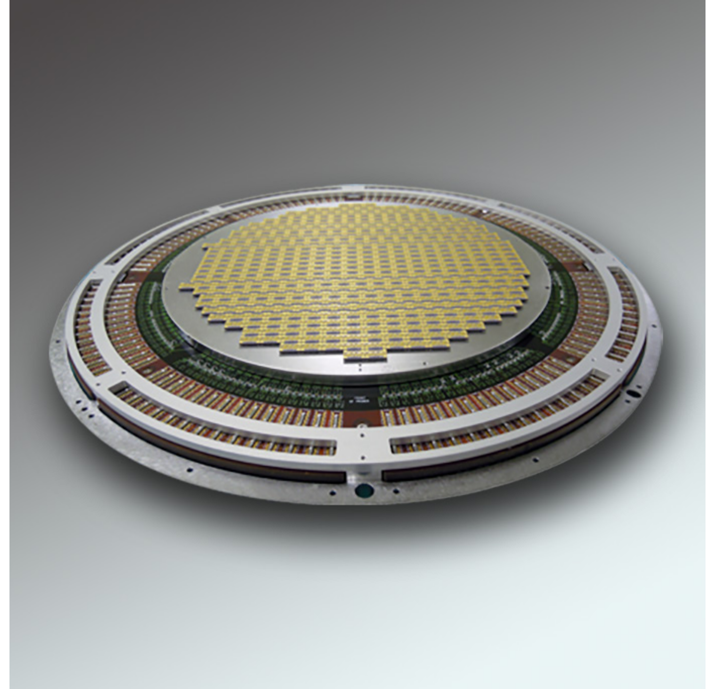
SmartMatrix™ 1500XP

DRAM Probe Card Architecture

Overview

SmartMatrix 1500XP provides 300 mm full-wafer contact testing on mobile and commodity DRAM, graphic memory (GDDR), high bandwidth memory (HBM), and emerging memory devices. Specifically developed to support fast design ramps and advanced product roadmaps, this platform extends the proven Matrix™ architecture to address increased probe card parallelism up to 1536 sites per wafer on a single touchdown. It supports faster test speeds/clock rates, from 125 MHz to 200 MHz, on x16 TRE share group signals using FormFactor's terminated tester resource extension (TTRE) technology. SmartMatrix 1500XP is capable of testing from -40˚C to 160˚C for automotive semiconductor high-temperature requirements.

High performance and short delivery times for SmartMatrix 1500XP enable yield optimization and faster time-to-market for today's DRAM and advanced memory devices.



Features / Benefits

Higher parallelism, higher efficiency and lower cost of DRAM test	• Increase throughput by using ATRE to test more than 1500 DUTs simultaneously on a single touchdown • Increase test speed from 125 MHz to 200 MHz without compromising signal fidelity
Robust 3D MEMS spring with superior tip position and performance	• Scalable 3D MEMS MicroSpring™ technology enables flexible pad layout with superior contact performance • Enables contact pad geometry shrinkage aligning with technology node transition to 1x, 1y, and 1z nm nodes • Excellent current-carrying capacity with large 3D spring cross section
Superior thermal performance and design flexibility	• Full wafer contactor substrate with various CTE optimized for single- and dual-temperature designs • Increase test cell efficiency by achieving >50% soak time reduction on single-temperature design • FormFactor 3D MEMS MicroSpring with post-on-wafer technology enables 160C testing for automotive requirements
Excellent production uptime	• Consistently achieved greater than 95% uptime in mass production environment
Ease of use and serviceability	• Real-time planarity adjustment and optimization capability with probe card on the test cell • On-site single spring repair and probe head replacement capability reduces time loss for service events and improves equipment efficiency

Main Applications

- DDR3, DDR4
- LPDDR3, LPDDR4, GDDR5, GDDR6
- HBM, HBM2 with 2Hi, 4Hi, and 8Hi stack
- KGD (known good die) and KGS (known good stack) test up to 3.2 Gbps
- Next-generation and emerging DRAM memory devices

Mechanical Parameters

Parameter	Specification
Minimum Touchdown (TD)/wafer	1TD - 300 mm wafer
Maximum array size	300 mm diameter
Maximum number of DUTs/TD	1536
Minimum pad pitch	50 µm
Minimum pad size	40 µm (with 5 µm keep out)
Maximum spring count	110,000 springs
Probe tip size	8-10 µm square
Probe tip-to-beam clearance	≥ 200 µm (T11.2)
X-Y tip placement	≤ 10 µm
Optical planarity	≤ 25 µm @ 25°C
Electrical planarity	≤ 40 µm @ 25°C and 85°C
Force/probe (k = gram force/25 µm overdrive)	0.8 gm (T11.2)
Maximum over travel (From 1st electrical contact)	130 µm
Minimum operating temperature	- 40°C
Maximum operating temperature	+ 160°C @ 65 µm OD ; + 125˚C @ 130 µm OD
Maximum temperature range	200°C

Electrical Parameters

Parameter	Specification
Power path resistance	≤ 0.5 Ω
Ground path resistance	≤ 0.1 Ω
Signal path resistance	≤ 10.0 Ω
Low resistance path signal path resistance	≤ 2.0 Ω
Maximum pulsed current CCC	≤ 2.5A @ 20 µs pulse width
Maximum continuous current capability/probe	≤ 1200 mA, ISMI @ 50 µm pad pitch; ≤=1600 mA @ ≥ 60 µm pad pitch
Maximum power dissipation/probe	≤ 500 mW @ 85°C ≥ 60 µm pad pitch
Leakage - signal pin (non-ATRE)	≤ 10 nA @ 5 V
Maximum frequency	200 MHz on X16TRE, share group
Maximum TPD	5 ns
Maximum skew @ maximum sharing	250 ps

Reliability

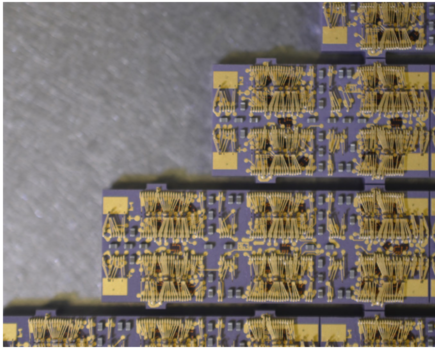
Parameter	Specification
Life time of probe tips	> 250,000 TDs or one year

Custom Services Provided

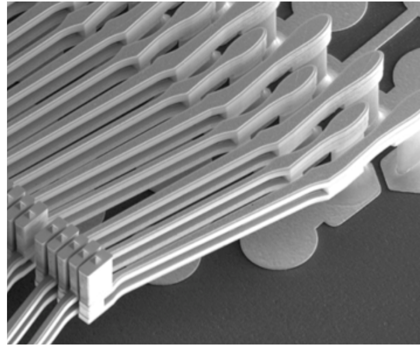
Signal path simulation	Touchdown optimization
ATRE design, simulation and implementation	Customized firmware for ATRE

The specifications listed above represent results attainable under optimized conditions. Optimized results depend upon many factors, including (but not limited to) operating conditions, pad layout, pad size, device voltage, physical material types, and other parameters. Since priorities are different for each customer and device type, FormFactor works to optimize the specifications of the highest importance to customers.

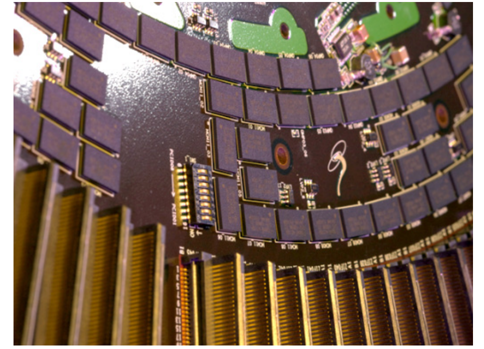
Product Details



DUTLet

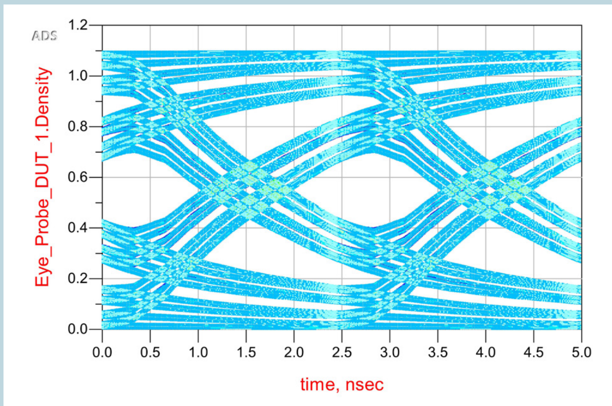


3D MicroSpring MEMS structure

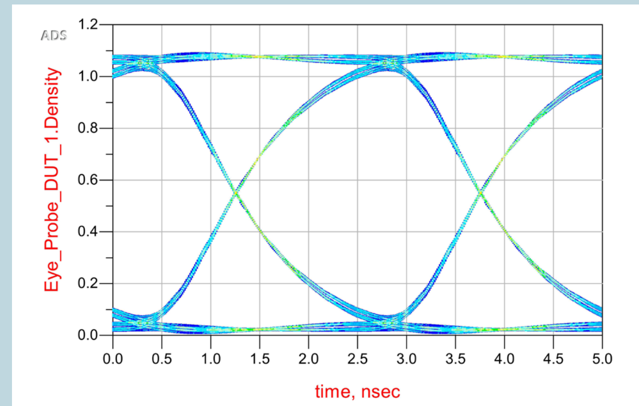


ATRE components

Eye-Diagram measurement result taken at 200 MHz on x16TRE share group



Without TTRE



With FFI TTRE

Eye-diagram from actual measurement illustrating the improvement by TTRE at 200 MHz: Significant signal fidelity improvement achieved by implementing FormFactor's proprietary TTRE (terminated TRE) circuit design, allowing increased test speed up to 200 MHz on ultra high parallelism probe card up to 1536 die on a single touchdown.

Warranty

Warranty*	One year or 250K touchdowns, whichever comes first
Service contracts	Single- and multi-year programs available to suit your needs

* See FormFactor's Terms and Conditions of Sale for more details.

Ordering Information

Consult a FormFactor sales representative for detailed specification, suitable configuration for intended usage, pricing and delivery

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