



# High-Density 65W USB-PD GaN Chargers: Market Demand, Technical Solutions and Pricing

APEC 2020, PSMA Industrial Sessions  
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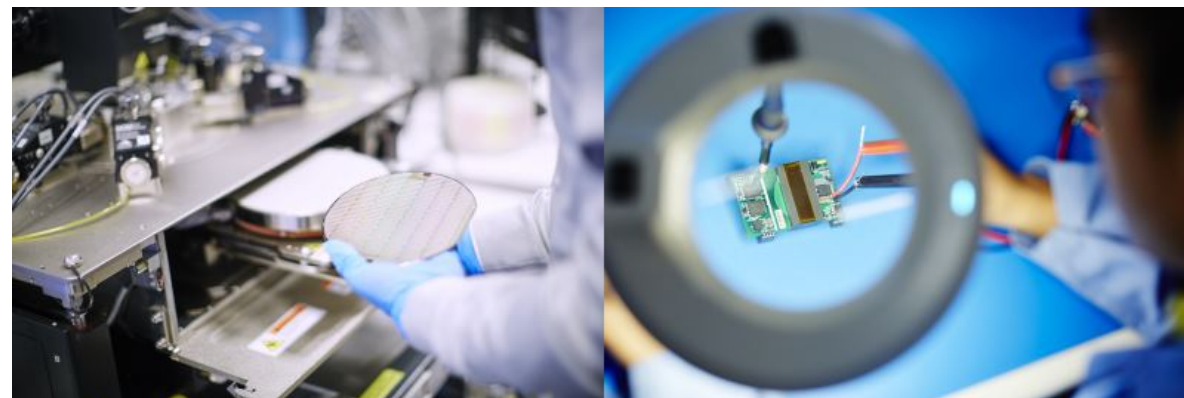
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# Navitas Semiconductor Inc.



- World's first & only GaN power IC company
  - Production released with fast revenue ramp
  - Qualified 'Beyond JEDEC', zero ppm field returns
  - 1M+ shipped (Dec'19), 6-12 weeks leadtime
- Navitas: Latin for *Energy*
  - **Energy** savings
  - *Bringing a new Energy to power electronics*
- Founded January 2014, HQ El Segundo, CA
- Proven management team, 75 employees
- Tier 1 manufacturing partners
- Strong financial investors (\$1B+ managed capital)



navitas  
noun | en-er-gy





# More Screen, More Battery... & 5G?



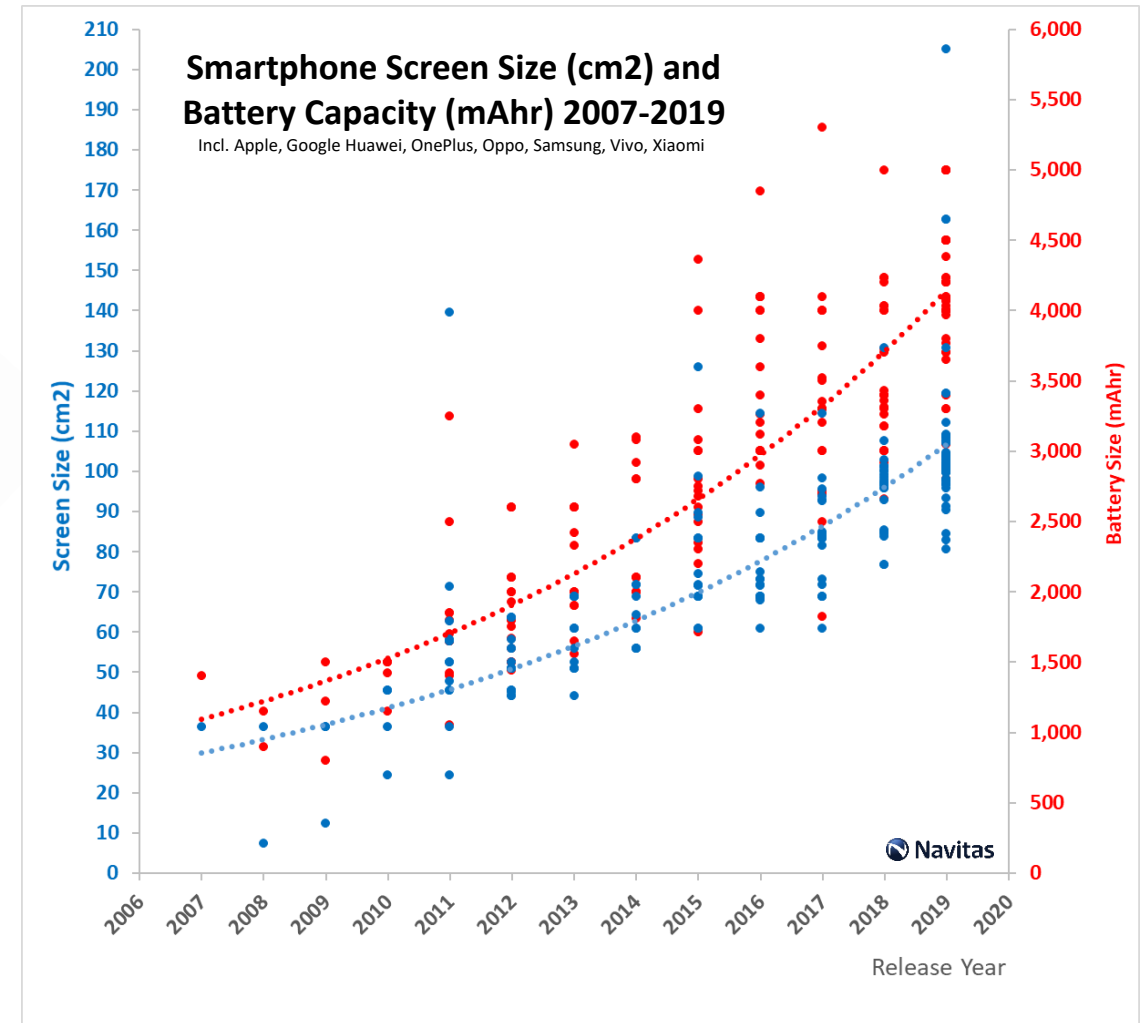
2007  
Apple  
iPhone 1  
36.5 cm<sup>2</sup>  
1,400 mAh



2013  
Samsung  
Galaxy S4  
68.9 cm<sup>2</sup>  
2,600 mAh



2019  
Huawei  
Mate X  
205 cm<sup>2</sup>  
4,500 mAh





# More Battery, More Charge Time



Apple 5W  
Cube



2007  
iPhone 1  
1,400 mAh

1.7 hrs



2013  
Galaxy S4  
2,600 mAh

3.1 hrs



2019  
Mate X  
4,500 mAh

5.4 hrs



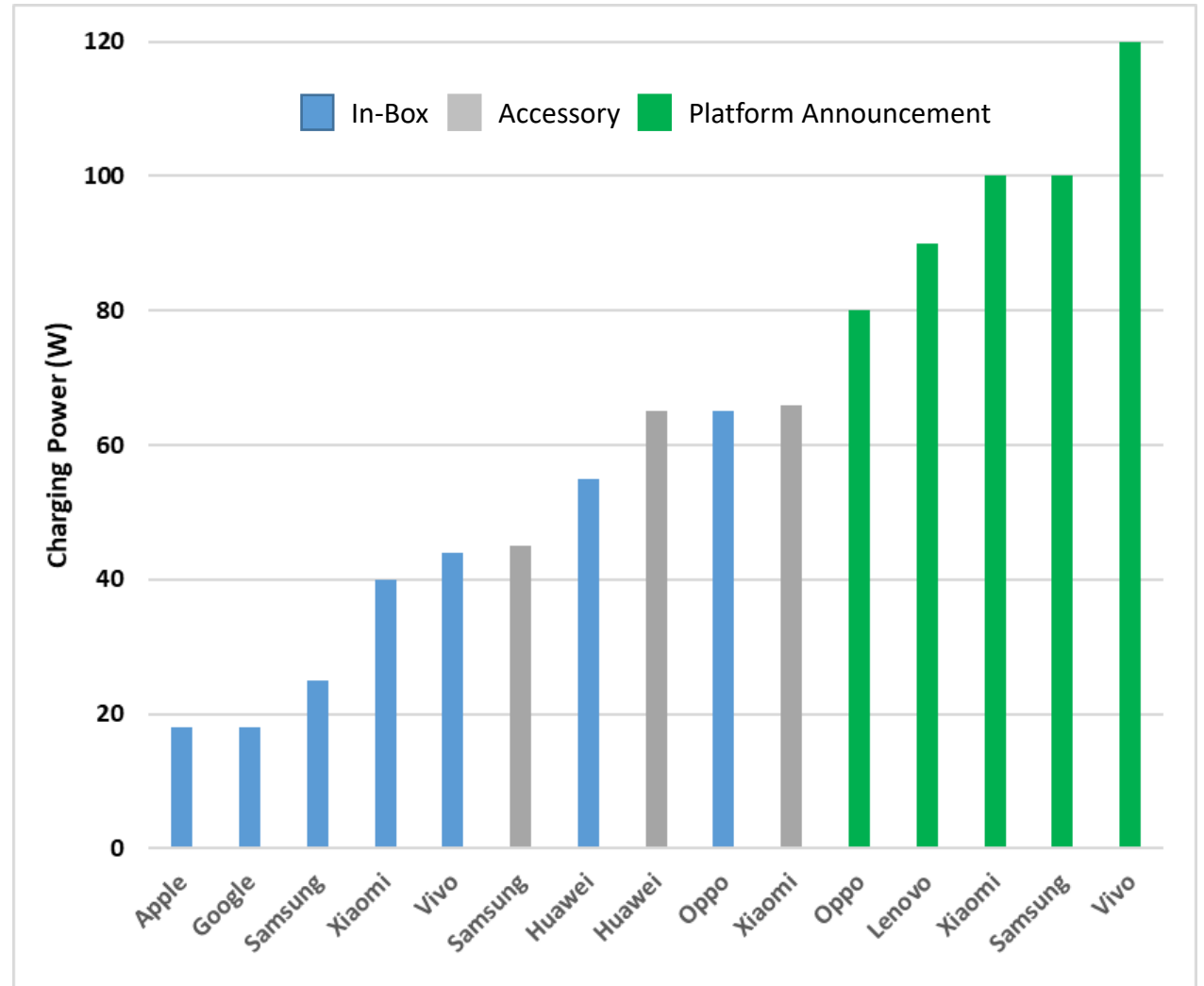


# More Power, Faster Charge



Vivo's Super FlashCharge 120W technology, claims 100% charge of a 4,000 mAh phone battery in just 13 minutes.

### OEM Charger Power Q2 2020





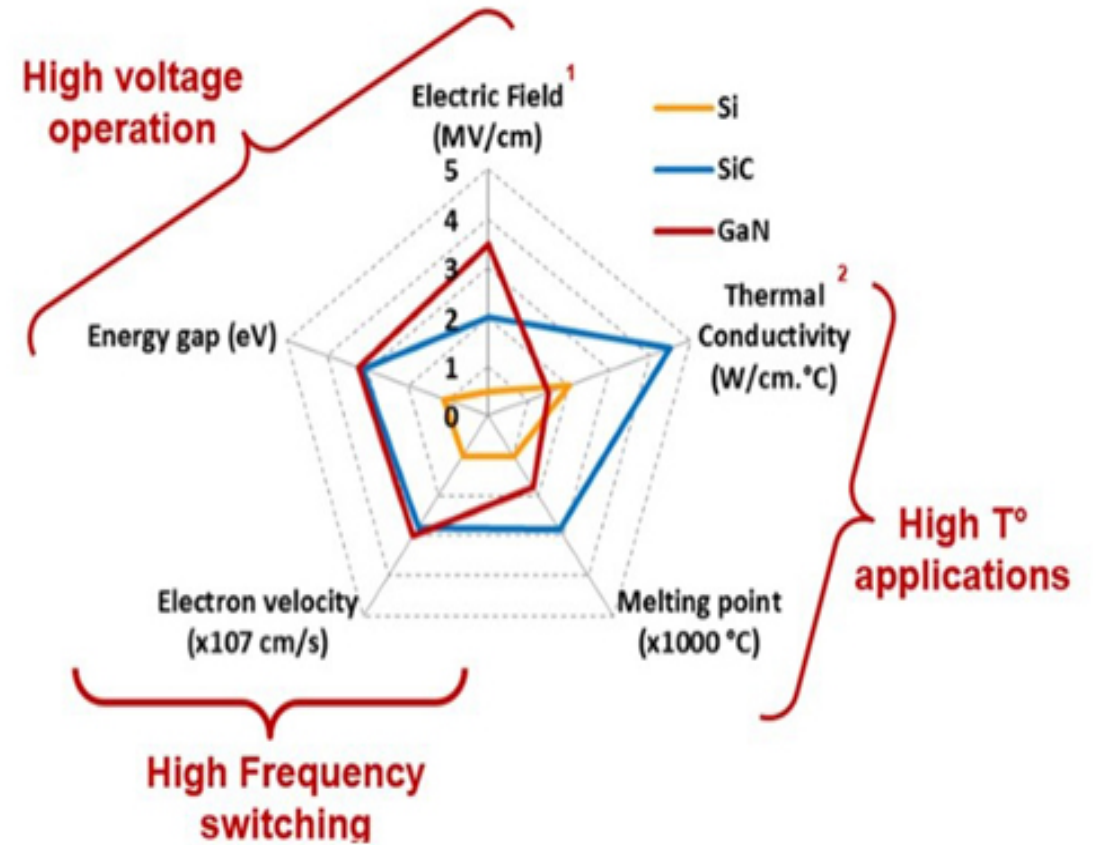
# Enabling Technology: GaN



*GaN replaces silicon, electrifies applications around the world*

**GaN Speed**  
**GaN Efficiency**  
**GaN Density**

**Ga** 31 Gallium  
**N** 7 Nitrogen

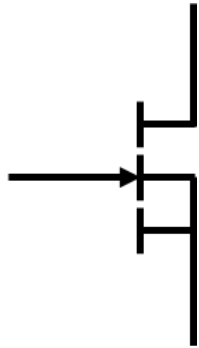




# World's First GaNFast™ Power ICs



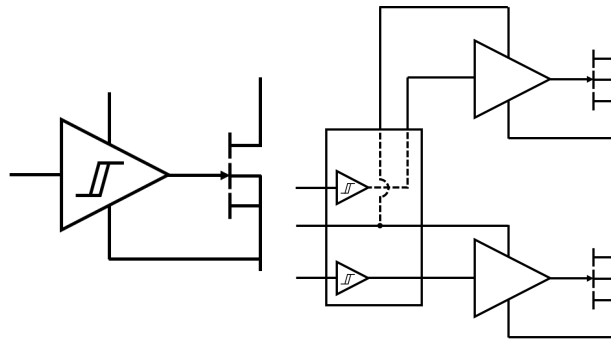
**Fastest, most efficient  
GaN Power FETs**



>20x faster than silicon  
>5x faster than cascoded GaN  
Proprietary design



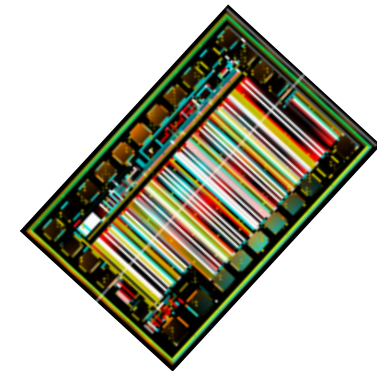
**First & Fastest Integrated  
GaN Gate Drivers**



>3x faster than any other gate driver  
Proprietary design  
75+ patents granted/applied



**World's First  
GaNFast™  
Power ICs**



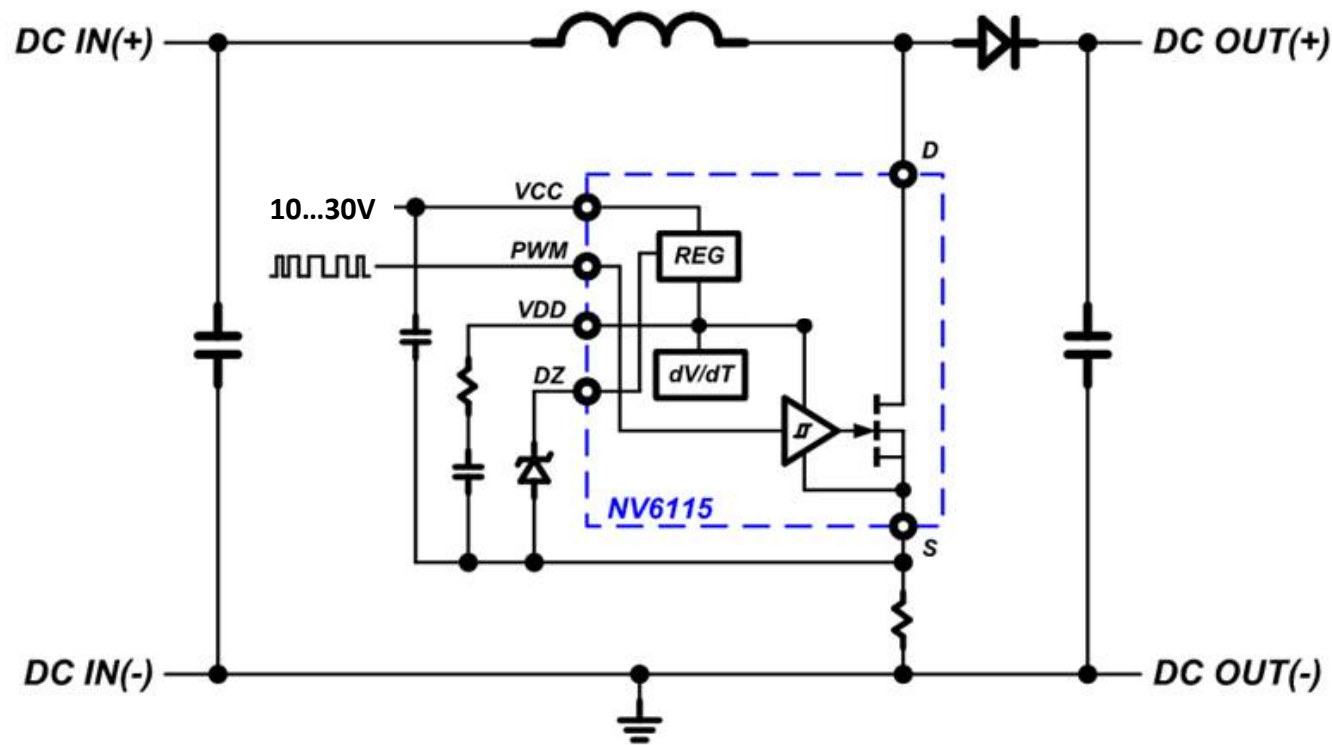
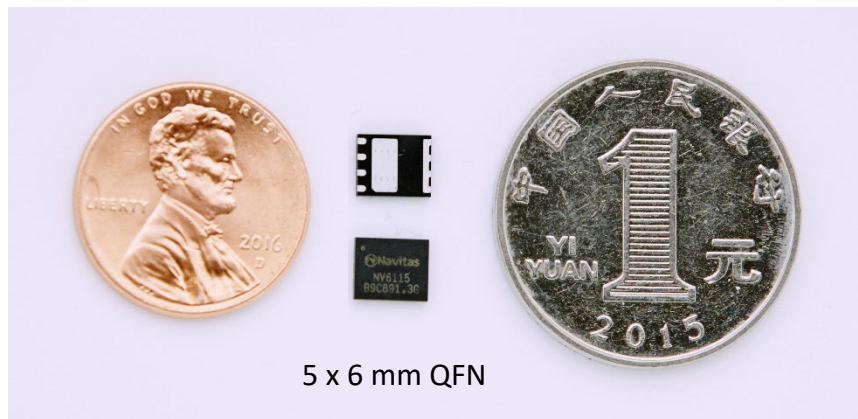
**Up to 40 MHz switching, 5x higher density & 20% lower system cost**



# Single GaNFast Power IC



- Monolithic integration, 650V
  - GaN FET
  - GaN Driver
  - GaN Logic
- “Digital In, Power Out”

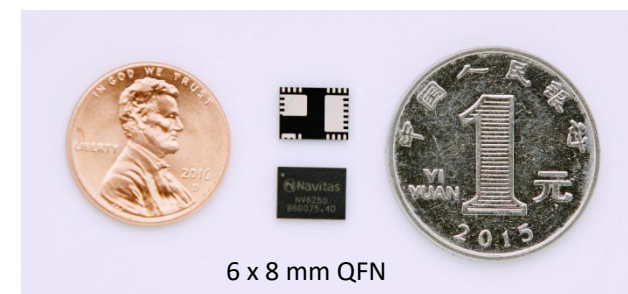
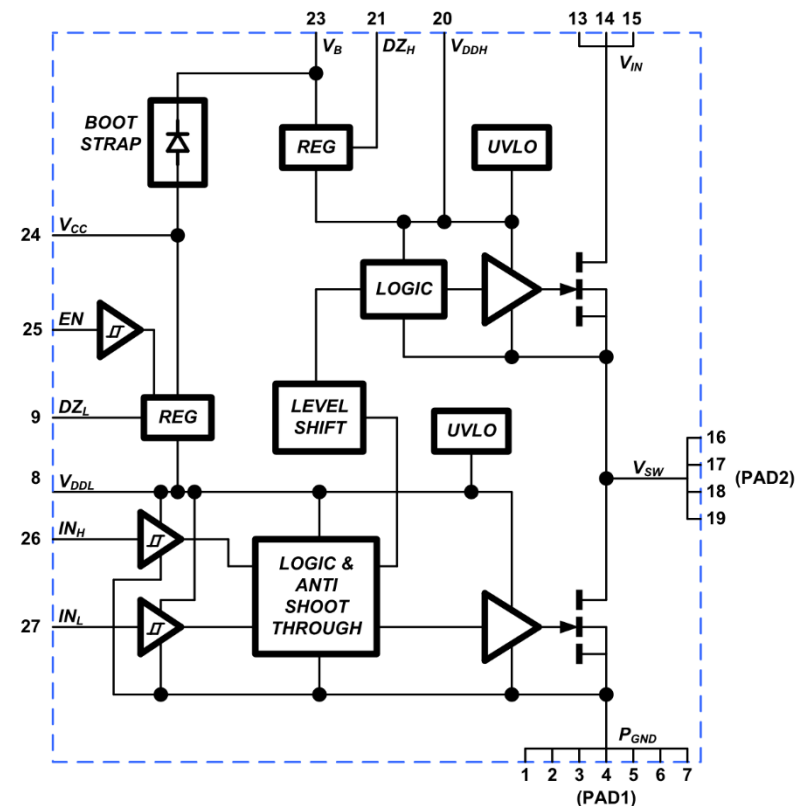
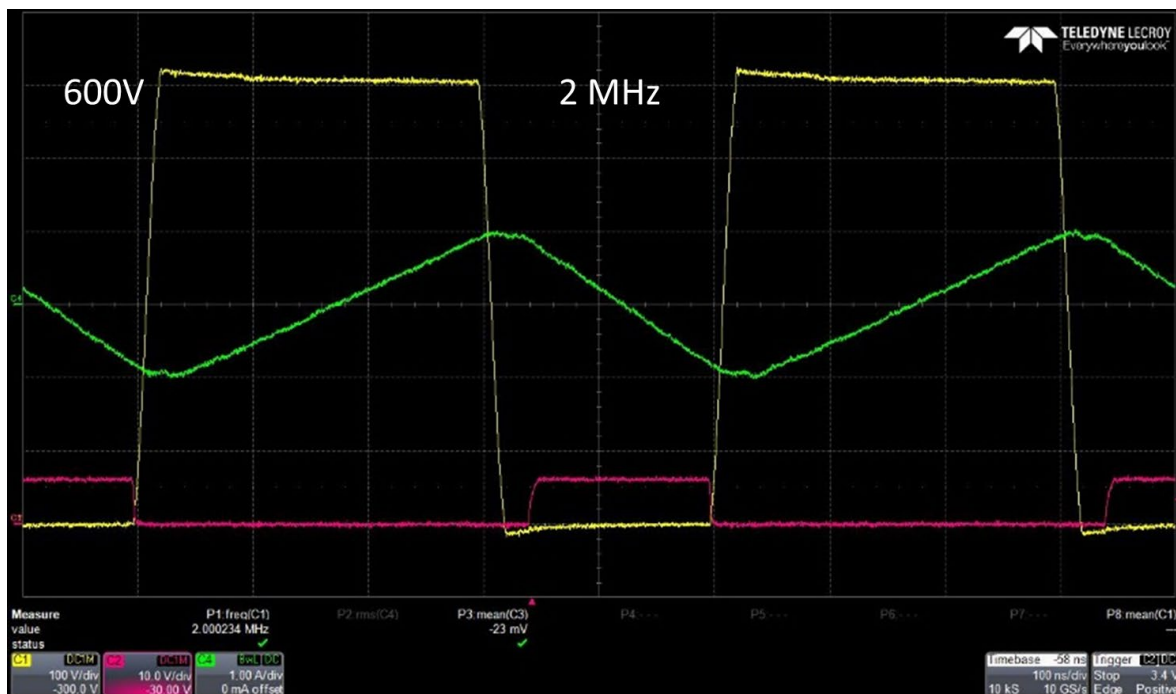






# Half-Bridge GaNFast Power IC

- Monolithic integration, 650V
  - 2x GaN FETs
  - 2x GaN drivers
  - GaN Logic (level-shift, bootstrap, UVLO, shoot-through, ESD)
- “Digital In, Power Out”

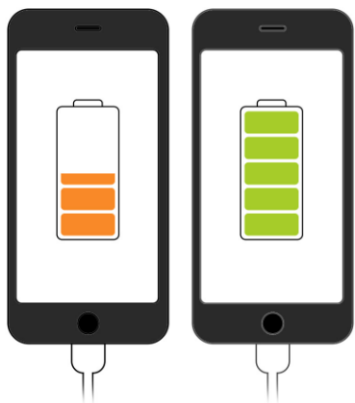




# GaNFast Chargers Are Here!

## Fast

Up to 3x more power  
Up to 3x faster charging



## Mobile

Half the size & weight  
of traditional chargers



## Universal

One charger for **ALL** your devices  
**One and Done!!**



Macbook 12" | iPhone XS | Nintendo Switch  
Dell XPS 15/13 | Google Pixel 2 | And more...

## Flexible

Charger **and** battery pack,  
**and** multiple outputs



### AUKEY

MADE IN MIND

### RAVPOWER®

### ANKER

### Apple Store



27W

24W

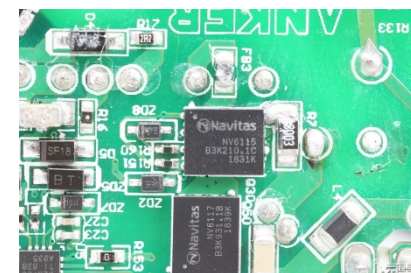
30W



45W



45W



42W (30W-C + 18W-A)  
+ 5,000 mAh

Design = Apple + Anker + Navitas



# More Power, Higher Power Density



Apple Si 18W  
42 x 41 x 27 mm  
= 47 cc, 60 g  
*(fixed AC pins)*

**AUKEY** 27W  
36 x 36 x 32 mm  
= 41.5 cc, 45 g

**70% more Power for Size**  
(1.7x W/cc)



Apple Si 61W  
73 x 73 x 28 mm  
= 149 cc, 193 g

**EGGTRONIC** 65W  
68 x 50 x 19 mm  
= 65 cc, 90 g

**140% more Power for Size**  
(2.4x W/cc)



Ultra Portability

# 3-in-1, 3x Smaller, Lighter, Cheaper

**GaNFast™**



USB-C #1 up to 65W  
USB-C #2 up to 30W  
USB-A up to 30W

Apple Si 18W  
42 x 41 x 27 mm  
= 47 cc, 60 g  
*(fixed AC pins)*

Apple Si 30W  
55.9 x 55.9 x 32 mm  
= 87 cc, 158 g

Apple Si 61W  
73 x 73 x 28 mm  
= 149 cc, 193 g

**B** Baseus GaN 65W  
75 x 35 x 32 mm  
= 84 cc, 125 g

Retail \$29

\$49

\$69

**283 cc, 411 g, \$147**



**84 cc, 125 g, \$35**



# AUKEY

*World's smallest 61W, 65W, 100W*



# World's Smallest 300W



World's Fastest Laptop:  
Asus ProArt StudioBook One  
NVIDIA Quadro RTX™ 6000

300W in 92 x 92 x 28 mm  
= 237 cc  
= 1.3 W/cc

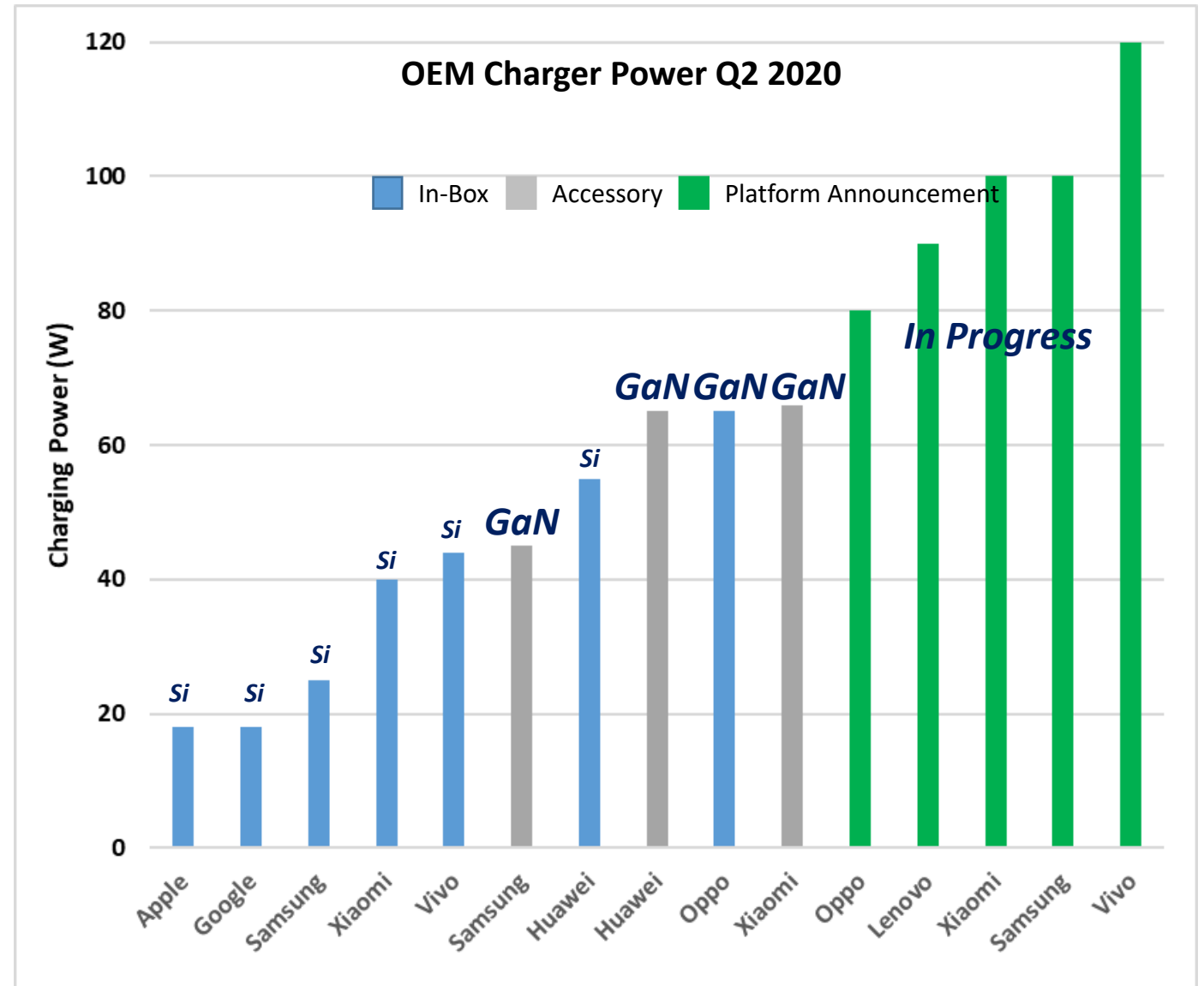




# More Power, Faster Charge



Vivo's Super FlashCharge 120W technology, claims 100% charge of a 4,000 mAh phone battery in just 13 minutes.





 **纳微 Navitas**  
**Let's go GaNFast™**

Mr. Jun LEI, Xiaomi CEO  
GaNFast 65W charger for the Mi 10 and Mi 10 PRO  
February 13<sup>th</sup> 2020

雷军先生 小米首席执行官  
全球旗舰产品发布时, 推出GANFast 65W充电器  
Mi 10和Mi 10 PRO 2020年2月13日

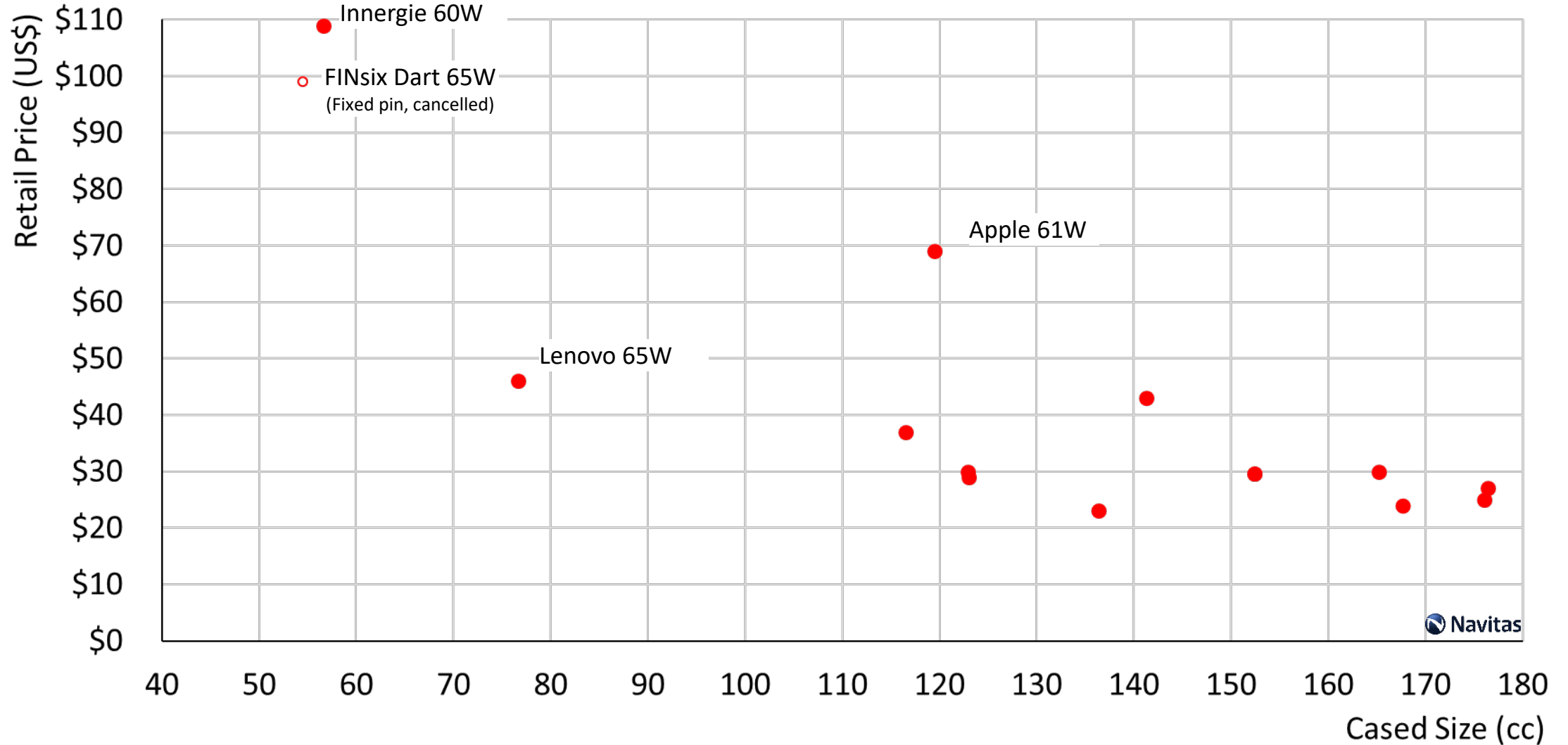


World's smallest 65W charger  
世界上最小的65W充电器



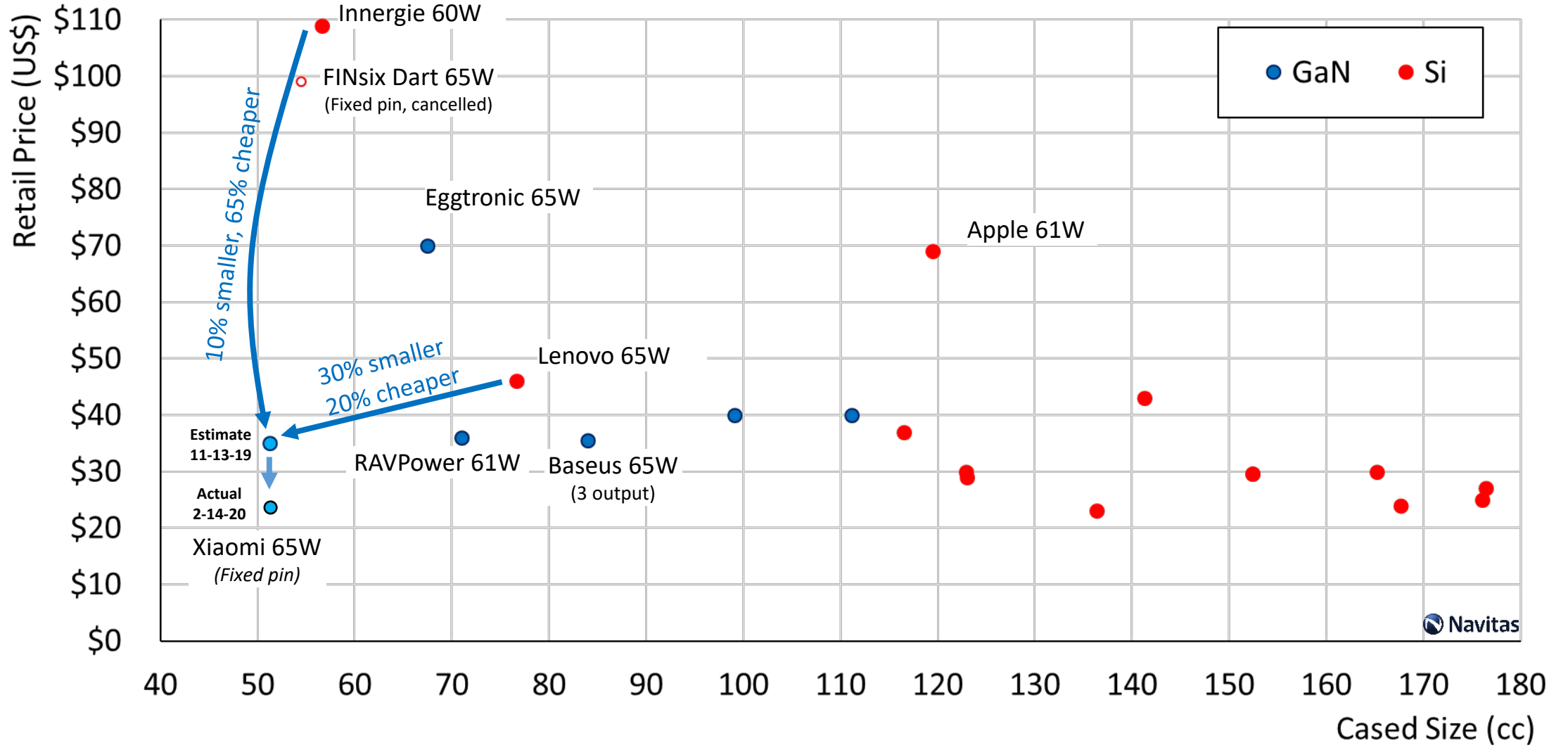


# Si: Size and Price (60-65W USB-PD)





# GaN: Smaller and Cheaper

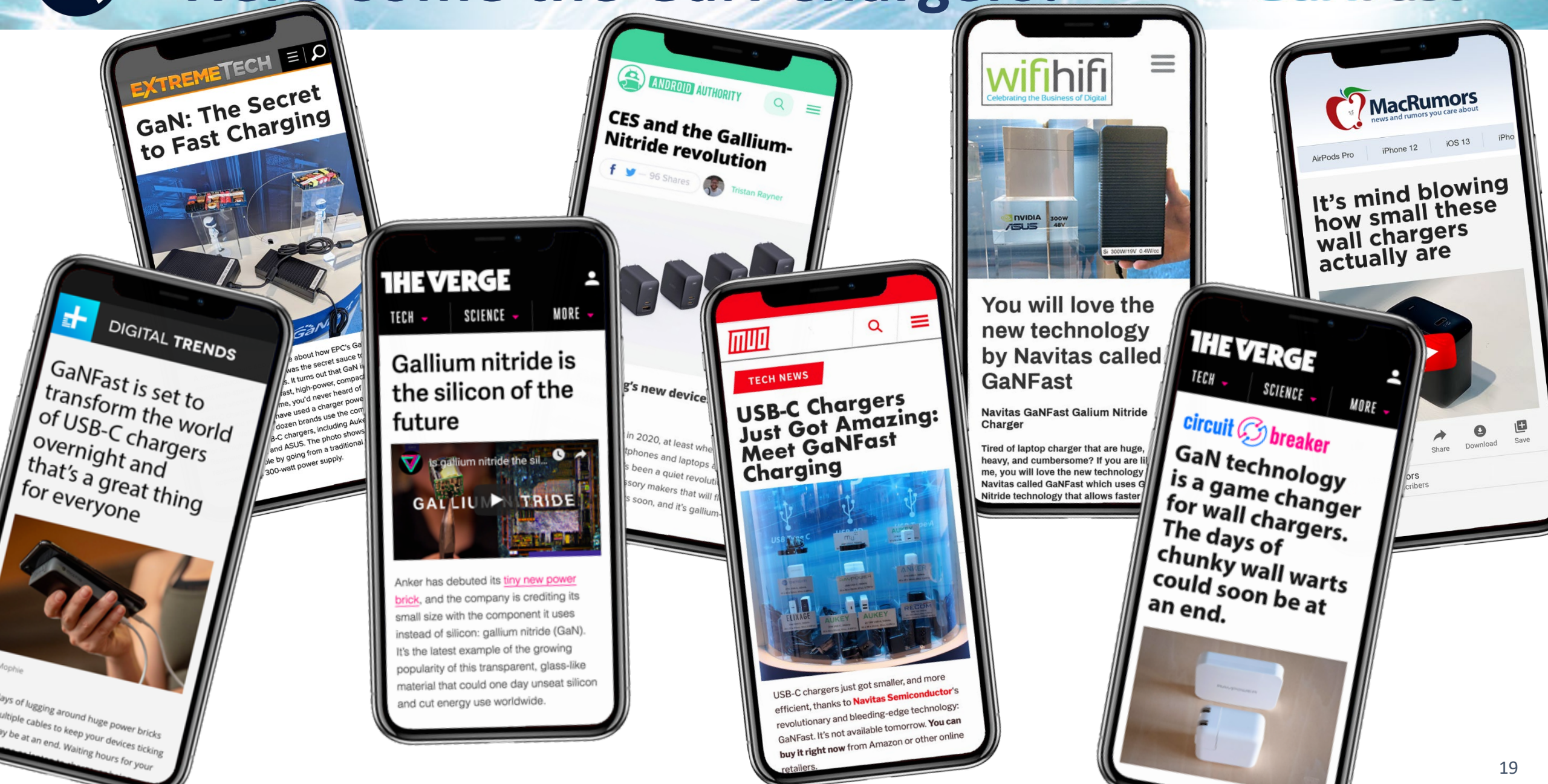


Source: Navitas research  
 Survey of universal AC-input, USB-PD chargers Nov 13<sup>th</sup> 2019. Folding pins unless otherwise stated. 6 Si chargers with >20% 1-star (negative) reviews excluded



# Here Come the GaN Chargers!

GaNFast™



**EXTREME TECH**  
**GaN: The Secret to Fast Charging**

**ANDROID AUTHORITY**  
**CES and the Gallium-Nitride revolution**  
96 Shares  
Tristan Rayner

**wifi hifi**  
Celebrating the Business of Digital  
**300W 48V**  
ASUS  
NVIDIA  
300W/110V G-4W/2C

**MacRumors**  
news and rumors you care about  
AirPods Pro iPhone 12 iOS 13 iPho  
**It's mind blowing how small these wall chargers actually are**

**DIGITAL TRENDS**  
**GaNFast is set to transform the world of USB-C chargers overnight and that's a great thing for everyone**

**THE VERGE**  
TECH SCIENCE MORE  
**Gallium nitride is the silicon of the future**  
Anker has debuted its **tiny new power brick**, and the company is crediting its small size with the component it uses instead of silicon: gallium nitride (GaN). It's the latest example of the growing popularity of this transparent, glass-like material that could one day unseat silicon and cut energy use worldwide.

**MUO**  
TECH NEWS  
**USB-C Chargers Just Got Amazing: Meet GaNFast Charging**  
USB-C chargers just got smaller, and more efficient, thanks to **Navitas Semiconductor's** revolutionary and bleeding-edge technology: GaNFast. It's not available tomorrow. **You can buy it right now** from Amazon or other online retailers.

**You will love the new technology by Navitas called GaNFast**  
Navitas GaNFast Gallium Nitride Charger  
Tired of laptop charger that are huge, heavy, and cumbersome? If you are like me, you will love the new technology Navitas called GaNFast which uses Gallium Nitride technology that allows faster

**THE VERGE**  
TECH SCIENCE MORE  
**circuit breaker**  
**GaN technology is a game changer for wall chargers. The days of chunky wall warts could soon be at an end.**



# *Here come the GaN chargers*

Visit [www.GaNFast.com](http://www.GaNFast.com) for more!