

POWER  CONFERENCE 2019



# Navitas

Let's go **GaNFast™**

Optimized for Performance and Price:  
**Here Come the GaN Chargers!**

Munich Airport Hilton, December 3rd 2019  
Stephen Oliver, VP Sales & Marketing, Navitas Semiconductor  
[stephen.oliver@navitassemi.com](mailto:stephen.oliver@navitassemi.com), +1-978-289-2364



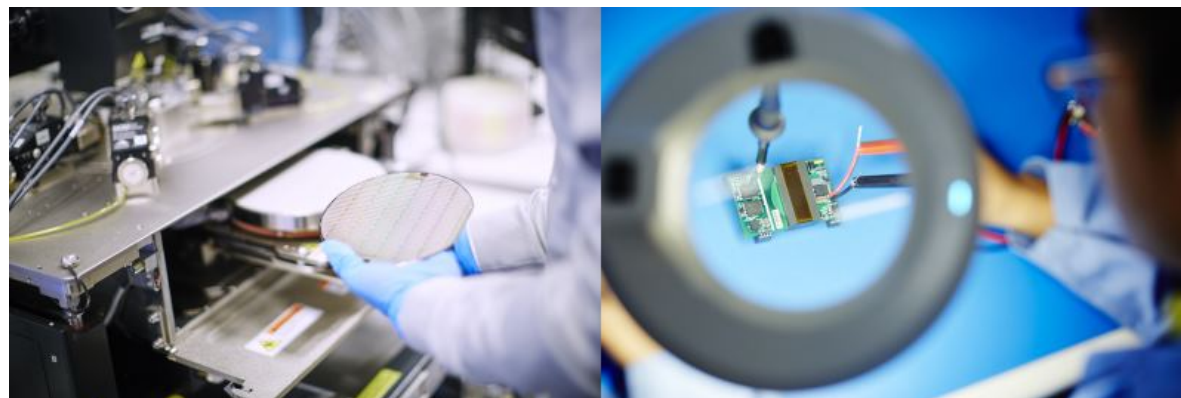




# Navitas Semiconductor Inc.



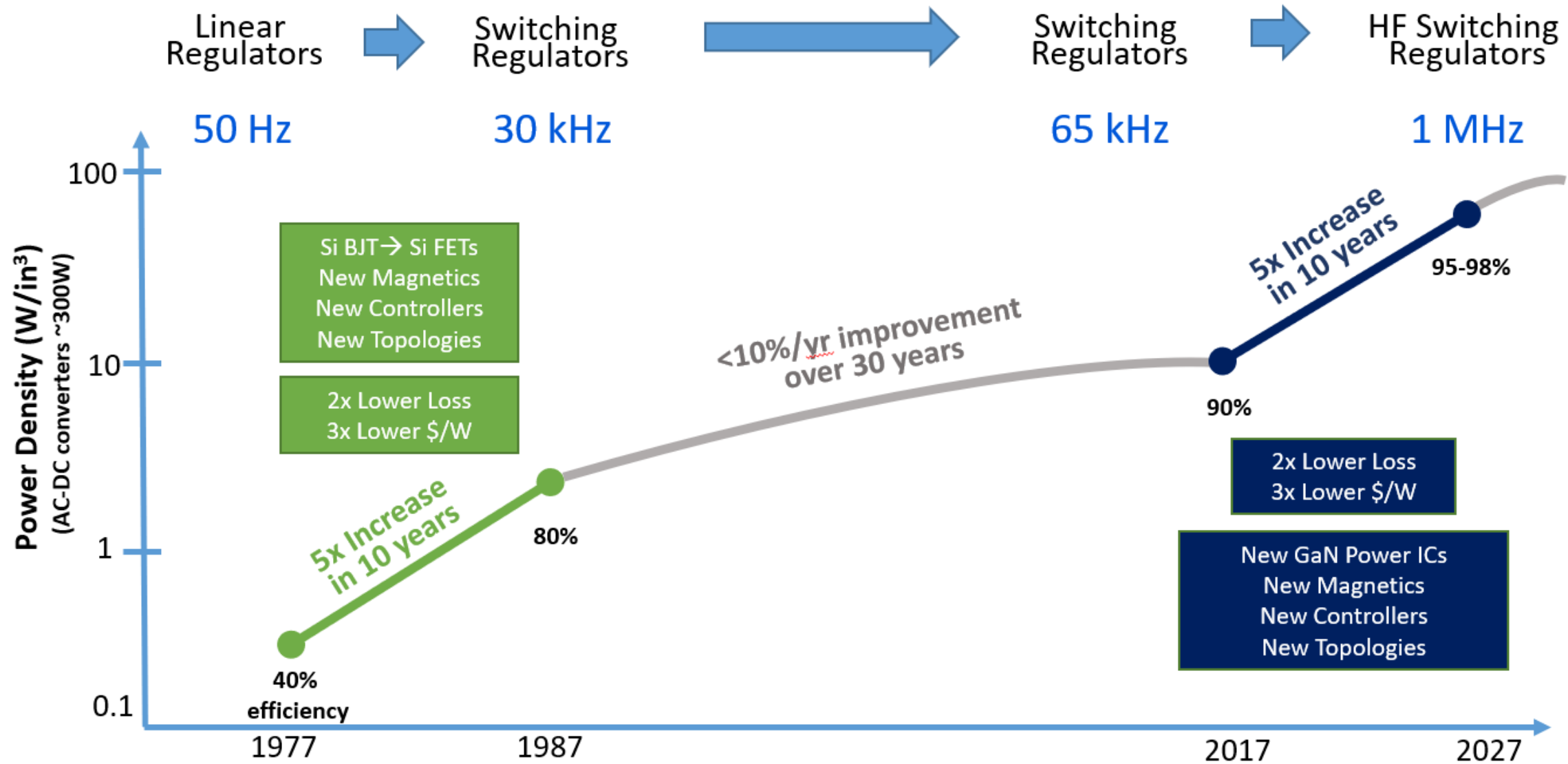
- World's first & only GaN power IC company
  - Production released with fast revenue ramp
  - Qualified 'Beyond JEDEC', zero ppm field returns
  - 1M+ shipped, 6-12 weeks leadtime
- Navitas: Latin for *Energy*
  - **Energy** savings
  - *Bringing a new Energy to power electronics*
- Founded January 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



# Today's Power Revolution





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



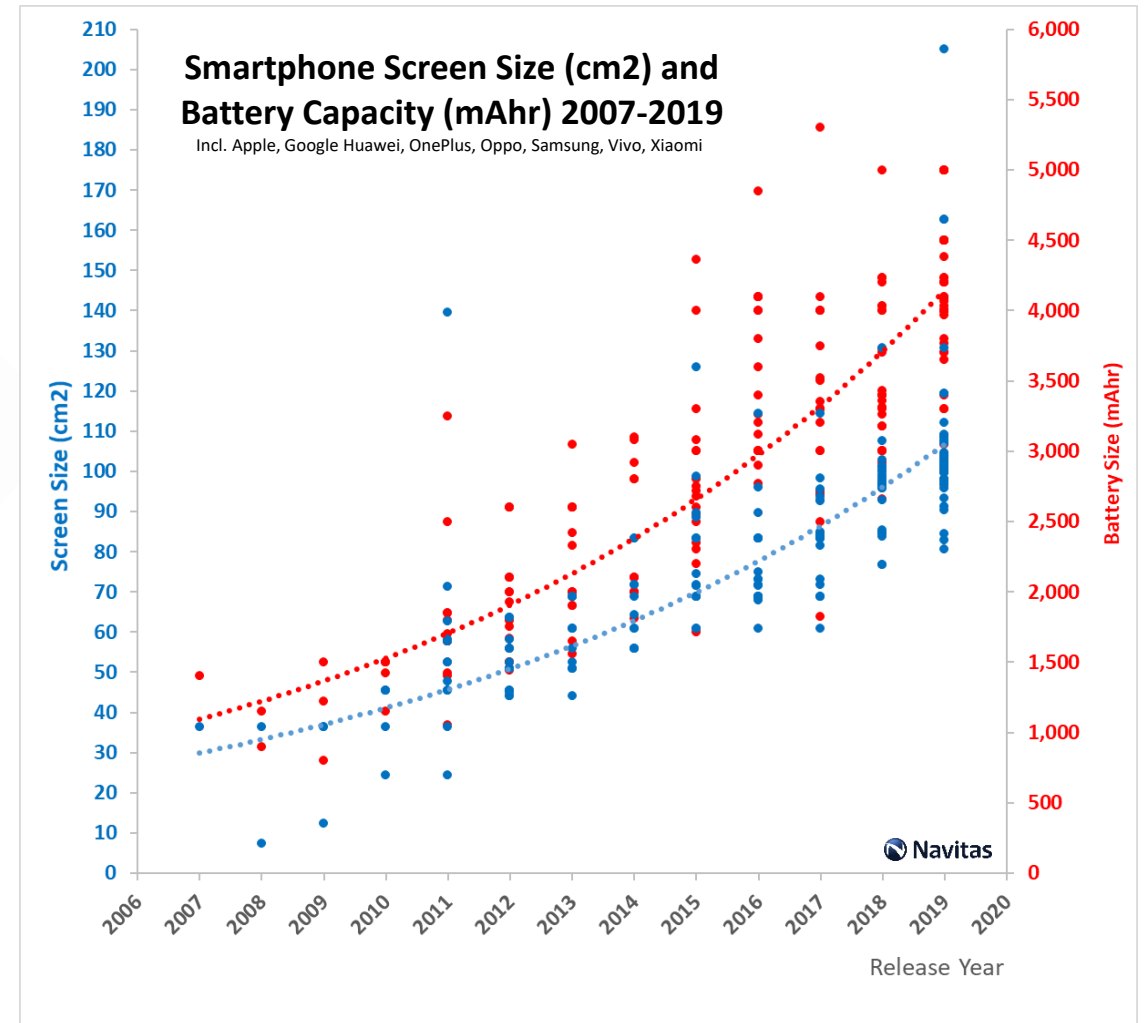
2007  
Apple  
iPhone 1  
36.5 cm<sup>2</sup>  
1,400 mAh



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



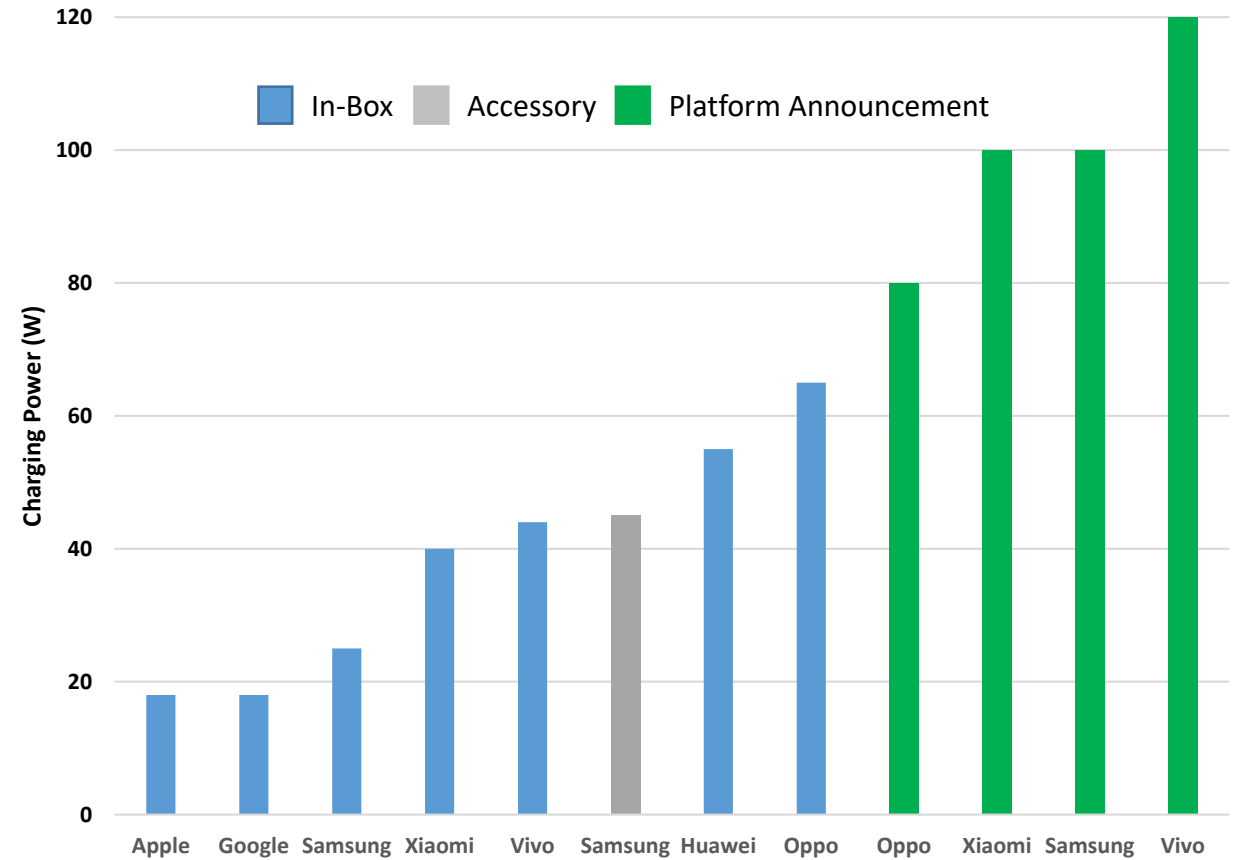


# More Power, Faster Charge



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

### OEM Charger Power 2019





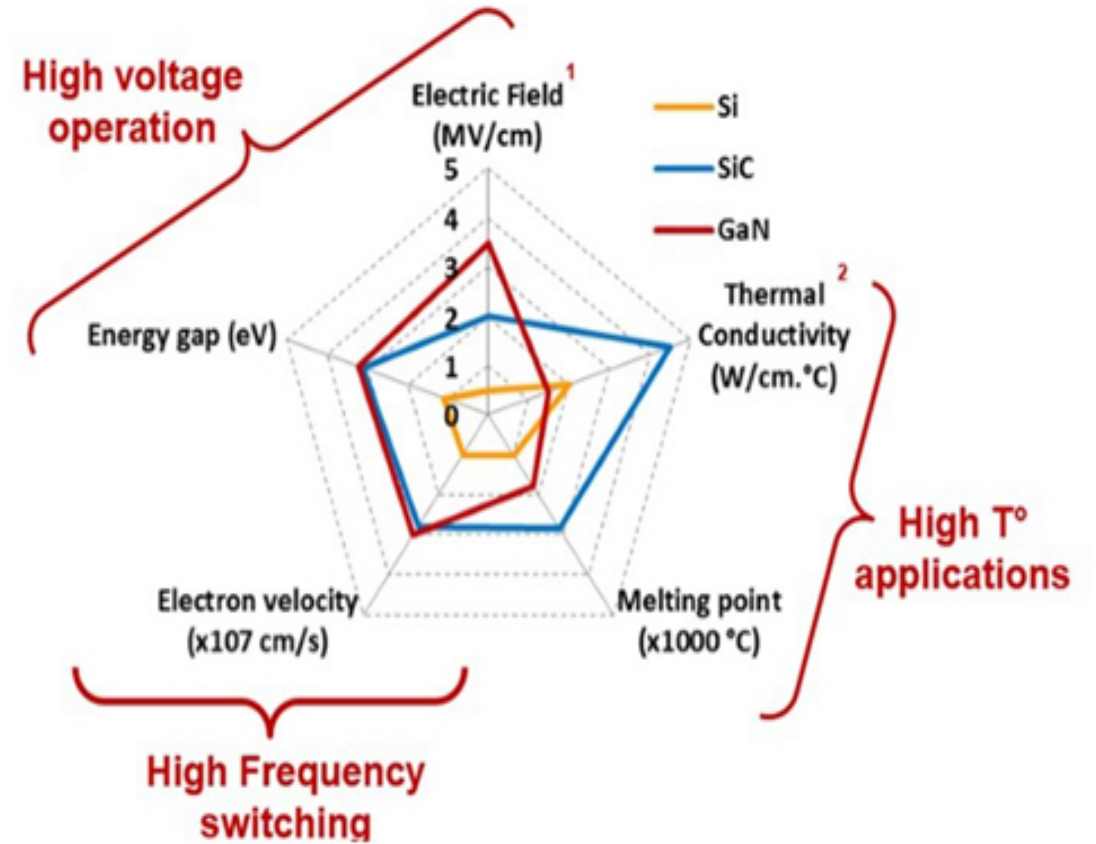
# Enabling Technology: GaN



*GaN replaces silicon, electrifies applications around the world*

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

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



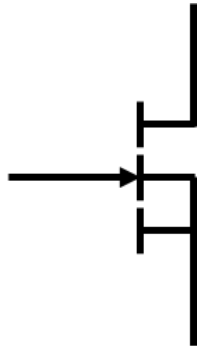




# World's First GaNFast™ Power ICs



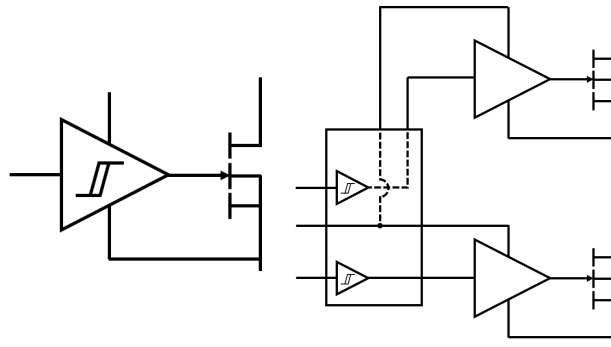
**Fastest, most efficient  
GaN Power FETs**



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



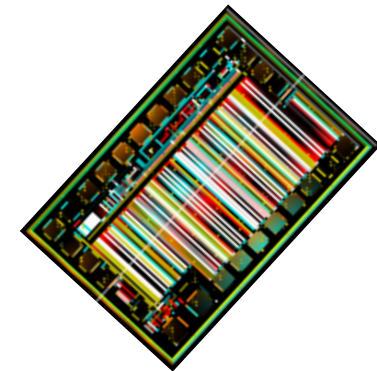
**First & Fastest Integrated  
GaN Gate Drivers**



>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**

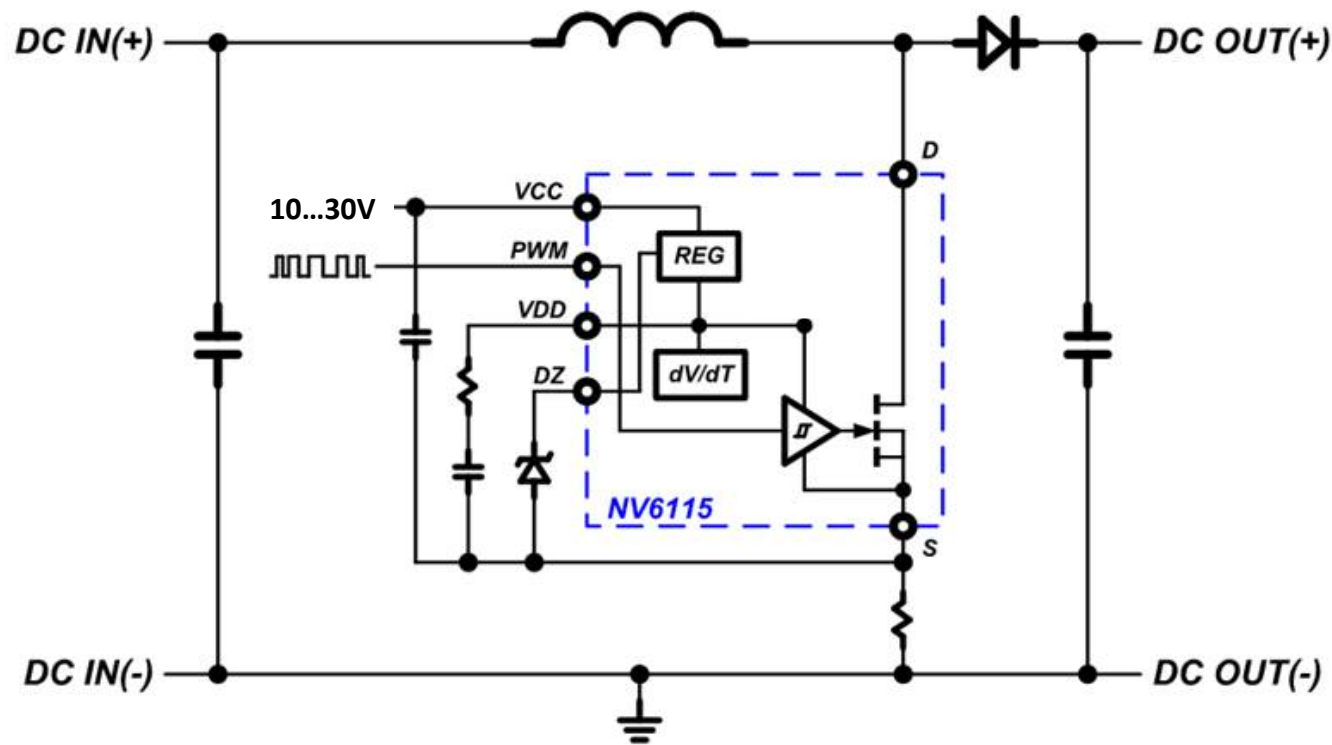
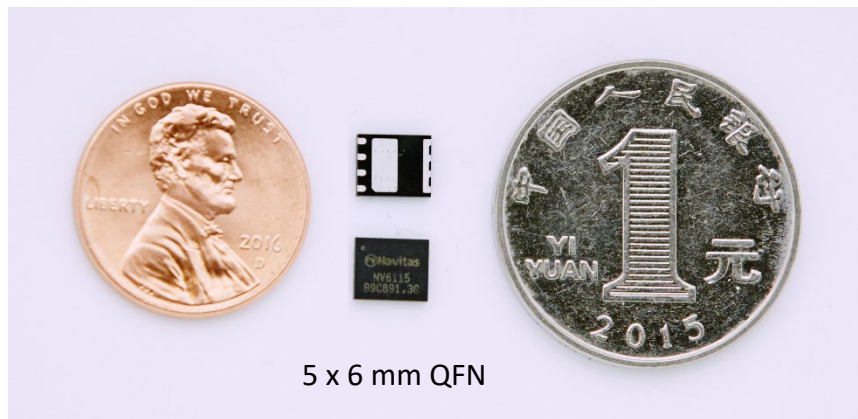




# Single GaNFast Power IC



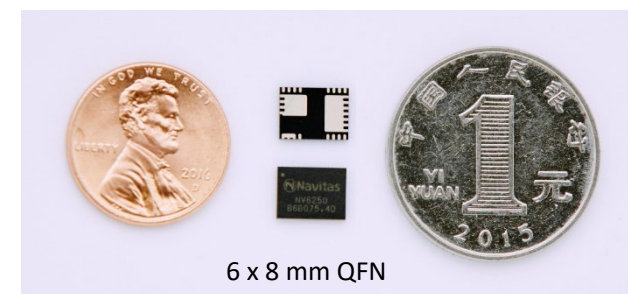
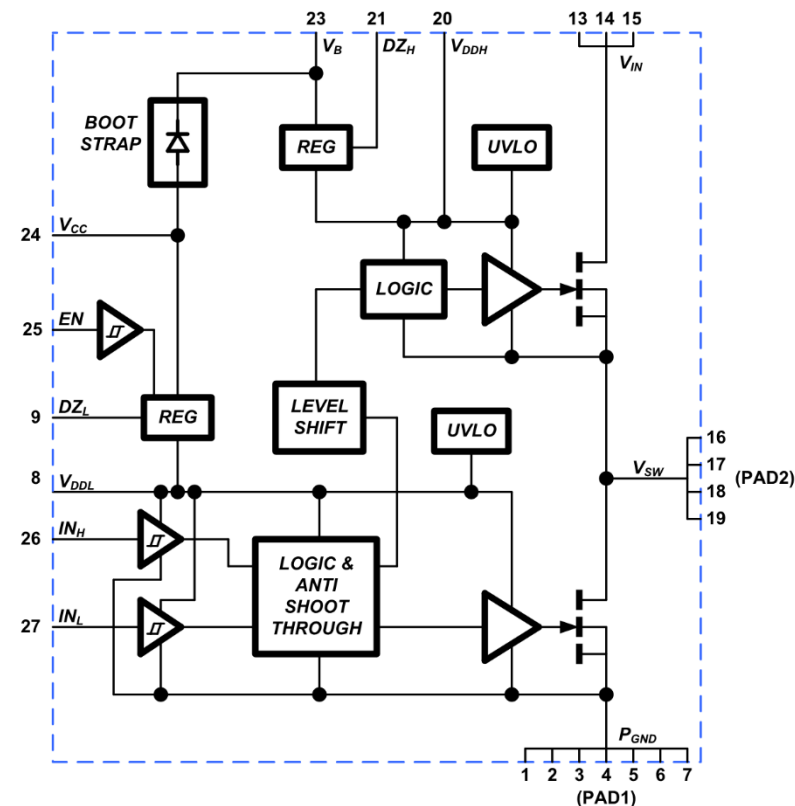
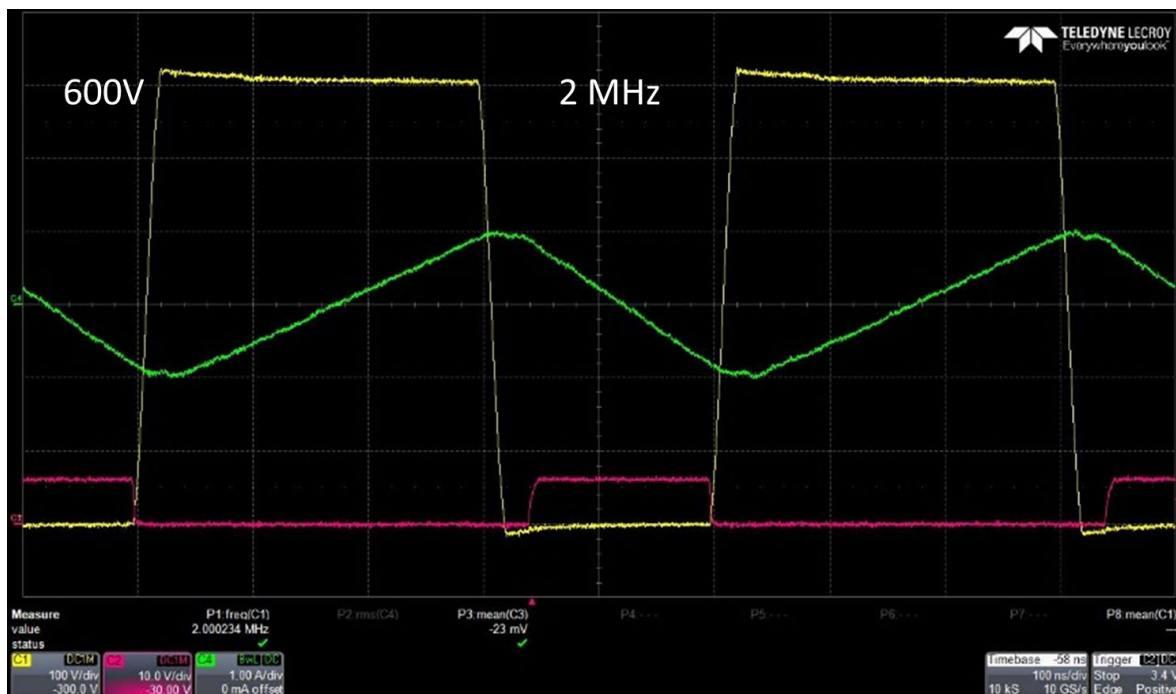
- Monolithic integration, 650V
  - GaN FET
  - GaN Driver
  - GaN Logic
- “Digital In, Power Out”





# 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”



6 x 8 mm QFN



# Reliability → Qualification → Release



Reliability models on IC building blocks = Robust design

Mission profile driven reliability = Protected Customer

Comprehensive reliability monitoring

Reference	Test Conditions	Duration	Lots	S.S.	
JESD22-A113 J-STD-020	Preconditioning (MSL1): Moisture Preconditioning + 3x reflow: HAST, UHAST, TC & PC	N/A	3	308	PASS (0/308)
JESD22-A104	Temperature Cycle: -55°C / 150°C	1,000cy	3	77	PASS (0/231)
JESD22-A122	Power Cycle: Delta Tj = 100°C	10,000cy	3	77	PASS (0/231)
JESD22-A110	Highly Accelerated Stress Test: 130°C / 85%RH / 100V V <sub>DS</sub>	96hrs	3	77	PASS (0/231)
JESD22-A108	High Temperature Reverse Bias: 150°C / 520V V <sub>DS</sub>	1,000hrs	3	77	PASS (0/231)
JESD22-A108	High Temperature Gate Bias: 150°C / 6V V <sub>GS</sub>	1,000hrs	3	77	PASS (0/231)
JESD22-A108	High Temperature Operating Life	1,000hrs	3	77	PASS (0/231)
JESD22-A108	Early Life Failure Rate	24 hrs	3	1,000	PASS (0/3,000)
JS-001-2014	Human Body Model ESD	N/A	1	3	PASS 0/3
JS-002-2014	Charged Device Model ESD	N/A	1	3	PASS 0/3

Metric	Results
Equivalent device hours tested*	1.7 billion hours
FIT*	0.54

**GaNFast™ Power ICs**

Quality

Speed

Efficiency

Now in high volume production!

\*Calculated from HTOL tests

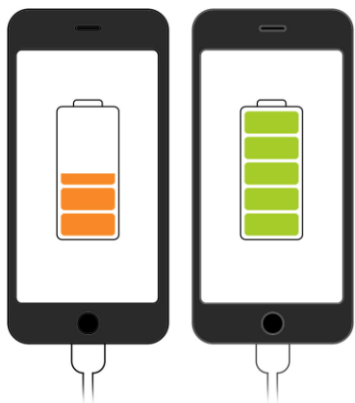




# GaNFast Chargers Are Here!

## 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

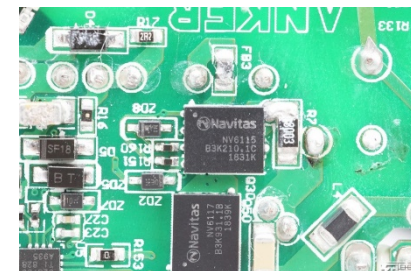
30W



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



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





# 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



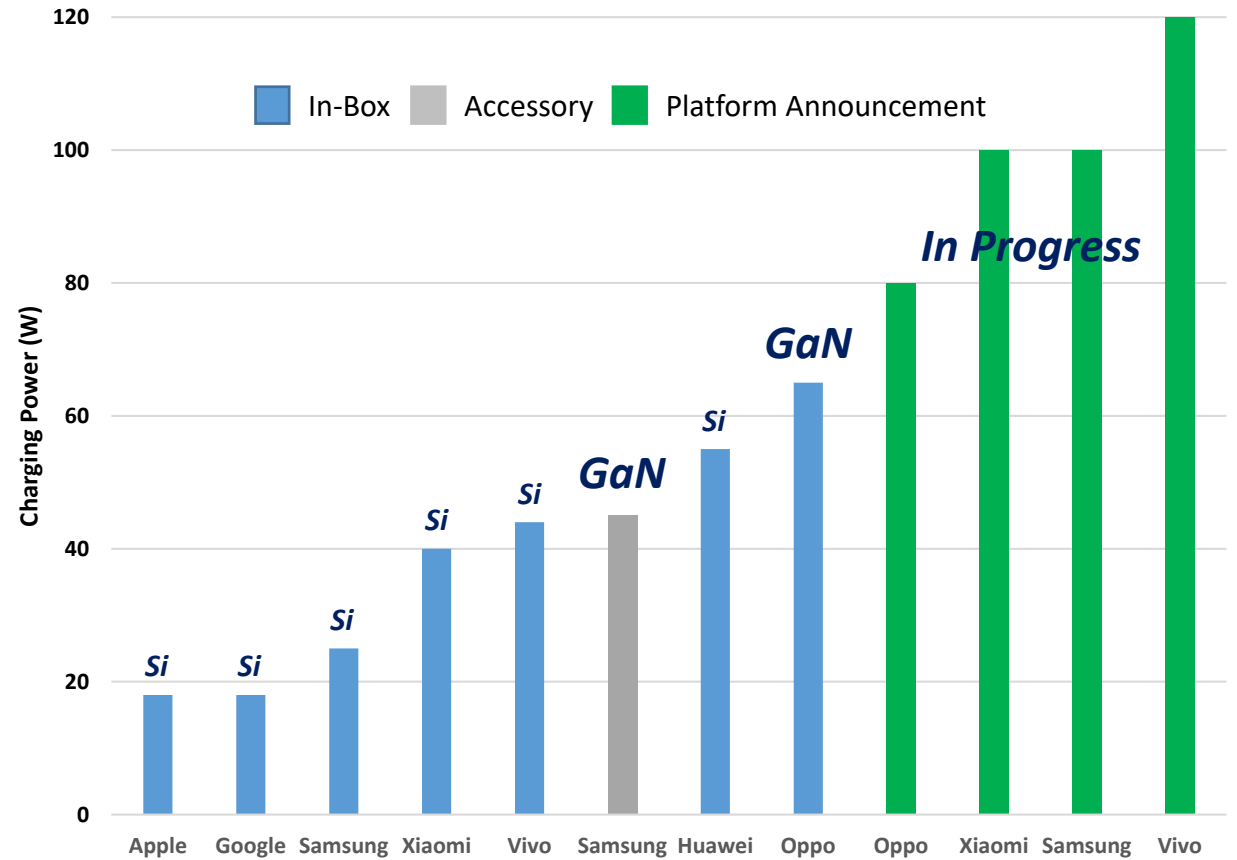


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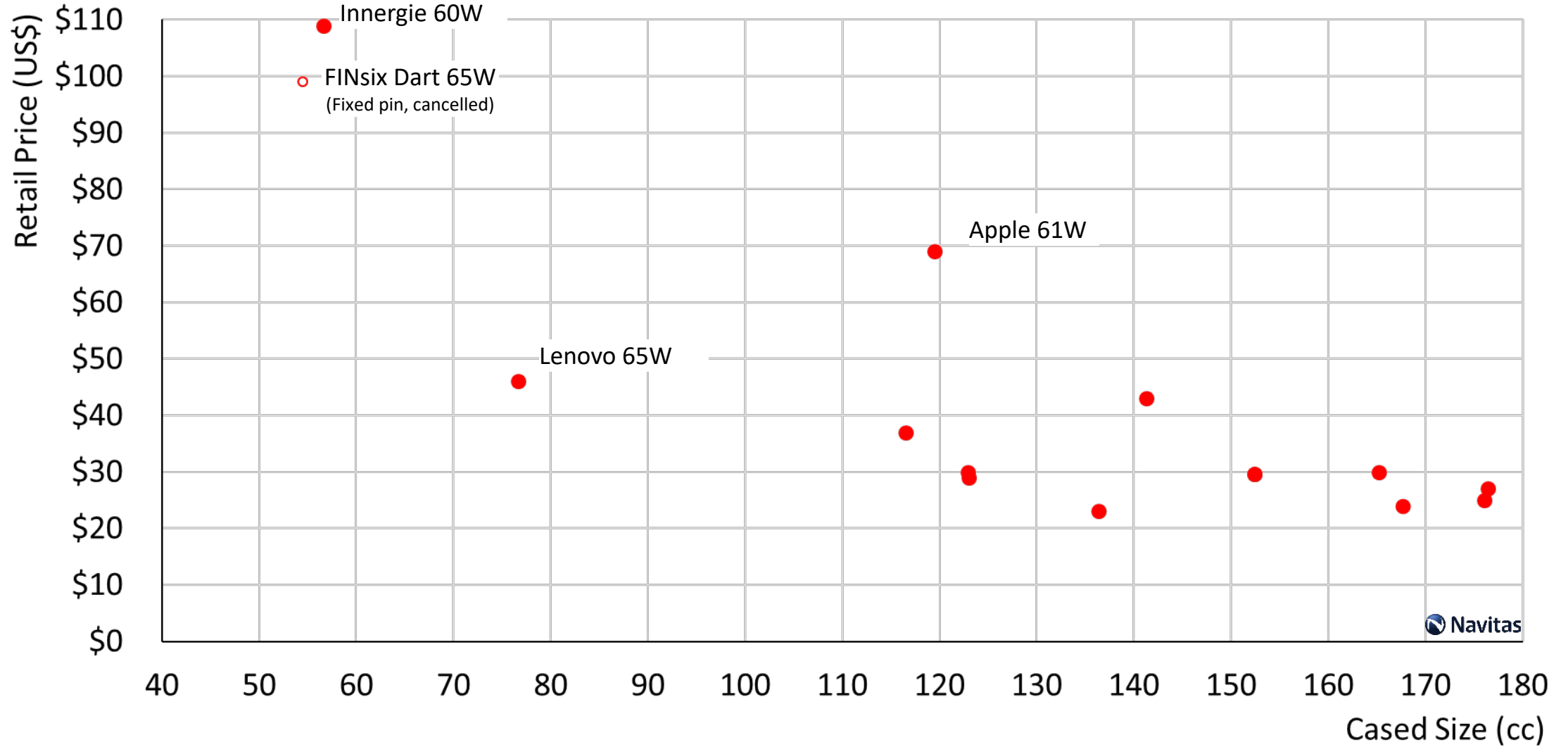
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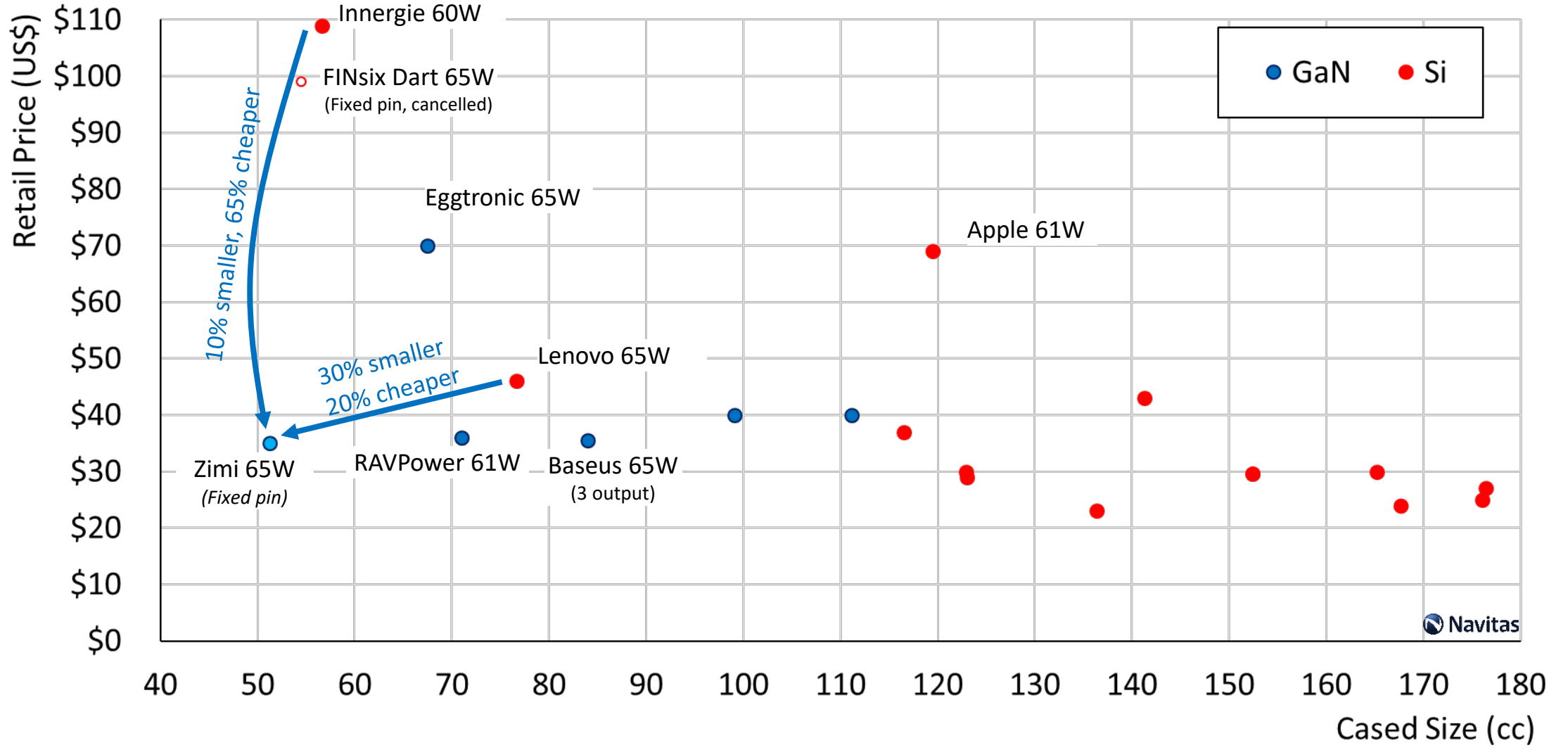
# Si: Size and Price (60-65W USB-PD)







# 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*

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