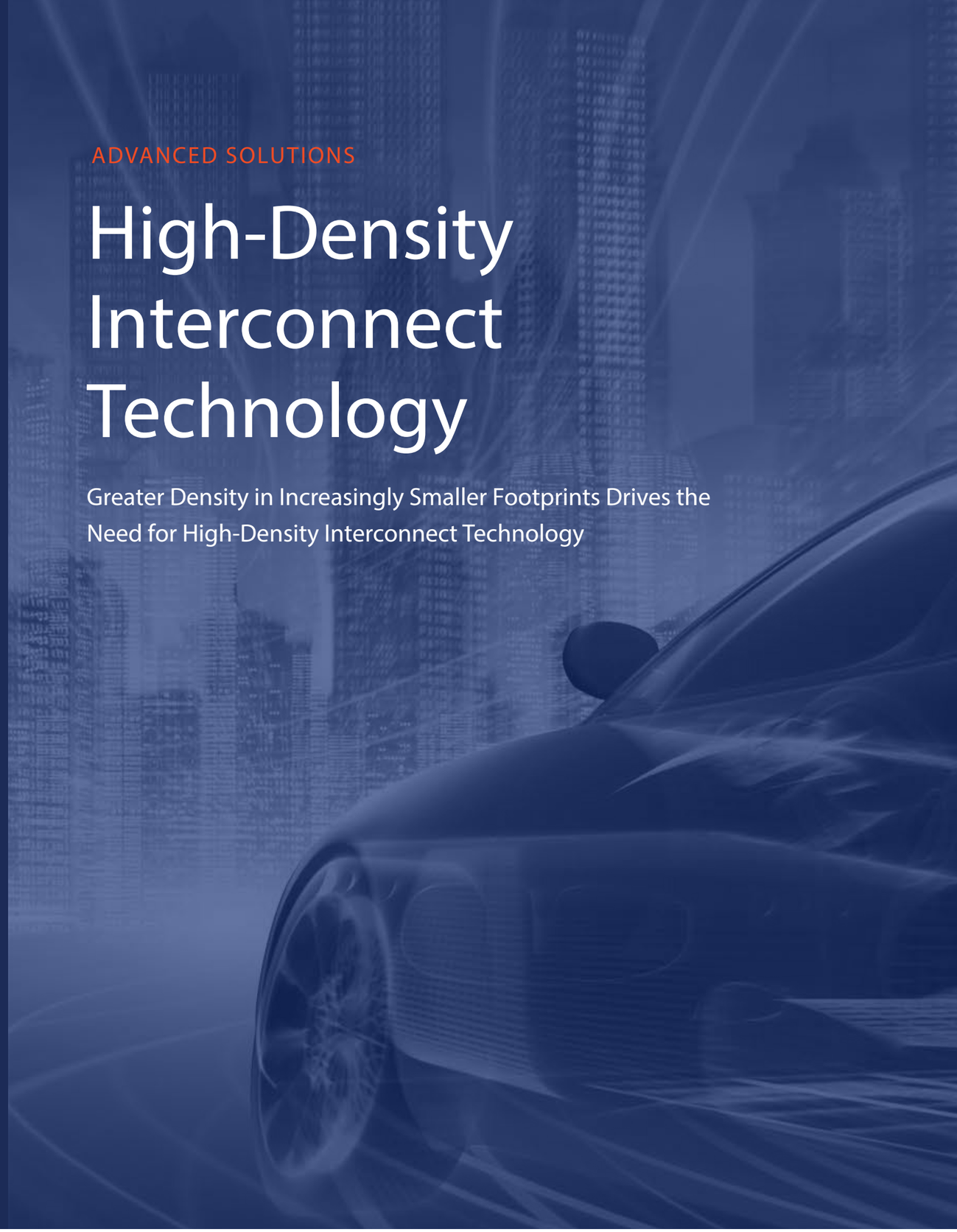
ADVANCED SOLUTIONS

High-Density Interconnect Technology

Greater Density in Increasingly Smaller Footprints Drives the Need for High-Density Interconnect Technology



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ADVANCED SOLUTIONS

High-Density Interconnect (“HDI”) Technology

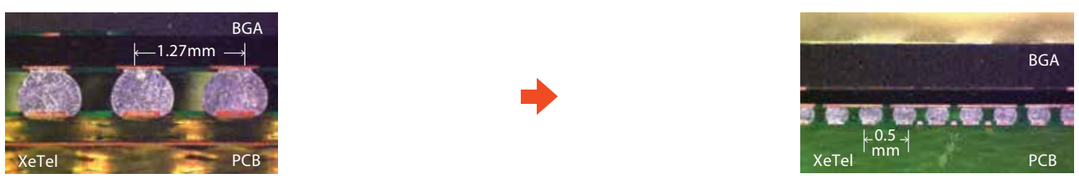
HIGH PERFORMANCE, HIGH-DENSITY SOLUTIONS FOR ADVANCED APPLICATIONS

HDI Printed circuit board ("PCB") have high-density attributes, including laser microvias, sequential lamination structures, fine lines, and high-performance thin materials. This increased density enables more functions per unit area. Advanced technology HDI PCBs have multiple layers of copper-filled stacked microvias, which creates a structure that allows even more complex interconnections. These complex structures provide the necessary routing and signal integrity solutions for today's large pin-count, fine pitch, and high-speed chips in high technology products.

A FAST-GROWING PCB TECHNOLOGY FOR ADVANCED APPLICATIONS

Increasing packaging density and decreasing component pitch, the use of micro ball grid arrays ("BGA"s), and the ongoing need to reduce the size and weight of devices is pushing the PCB technology towards creating more dense structures. Line width, spaces and pad sizes are minimized and the use of laser vias is necessary to meet the designers requirements. Improved registration is implemented to realize the necessary tolerances and the imaging and etching technologies are improved for better resolution and tolerance. All these improvements are combined in the HDI Technology, while the most prominent feature is the laser drilled via.

ATTRIBUTE	STANDARD	ADVANCED
Pad diameter	275 µm – 325 µm (0.011” – 0.013”)	228 µm – 250 µm (0.009” – 0.010”)
Laser drill diameter	100 µm – 150 µm (0.004” – 0.006”)	100 µm (0.004”)
Dielectric thickness	64 µm (0.0025")	100 µm (0.004")
Aspect Ratio	0.4:1 - 0.5:1	0.8:1



1.27 MM BGA PACKAGE
LOCALIZED VIA DENSITY
62/CM2 (400/IN.2)

6.45 X INCREASE
IN VIA DENSITY

0.50 MM BGA PACKAGE
LOCALIZED VIA DENSITY
400/CM2 (2580/IN.2)

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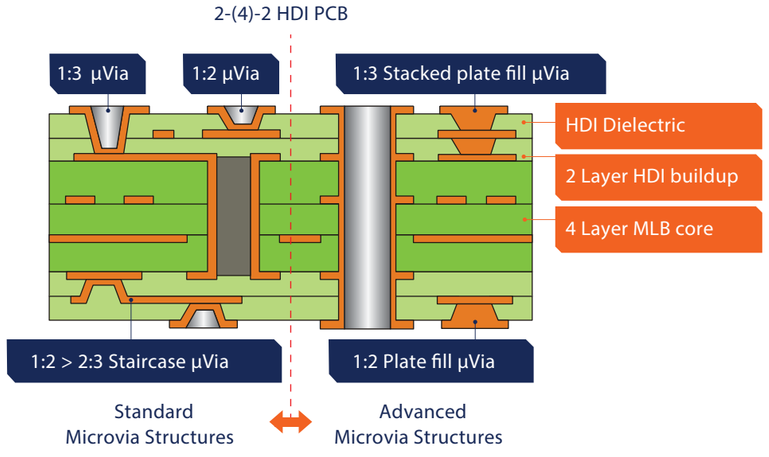
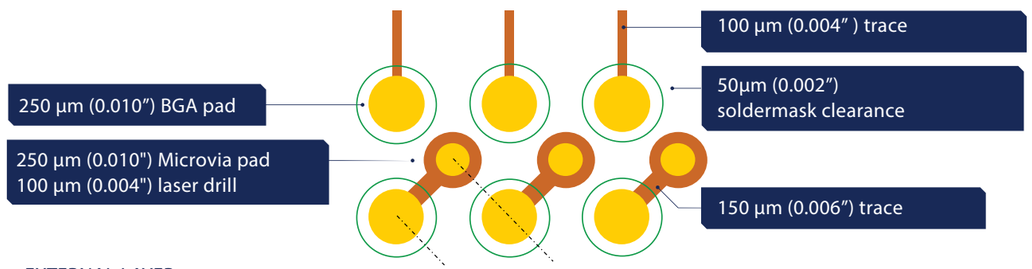
TYPICAL STACK-UP FOR HDI PRINTED CIRCUIT BOARDS (“PCB”S)



HIGHER ROUTING DENSITY IN BGAS

2-Track is possible for 0.8 mm BGA; still 1-track can be routed.

DESIGN EXAMPLE FOR 0.5 MM BGA



EXTERNAL LAYER

Requires LDI Solder Mask 25 µm(+/- 0.001”)

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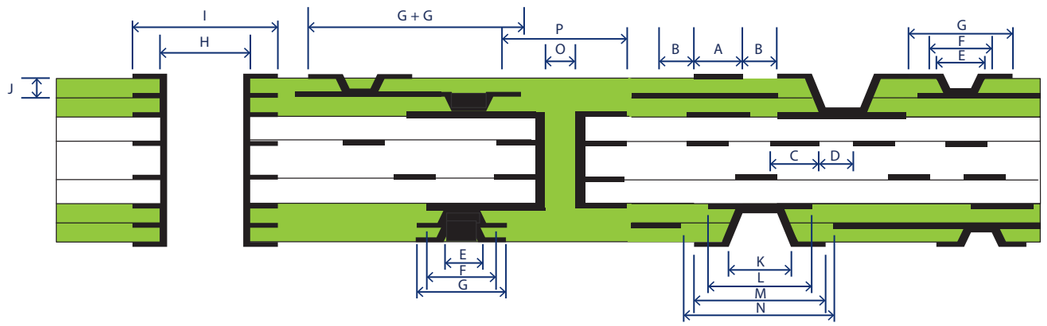
DESIGN FEATURES (2+N+2)



SYMBOL	MATRIX	STANDARD	ADVANCED	DEVELOPMENT
	Base Copper	Cu 0.2~0.28mil	Cu 0.28~0.35mil	Cu 0.28~0.35mil
A	Minimum linewidth outerlayer	3.5mil	3.0mil	3.0mil
B	Minimum spacing outerlayer	3.5mil	3.5mil	3.0mil
C	Minimum linewidth innerlayer	3mil	2.5mil	2.0mil
D	Minimum spacing innerlayer	3mil	2.5mil	2.0mil
E	Microvia hole size	4mil (min.)	4mil(min.)	4mil (min.)
F	Minimum Microvia landing pad	Hole size + 7mil	Hole size + 6mil	Hole size + 4mil
G	Minimum Microvia pad	Hole size + 7mil	Hole size + 6mil	Hole size + 4mil
H	Minimum drill size through hole	10mil	8mil	6mil
I	Minimum pad size through hole	drill size + 10mil	drill size + 9mil	drill size + 8mil
J	Dielectric thickness	2.5~4mil	2~4mil	2~4mil
K	Mircovia hole size	8mil (min.)	6mil(min.)	6mil(min.)
L	Minimum Microvia landing pad	Hole size + 8mil	Hole size + 7mil	Hole size + 6mil
M	Minimum Microvia pad	Hole size + 8mil	Hole size + 7mil	Hole size + 6mil
N	Minimum Microvia pad Clearance	Hole size + 15mil	Hole size + 14mil	Hole size + 13mil
O	Minimum drill size buried Vias*	8mil	6mil	8mil
P	Minimum pad size buried Vias*	Drill + 10mil	Drill + 9mil	Drill + 8mil
	Aspect Ratio	0.8:1	1:1	1:1
	Copper fill	0.8:1	1:1	1:1

ADVANCED CAPABILITIES

Microvias

A laser-drilled microvia has a drilled diameter as small as 0.004" (100µm), which is optically aligned in a pad diameter as small as 0.008" (200µm), allowing additional routing density.

- Via-in-pad (for direct component mounting), offset, staggered or stacked, non-conductive filled, and copper-plated over the top or solid copper filled or plated
- Add values when routing out of:
  - Fine pitch BGA such as 0.8 mm pitch devices and below
  - A 0.5 mm pitch device where staggered microvias can be used

TTM has years of experience with HDI products and was a pioneer of second-generation microvias or stacked microvias, and offers an entire family of microvia technology solutions for your next-generation products.

Z-Interconnect Technology

TTM has developed and offers next-generation Z-Interconnect solutions utilizing conductive ink or paste to make electrical connections vertically through a PCB.

- Provides PCB designers the flexibility by enabling routing of the complex via structures
- Reduces lamination cycles which will minimize thermal exposure, material degradation, and cycle time reduction
- Replaces or supplements certain copper plated through holes, plated vias, and microvias
- Can offer improvements in electrical characteristics/Signal Integrity by eliminating/minimizing back drilling and via stubs
- Enables Z-Interconnect solution where traditional PCB processes cannot support

Additionally, TTM Sub-Link/Sub-Z/Hybrid Z is a modular concept that allows z-axis interconnection of multiple subs using conductive ink/paste. This innovative technology provides the solution to fabricate high layer count PCBs with an extreme aspect ratio (>40:1) and eliminates the challenges related to high aspect ratio drilling and copper plating.

TTM recognizes our opportunity to positively impact the world around us by managing our operations in a sustainable manner. We believe that sustainable practices are essential to the long-term success of our business and that we have a responsibility to consider how our business interacts with society and impacts the environment. To learn more about our sustainability efforts, view our CSR report at ttm.com.

HyberBGA ®

It's the solution for networking, high-end server, telecommunications, military, and medical markets – anyplace where speed, reliability, and increased signal I/O must combine with reduced size, weight, and power ("SWaP").

- 25 microns line and space
- RAD tolerant
- High-speed

CoreEZ ® semiconductor packaging

CoreEZ ® semiconductor packaging uses the HyperBGA® manufacturing platform. It is an excellent choice for applications requiring low-cost build-up materials and high reliability, performance, and wireability.

- 28 microns line and space
- RAD Hard
- Tight registration build-up technology

For more information on HDI technologies, please speak with your TTM Sales representative or contact us by:

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ttm.com/contact

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