Exponent®
Engineering & Scientific Consulting

Jay Mitchell, Ph.D.
Senior Associate | Mechanical Engineering
Farmington Hills
+1-248-324-9182 | mitchellj@exponent.com

Professional Profile

Jay Mitchell, Ph.D., is a Senior Associate at Exponent and former company founder with over 15 years of experience in precision sensors and semiconductor devices for consumer electronics, medical wearable, military, and automotive products. His consulting covers sensor and chip failure analysis, harsh-environment design, thermal, stress and vibration analysis, reliability qualification to Joint Electron Device Engineering Council (JEDEC) and military standards (MIL-STD) requirements, and patent claim analysis.

Dr. Mitchell assists clients with design reviews, reliability and qualification programs, and technical analysis in patent matters. His approach combines sensor and semiconductor design and manufacturing knowledge with a structured process for defining product requirements and test programs. He has extensive experience with printed circuit board (PCB)-induced stress analysis, thermal design and optimization, vibration mode analysis, and reliability testing. His testing experience includes high temperature operating life (HTOL), highly accelerated stress test (HAST), temperature cycling, accelerated life testing, vibration and shock, and custom tests built around specific device functions.

Before joining Exponent, Dr. Mitchell founded and sold ePack, Inc., a company that specialized in packaging sensors for high-performance applications. At ePack, he won projects through Phase II Small Business Innovation Research (SBIR) awards from DARPA, the Navy, the Army, and the National Science Foundation (NSF), and through projects funded directly by companies including Boeing, Honeywell, and Analog Devices. Dr. Mitchell then served as Chief Technology Officer (CTO) at Bliley Technologies, a quartz crystal oscillator company developing precision timing products for telecom and military applications. He later served as Product Architect at SiTime Corporation, leading the development of a miniaturized timing reference with atomic clock stability for data centers and precision GPS navigation in military applications. At SiTime he also served as Site Director for the Michigan office and managed a customer engineering group that did competitive analysis. Most recently, Dr. Mitchell consulted for an atomic clock startup and two medical wearable startups on technical due diligence, product requirements, and product strategy.

Dr. Mitchell holds a Ph.D. in mechanical engineering from the University of Michigan. He is a named inventor on six patents and applications and has co-authored 13 peer-reviewed papers, with particular depth in MEMS packaging, inertial sensing, and precision timing. He also holds a Professional Certificate in Product Management from Northwestern University's Kellogg Executive Education (2025).

Before joining Exponent, Dr. Mitchell led the following work:

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Design Reviews and Product Requirements

- Reviewed sensor and system designs at preliminary and critical design stages, and translated customer needs into product requirements, test limits, and test programs. Let programs from R&D to product launch.

Patent and Intellectual Property Analysis

- Authored and prosecuted patents in MEMS packaging, precision timing, and inertial sensing, and analyzed patent claims to inform portfolio strategy from a manufacturer's perspective.

Reliability Qualification and Accelerated Life Testing

- Planned and executed JEDEC and MIL-STD qualification programs, running HTOL, early life failure rate (ELFR), HAST, burn-in, and temperature cycling tests (TCT) across statistically relevant populations. Used failure mode and effects analysis (FMEA) to rank risks, Arrhenius acceleration models to predict field lifetime, and root cause analysis to resolve qualification failures.

Thermal and Package Stress Analysis

- Optimized thermal design and analyzed thermal expansion stress and other induced stress across PCBs, solder joints, die-attach epoxies, and flip-chip bonds, selecting materials and packaging processes to control temperature drift, aging (time dependent drift), and reliability.

Vibration and Shock Robustness

- Evaluated sensors and packages for vibration and shock using analytical models and finite element analysis. Optimized sensor and system assemblies for the vibration and shock environment and verified performance on custom test rigs for automotive and military environments.

Custom Test Systems and Characterization

- Designed automated test systems and fixtures for characterization, production calibration, and long-duration testing, applying statistical process control (SPC) and noise, drift, and aging analysis to the data. Also designed custom vibration, shock and precision timing setups.

Academic Credentials & Professional Honors

Ph.D., Mechanical Engineering, University of Michigan, 2008

M.S., Mechanical Engineering, Case Western Reserve University, 2000

B.S., Mechanical Engineering, Case Western Reserve University, 1999

Prior Experience

Business Development Consultant, Self-Employed, 2025-2026

Product Architect, SiTime Corporation, 2022-2025

Site Director, SiTime Corporation, 2021-2025

Customer Engineering, SiTime Corporation, 2024-2025

Chief Technology Officer, Bliley Technologies, 2020-2021

CEO and Founder, ePack, Inc., 2010-2019

Patents

US Patent 11,332,362: Vibration isolator platform with electronic acceleration compensation, May 2022 (Mitchell JS, Lemmerhirt D, Srivannavit O).

US Patent 11,125,772: System with oven control and compensation for detecting motion and/or orientation, September 2021 (Mitchell JS, Challoner A, Lee S).

US Patent 10,611,628: MEMS isolation platform with three-dimensional vibration and stress isolation, April 2020 (Lee S, Mitchell JS, Srivannavit O).

US Patent 10,386,385: System with oven control and compensation for detecting motion and/or orientation, August 2019 (Mitchell JS, Challoner A, Lee S).

US Patent 10,266,392: Environment-resistant module, micropackage and methods of manufacturing same, April 2019 (Najafi K, Lee S-H, Lee SW, Mitchell JS, Srivannavit O).

US Patent 7,203,393: MEMS micro mirrors driven by electrodes fabricated on another substrate, April 2007 (Rajan N, Wu C-H, Mitchell JS, Huang L).

Publications

Lemmerhirt DF, Srivannavit O, Chen S, Litow T, Mitchell JS, Cooksey PC, Sturdevant R, Bingham JK, Padilla O, Trevino MN. Improved scale-factor and bias stability of ovenized inertial sensors in an environmentally-stabilized inertial measurement unit (eIMU). 2019 IEEE International Symposium on Inertial Sensors and Systems (INERTIAL), Naples, FL, April 1-5, 2019; 1–4.

Yang DM, Najafi K, Lemmerhirt DF, Mitchell JS. A micro thermal and stress isolation platform for inertial sensors. 2018 IEEE International Symposium on Inertial Sensors and Systems (INERTIAL), Moltrasio, Italy, 2018; 1–4.

Yang D, Woo J, Lee S, Mitchell JS, Challoner AD, Najafi K. A micro oven-control system for inertial sensors. Journal of Microelectromechanical Systems 2017; 26(3):507–518.

Woo J, Yang D, Najafi K, Lee S, Mitchell JS. Miniaturized digital oven-control microsystem with high power efficiency and ±1.8 ppm frequency drift. 2016 IEEE International Frequency Control Symposium (IFCS), New Orleans, LA, 2016; 1–4.

Yang D, Woo JK, Najafi K, Lee S, Mitchell J, Challoner D. ±2 ppm frequency drift and 300× reduction of bias drift of commercial 6-axis inertial measurement units using a low-power oven-control micro platform. IEEE SENSORS 2015, Busan, Korea, 2015; 1–4.

Mitchell JS, Najafi K. A detailed study of yield and reliability for vacuum packages fabricated in a wafer-level Au-Si eutectic bonding process. 15th International Conference on Solid-State Sensors, Actuators and Microsystems (Transducers 2009), Denver, CO, 2009; 841–844.

Mitchell JS, Lahiji GR, Najafi K. An improved performance poly-Si Pirani vacuum gauge using heat-distributing structural supports. Journal of Microelectromechanical Systems 2008; 17(1):93–102.

Mitchell JS, Najafi K. Localized back-side heating for low-temperature wafer-level bonding. 20th IEEE International Conference on Micro Electro Mechanical Systems (MEMS 2007), Kobe, Japan, 2007; 377–380.

Mitchell JS, Lahiji GR, Najafi K. Long-term reliability, burn-in and analysis of outgassing in Au-Si eutectic wafer-level vacuum packages. Solid-State Sensors, Actuators, and Microsystems Workshop (Hilton Head 2006), Hilton Head Island, SC, 2006; 376–379.

Mitchell JS, Lahiji GR, Najafi K. Reliability and characterization of micro-packages in a wafer level Au-Si eutectic vacuum bonding process. ASME Conference on Integrated Packaging of MEMS, NEMS and Electronics, San Francisco, CA, 2005.

Mitchell JS, Lahiji GR, Najafi K. Encapsulation of vacuum sensors in a wafer level package using a gold-silicon eutectic. 13th International Conference on Solid-State Sensors, Actuators and Microsystems (Transducers 2005), Seoul, Korea, 2005; 928–931.

Mitchell JS, Zorman C, Kicher T, Roy S, Mehregany M. Examination of bulge test for determining residual stress, Young's modulus, and Poisson's ratio of 3C-SiC thin films. Journal of Aerospace Engineering (ASCE) 2003; 16(2):46–54.

DeAnna RG, Mitchell JS, Zorman CA, Mehregany M. Finite-element modeling of 3C-SiC membranes. Modeling and Simulation of Microsystems, San Diego, CA, 2000; 253–256.

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