

THE IMPORTANCE OF FABS IN CRYPTO MINING

AFFORDABLE PROCESS NODES AND INNOVATION HELP ENABLE MARKET

EXECUTIVE SUMMARY

The cryptocurrency markets have caused upheaval in the technology and financial markets. When the price of Bitcoin peaked at roughly \$19,000, there was a mad rush to acquire cryptocurrencies, including Bitcoin, Ethereum, and Litecoin. This frenzy drove people to flood the exchanges, many of which closed to new users, making acquiring cryptocurrencies difficult unless you mined it yourself. Because of the price of a single Bitcoin, people were ready and willing to spend virtually any amount of money to mine (using hashing computing power) these cryptocurrencies using GPUs and ASICs. Today, the current price of Bitcoin is \$7,096, which is many times greater than it was a year ago. Despite this volatility, there has been a constant demand for hardware to feed the mining of cryptocurrencies.

Most users spun up their gaming graphics card to run hashing algorithms that would ultimately solve the cryptography problems in the early days of cryptocurrencies. Because many cryptocurrencies increase mining (problem-solving) difficulty as they scale, GPU mining became increasingly less relevant over time because the problems became far too difficult to be profitable for most GPU miners. However, GPU mining became profitable again creating a global shortage of GPUs when the price of a single Bitcoin peaked at approximately \$19,000. This same sequence of events effectively repeated itself when Bitcoin first exceeded \$1,000 per coin.

Miners began using ASIC-based devices to make Bitcoin mining easier and more profitable when the price of Bitcoin first reached around \$400 during the first cryptocurrency boom of 2013-2014. These ASIC miners zeroed in on the algorithms that cryptocurrencies use and optimized the chip's design to solve more efficiently. As a result, these ASICs are purpose-built for the mining of that specific type of cryptocurrency and nothing else, unlike GPUs which are still capable of gaming and conducting other, general-purpose GPU compute. More ASIC miners for both Bitcoin and Ethereum exist today who are ready to jump in on the excitement and demand around their stratospheric price growth, particularly in the case for Bitcoin. Some miner OEMs are considerable players in the ASIC space and can drive significant chip volumes with the fabs that make them.

CRYPTOCURRENCY MINING LIMITS ON GPUS

The current market situation with ASIC miners and GPUs has caused significant shortages of both computer hardware for gamers and scarcity of ASIC miners. As a result, many ASIC miners cost upwards of thousands of dollars each and the prices of consumer GPU and RAM computer components have doubled. While some prices have started to normalize due to the settling of the Bitcoin price and other cryptocurrencies, we believe prices could skyrocket again.

Many of these ASIC miners are more efficient than GPUs at mining Bitcoin and Ethereum but are more expensive. This price difference has created a shortage of GPUs globally, which we believe should resolve as soon as ASIC miners become more available and less expensive. The introduction of an \$800 ASIC miner from Bitmain Technologies means that we can likely expect more of their competitors to follow suit. ASIC miners need to come down in cost from thousands of dollars per unit to hundreds of dollars or less for these miners to have a future.

Lowering the cost of ASIC miners makes the act of mining Ethereum more profitable—even with today’s lowered values—and frees up GPUs for gaming which will help the PC ecosystem. However, the cost of ASICs drives a large portion of the bill of materials (BOM) costs for these devices because miners can have upwards of 100 to 200 ASICs per device. These BOM costs also includes polychlorinated biphenyl (PCB) and power supplies. The supply of ASICs targeting this market will need to increase with efficient design and fabrication for BOM costs to reach a point where both miner and device manufacturer are profitable.

LEADING ASIC MINERS ARE USING LEADING FAB PARTNERS

Bitmain is one of the most notable leaders in ASIC mining and is placing fabrication orders in the hundreds of thousands of wafers and billions of dollars. The company not only manufactures miners, but also operates mining farms which is driving these large orders. Bitmain is filling the internal demand for mining farms and external demand for its ASIC miners, which we believe places the company in a unique position.

With the introduction of the new Antminer E3 Ethereum ASIC miner¹ at a much lower cost, analysts expect other manufacturers will do the same. Current depressed prices drive less demand for mining, but more may gravitate towards cryptocurrency again if

¹ Coindesk, “Bitmain Confirms Release of First Ethereum ASIC Miners”, April 3, 2018, <https://www.coindesk.com/bitmain-confirms-release-first-ever-ethereum-asic-miners/>

global markets become uncertain. We believe the current cryptocurrency boom is just beginning with ongoing demand for miners to continue completing blocks.

Mining hardware manufacturers like Bitmain have been placing significant orders with fabs like TSMC, Samsung, and Globalfoundries, taking up a considerable amount of their 16/14nm FinFET capacity. Rumors claim that some of the latest ASIC miners may even run on 10nm or 7nm processes, which would make them more expensive to produce, but also likely faster and more energy efficient. For many of these ASIC miner companies to continue to be profitable and scale, they need to establish stronger relationships with their fab partners. In fact, we have witnessed several ASIC miner companies partner directly with some of the biggest fabs in the world.

Currently, Bitmain is using TSMC's 16 and 28nm process nodes, but is expected to transition to 12nm and 7nm for their next nodes. Other ASIC manufacturers are using the Samsung/Globalfoundries 14nm LPP process and are expected to transition to next leading nodes which should further improve performance and power. However, these leading-edge FinFET process nodes are typically more expensive and don't drive down the overall cost of the ASICs in the miner.

FULLY DEPLETED-SILICON ON INSULATOR (FD-SOI) FOR CRYPTOCURRENCY ASIC MINING

One of the ways to keep ASIC costs down and within reach for miner companies is to leverage more affordable process nodes. Interestingly, many of these ASIC miner companies are forgoing the traditional pipeline of testing of newly manufactured chips and instead aiming for the fastest time to market and at the lowest cost.

Globalfoundries 22nm FDX is designed to lower wafer costs by roughly 30 percent compared to 16/14nm FinFET processes. Built on FD-SOI substrate, also known as FDX, the technology delivers an attractive FinFET-like level of performance at a cost comparable to basic 28nm planar. 22nm FDX offers a 20 percent smaller die size and 10 percent fewer masks than 28nm while also needing 50 percent fewer immersion lithography layers than FinFET solutions.

22nm FDX is optimized for energy efficiency, delivering as much as 70 percent lower power than 28nm technologies through ultra-low voltage operation. Energy efficiency is important for mining ASICs as they consume vast amounts of power. In fact,

approximately 65 terawatt Hours are consumed daily by mining², according to some sources.

With so much energy consumed daily, mining operations and manufacturers are always looking at the efficiency of their ASIC miners. Most mining devices “performance” is measured in hashes per watt rather than total hashing capability.

Globalfoundries’ FDX roadmap will expand in 2019 and 2020 to include 12nm FDX, which should operate at even lower power and higher performance while also having a cost-friendly profile. We believe this product expansion could significantly benefit miners. The cost of manufacturing chips is becoming an increasingly important factor in their success, particularly as Bitcoin and other altcoin ASIC mining companies aim to turn as much volume as possible.

CALL TO ACTION

The cryptocurrency markets are in a constant state of change and volatility. However, the algorithms on which these cryptocurrencies have changed very little which means they are ripe for ASIC mining targeting. The growth of ASIC mining is an especially welcome development from the IT and gaming hardware communities which have struggled to keep up with the demand from cryptocurrency mining. However, ASICs need to come down in cost to be attractive alternatives to GPUs and CPUs. Fab partners like Globalfoundries and their 22nm FDX and 12nm FDX processes are a logical way to help bring the cost of ASIC miners down and improve profitability.

² [Digiconomist](https://digiconomist.net/bitcoin-energy-consumption), “Bitcoin Energy Consumption Index”, <https://digiconomist.net/bitcoin-energy-consumption>

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