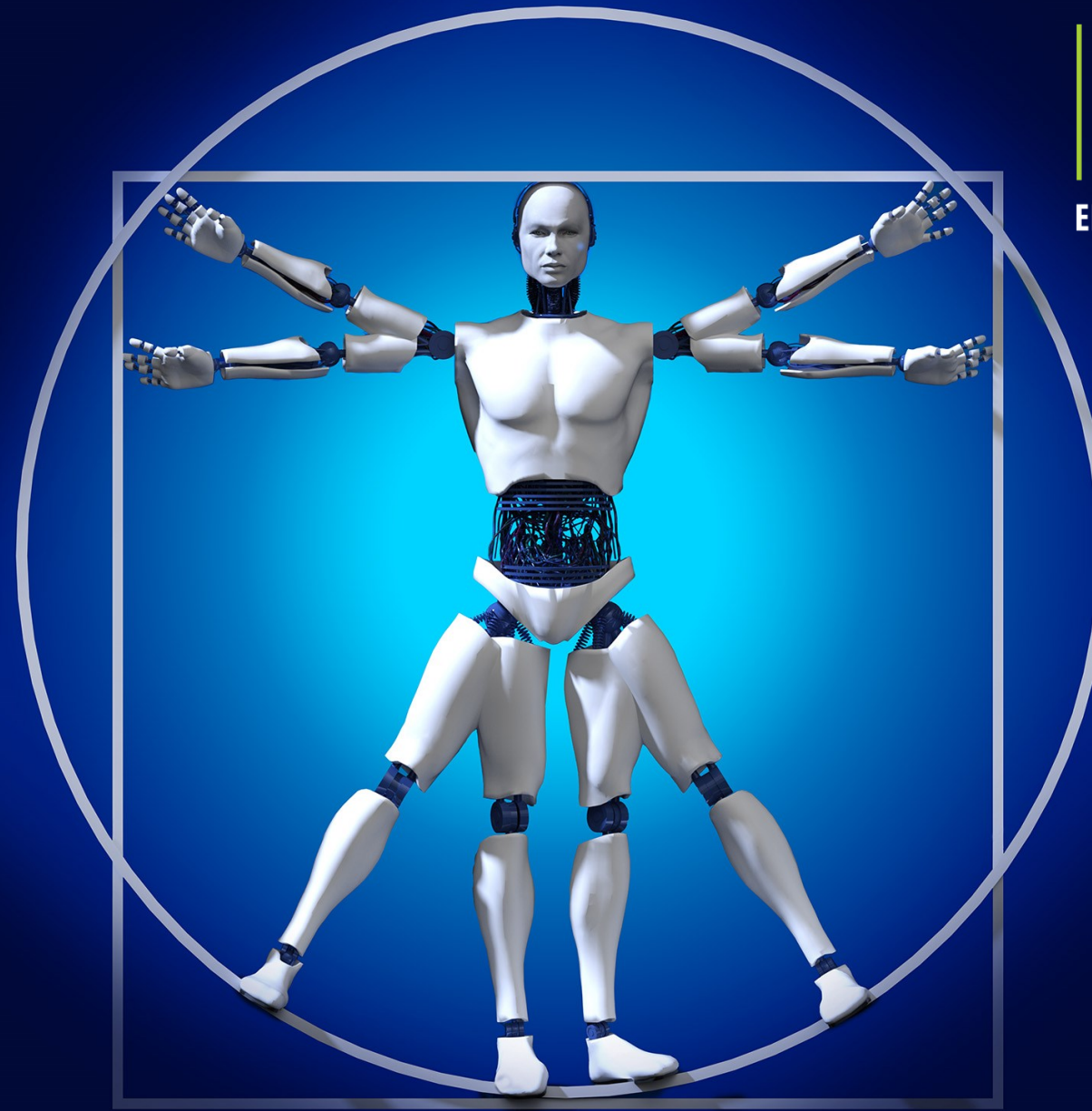
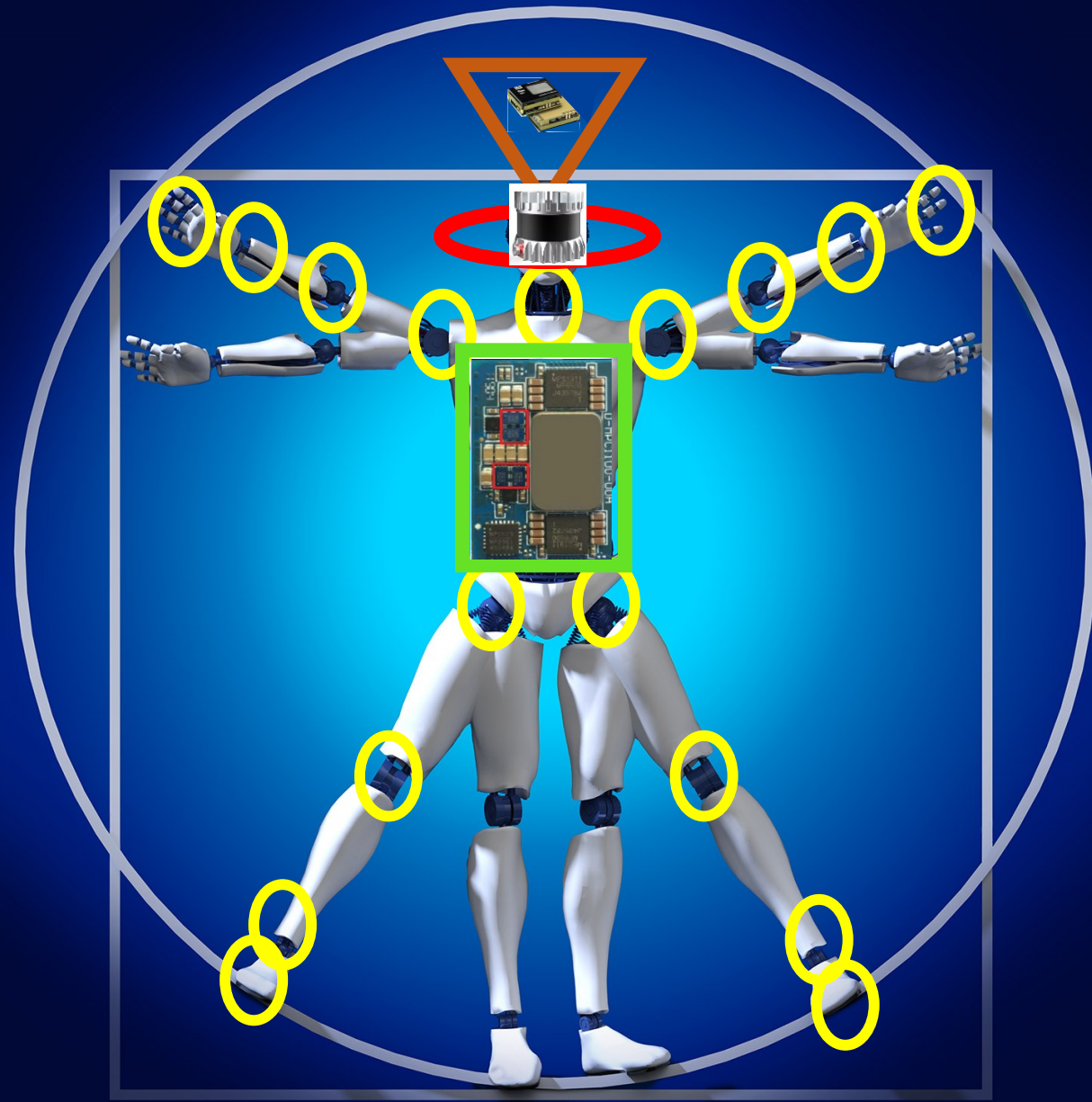


**Alex Lidow**  
**CEO EPC**

August 2024



# GaN and the Future of Untethered Robots



- 40 motors
- Lidar
- DC-DC
- AI DC-DC

# GaN Benefits in BLDC Motor Drives

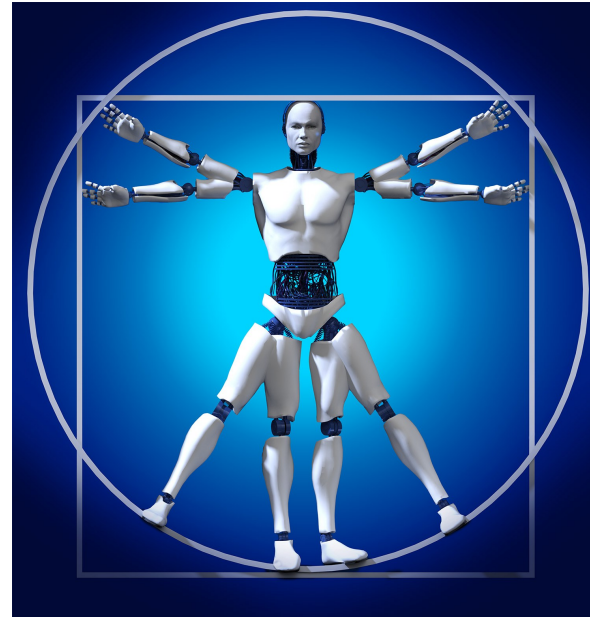
GaN FET/ICs switch fast with  $Q_{RR} = 0$

Higher switching frequency

Lower dead time

Electrolytic capacitor  
elimination. Reduced  
motor losses

Higher torque per  
Ampere



Improves **inverter & motor system efficiency**

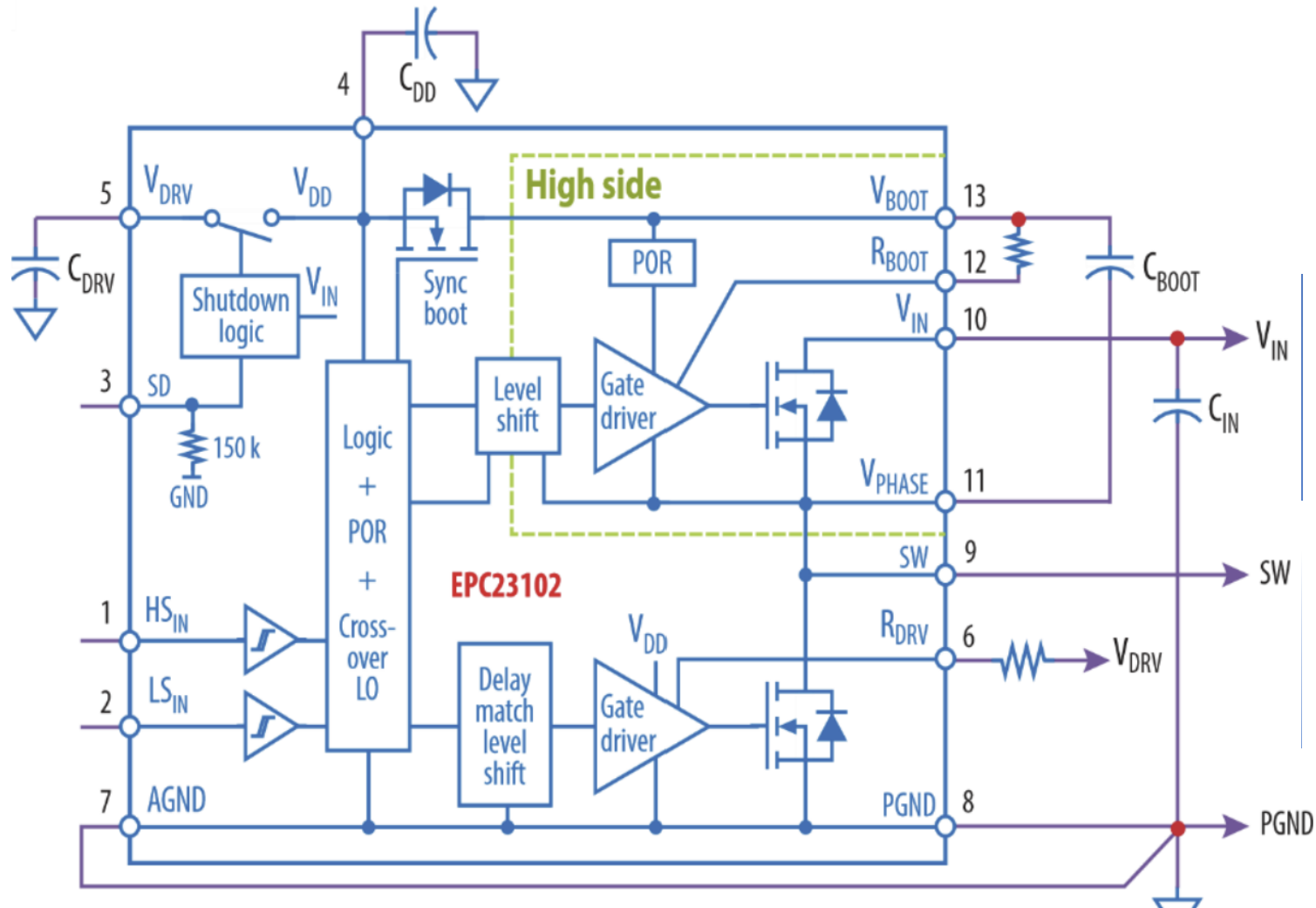
Reduces size & weight by integrating the inverter inside the motor

# Higher Efficiency, Smaller Size, Lower Cost

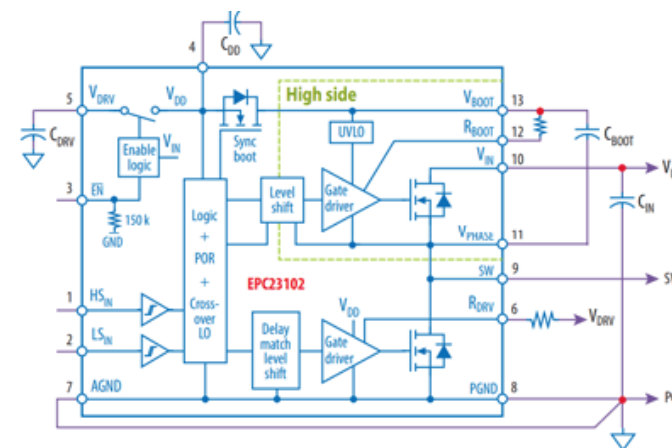
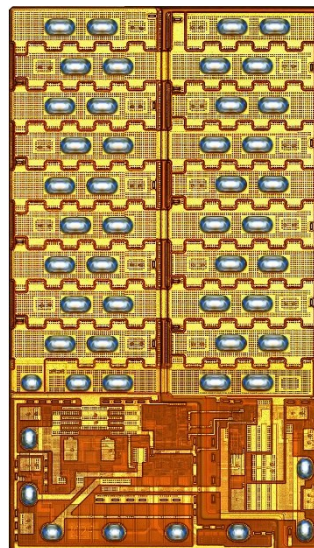
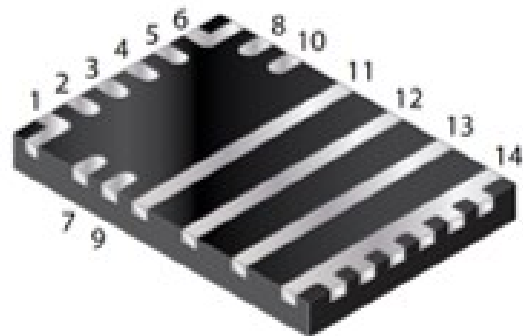


Setup	<u>MOSFET Inverter</u> 20 kHz, 500 ns dead time 400 RPM, 5 A <sub>RMS</sub>	<u>GaN Inverter</u> 100 kHz, 21 ns dead time 400 RPM, 5 A <sub>RMS</sub>
Input Inductance	2.7 μH	None
Input capacitor	660 μF electrolytic	44 μF ceramic
P <sub>IN</sub>	121.3 W	113.3 W
P <sub>OUT</sub>	119.6 W	111.3 W
η <sub>inverter</sub>	98.5 %	98.2%
Speed	42.25 rad/s	41.94 rad/s
Torque	1.876 N·m	1.940 N·m
P <sub>mech</sub>	79.3 W	<b>81.36 W</b>
η <sub>motor</sub>	66.3 %	73.1 %
η total efficiency	<b>65.3 %</b>	<b>71.8 %</b>

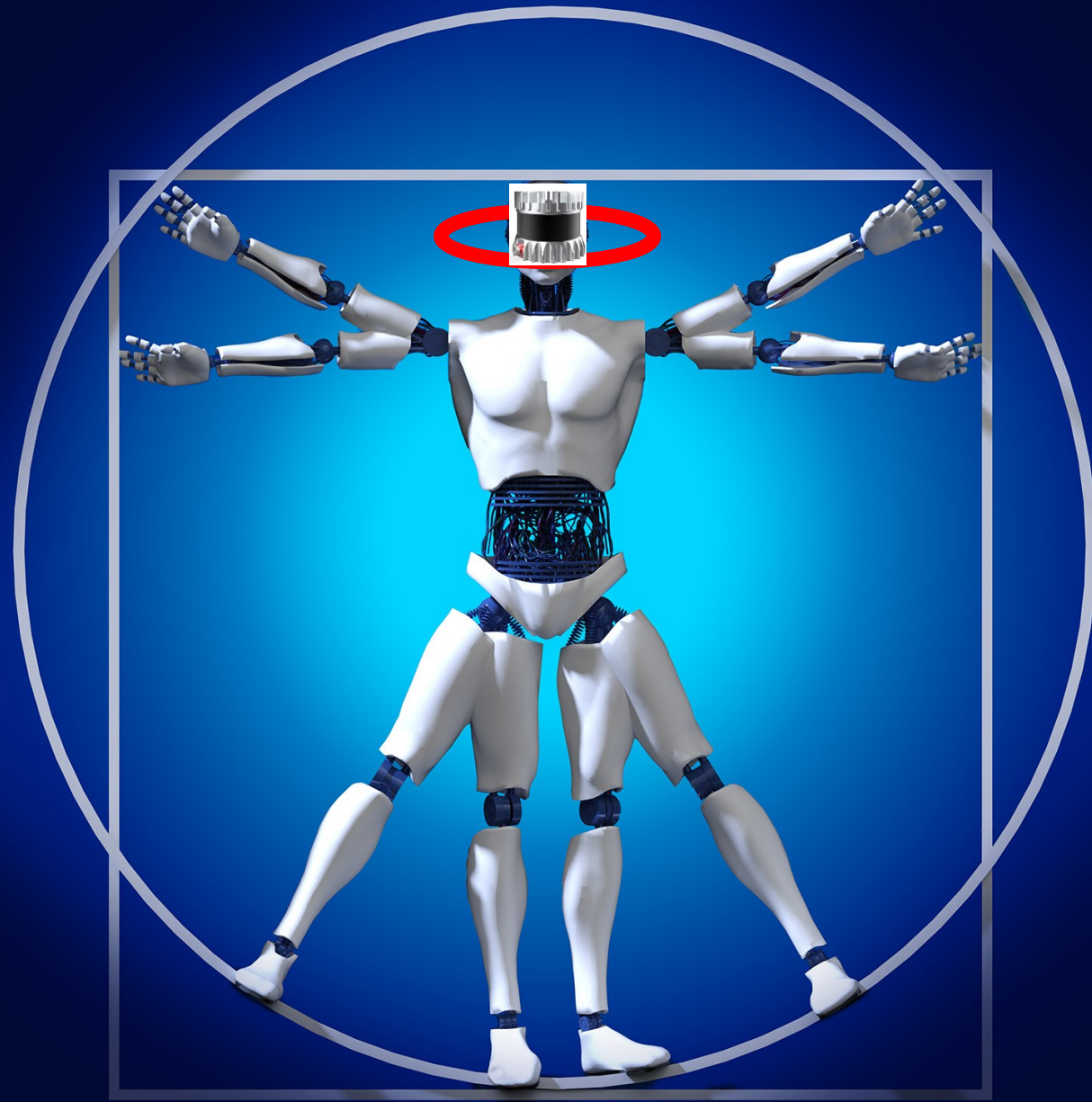
# Monolithic GaN Power Stage



# Power Stage ICs



Industrial	Format	Package	Size	Samples	Launch
EPC2152	HB+DR 10A	CSP	10mm <sup>2</sup>	Now	Q4'24
EPC23102	HB+DR 30A	FCQFN	3.5X5 mm	Now	Q4'24
EPC23104	HB+DR 7A	FCQFN	3.5X5mm	Now	Q4'24
EPC23100	LS FET + DR	FCQFN	3X5 mm	TBD	TBD



# GaN Benefits in Lidar

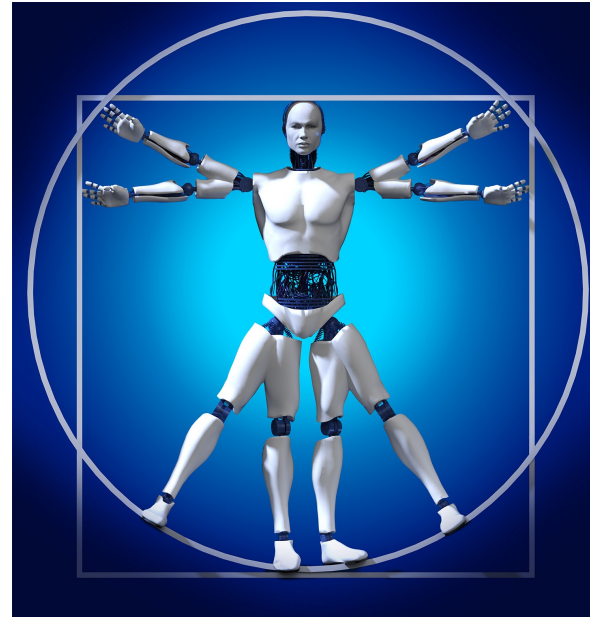
GaN FET/ICs switch fast with very high current

Higher switching speed

High Current

Better resolution  
and  
Faster frame rate

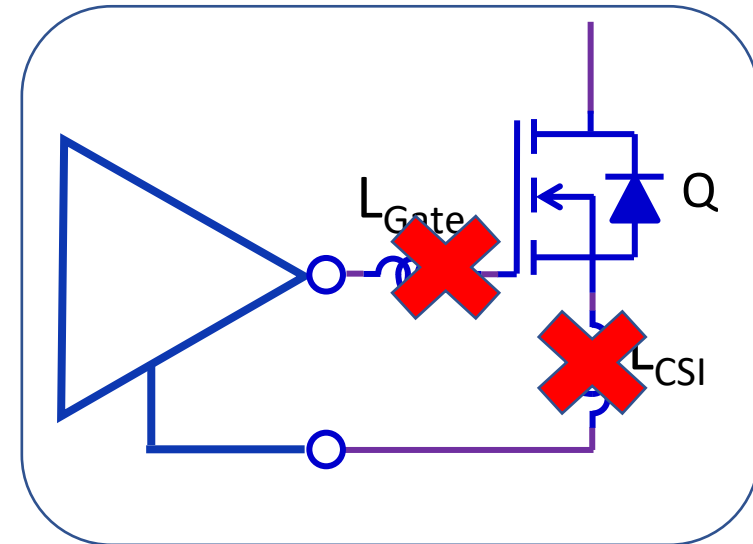
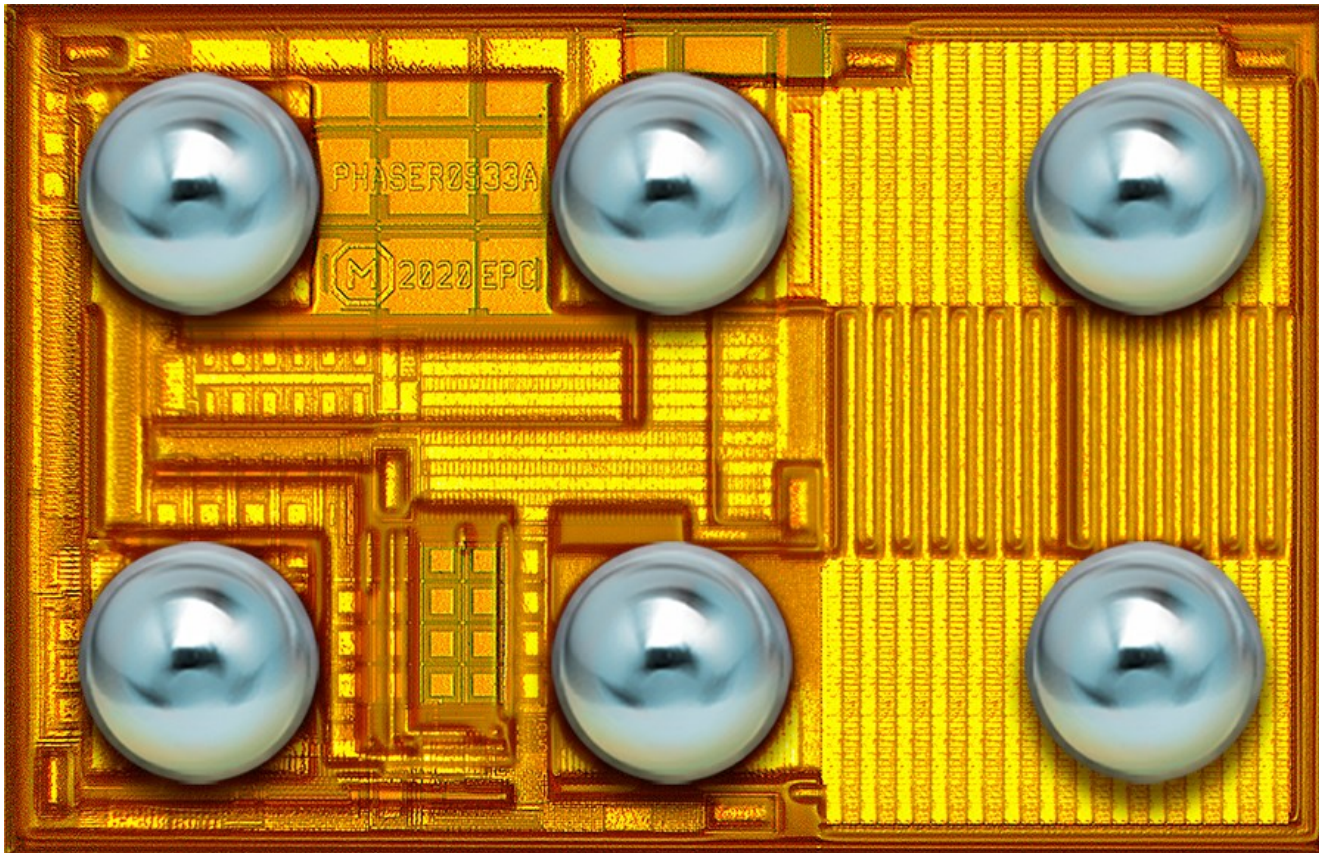
Longer distance  
and  
Smaller size



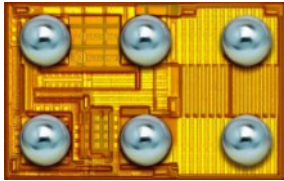
Improves **resolution, visible distance, frame rate, and size**



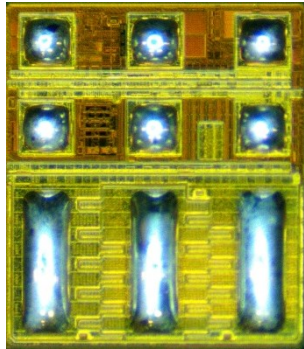
# eGaN<sup>®</sup> FET Plus Driver



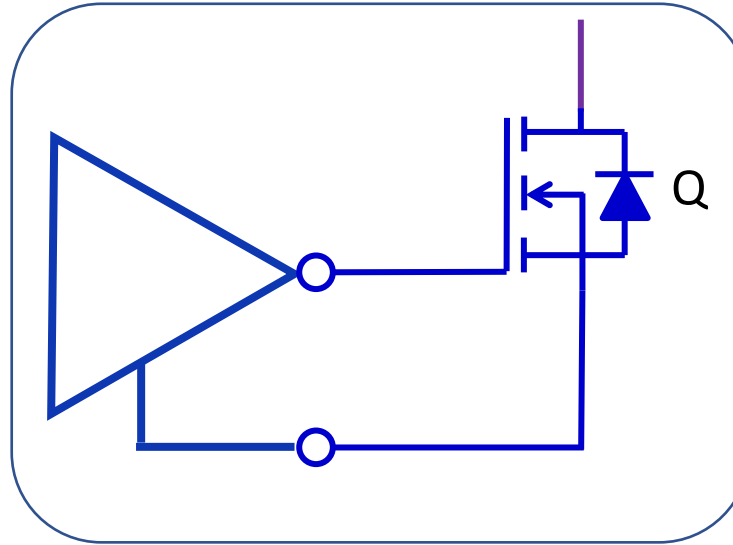
# LiDAR ICs



EPC21601/3

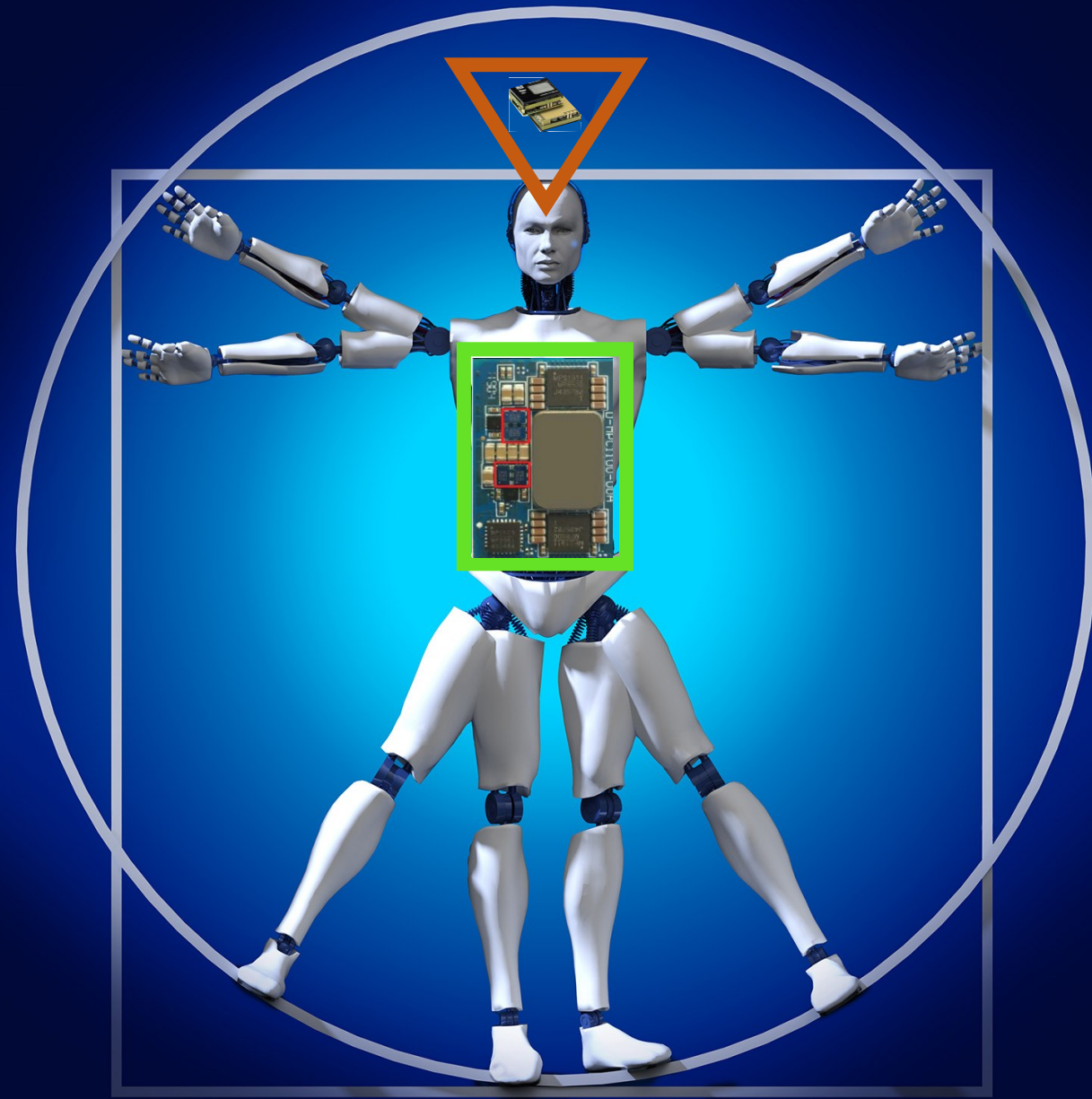


EPC21704



- Low current ICs are optimized for IToF
- High current ICs are optimized for DToF

Industrial	Description	Package	Size (mm)	Samples	MP
EPC21601	40V 10A 1 ch	WLCSP	1X1.5	Now	Now
EPC21603	40V 10A 1ch LVDS	WLCSP	1X1.5	Now	Now
EPC21701	80V 10-15A 1ch	WLCSP	1X1.8	Now	Now
EPC22704	100V 125A 1ch	WLCSP	1.3X2	Q4'23	Q4'24
EPC26107	100V 40A/ch 4ch	WLCSP	TBD	TBD	TBD



# GaN Benefits in High-Density DC-DC

GaN FET/ICs switch fast and are very small

Higher switching speed

Smaller passives  
and  
lower DCR losses in  
transformer



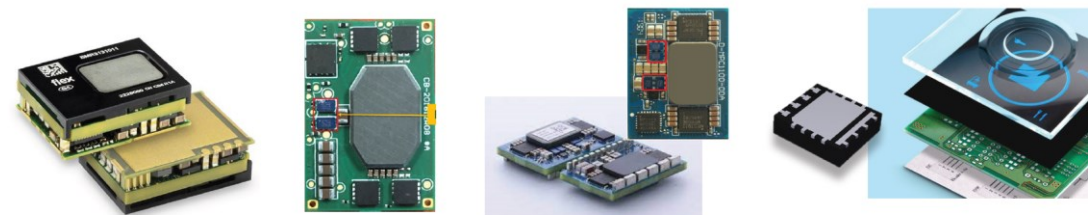
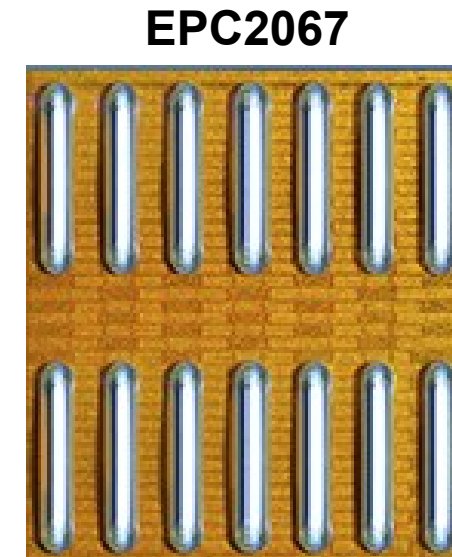
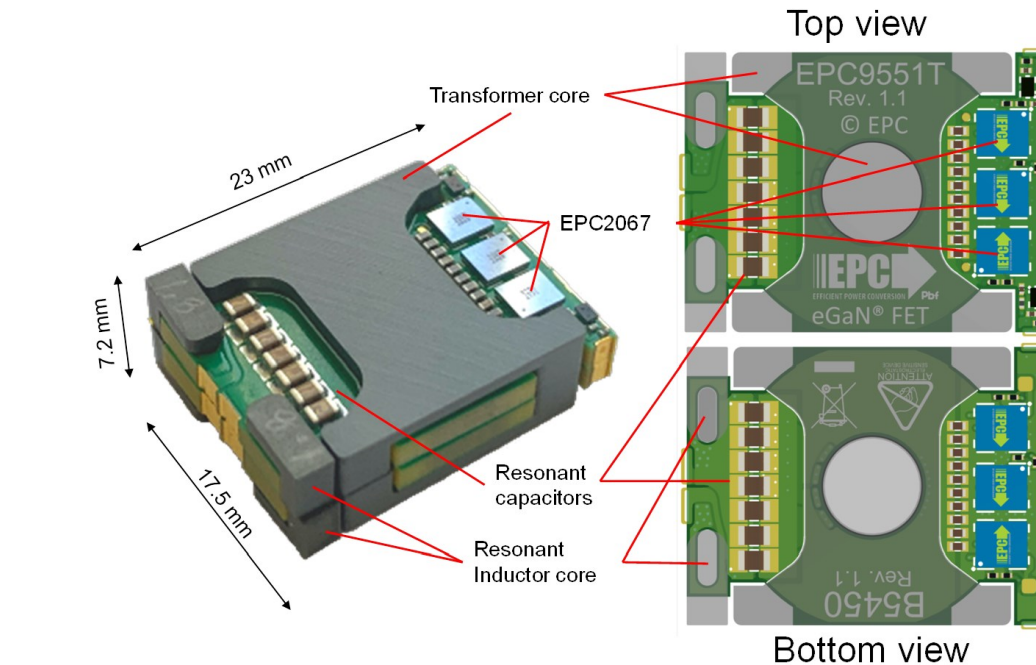
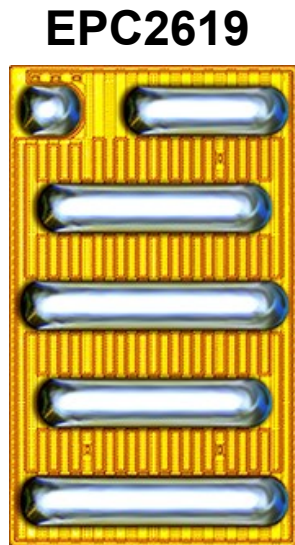
Small Size

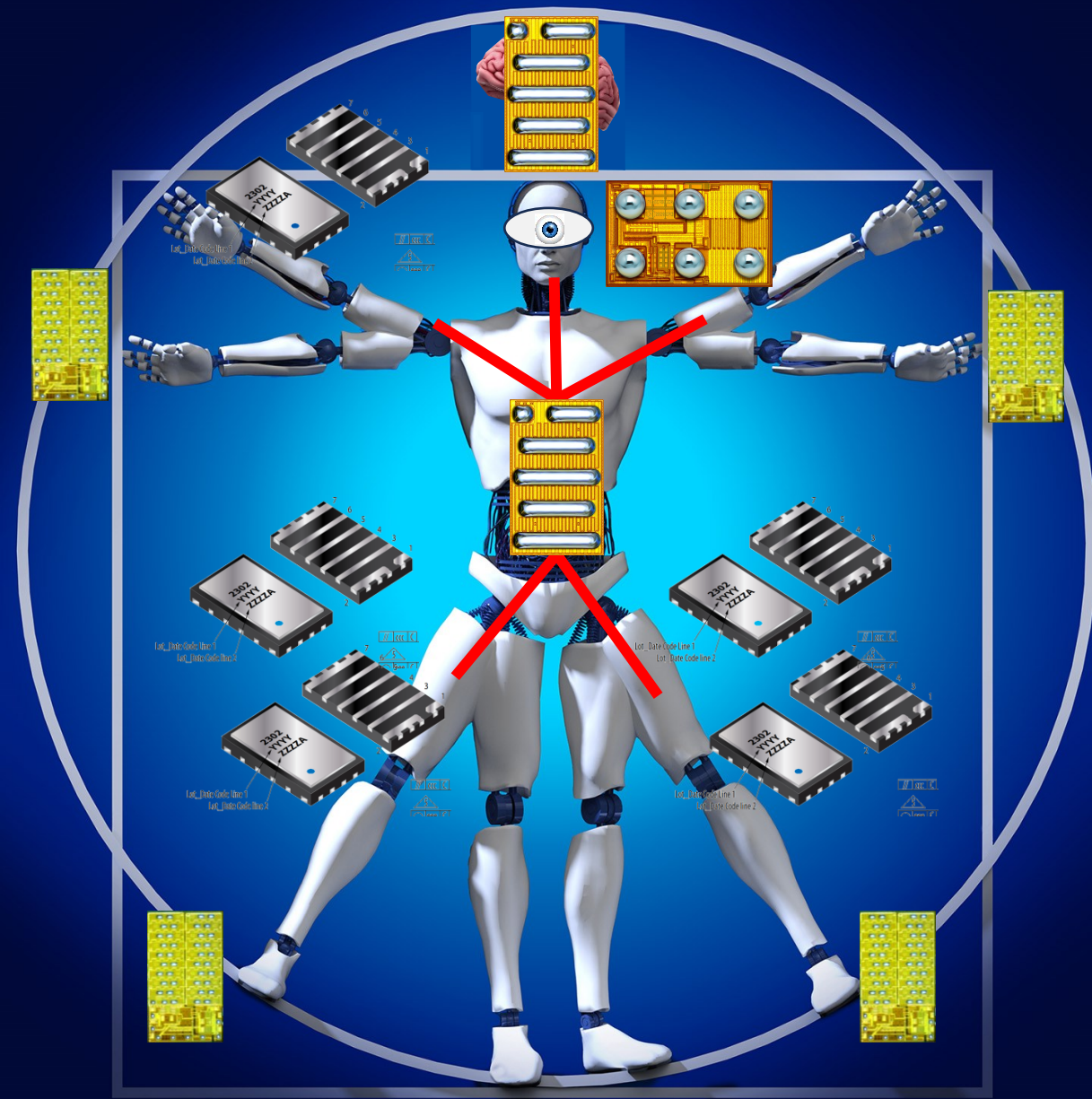
More space for  
transformer and  
other components

Improves **efficiency, power density, and cost**

# 1 kW 48 – 12 V DC-DC Converter

Greater than 5,000 W/in<sup>3</sup>



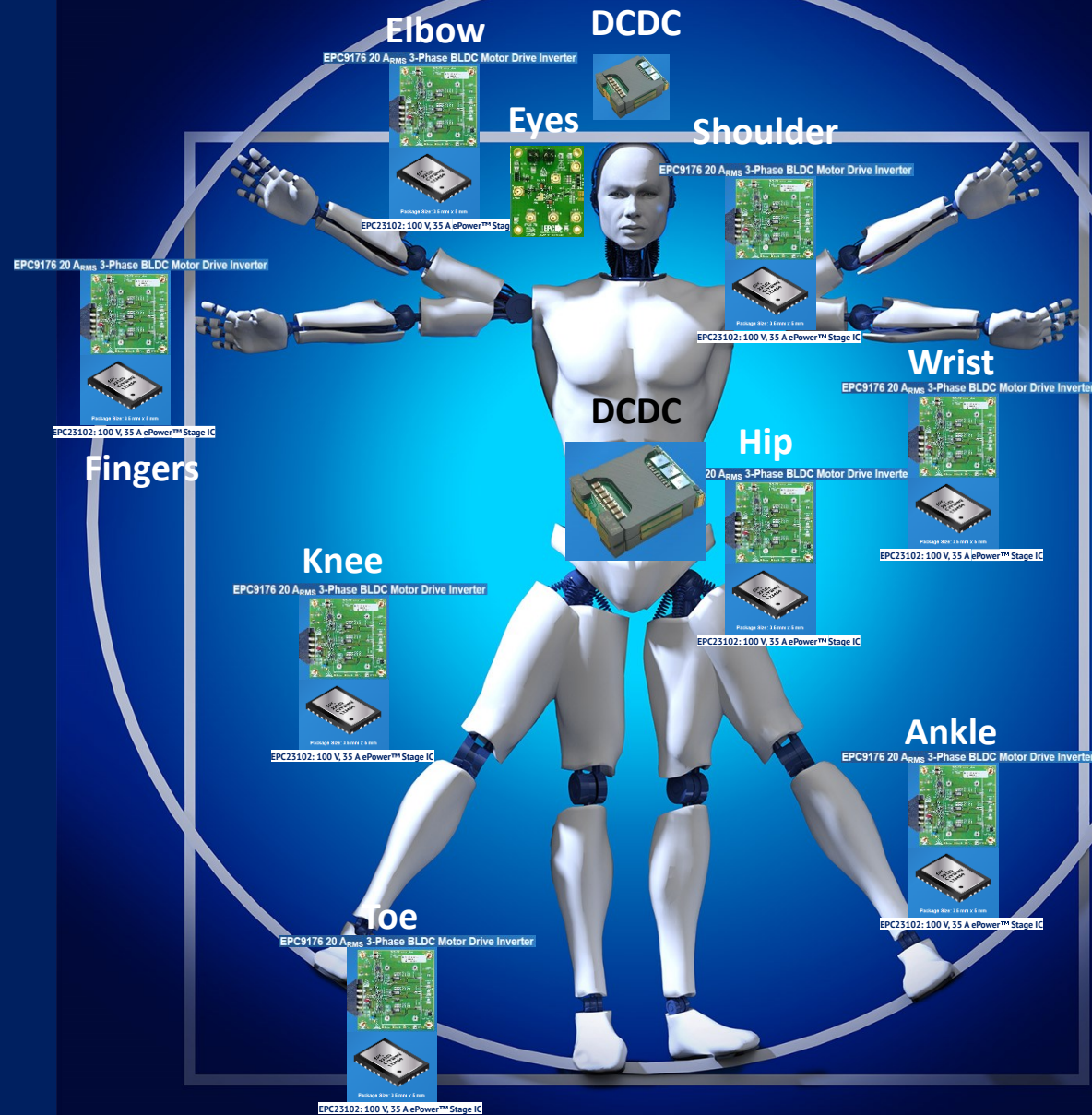


**Muscles**

**Eyes**

**Blood**

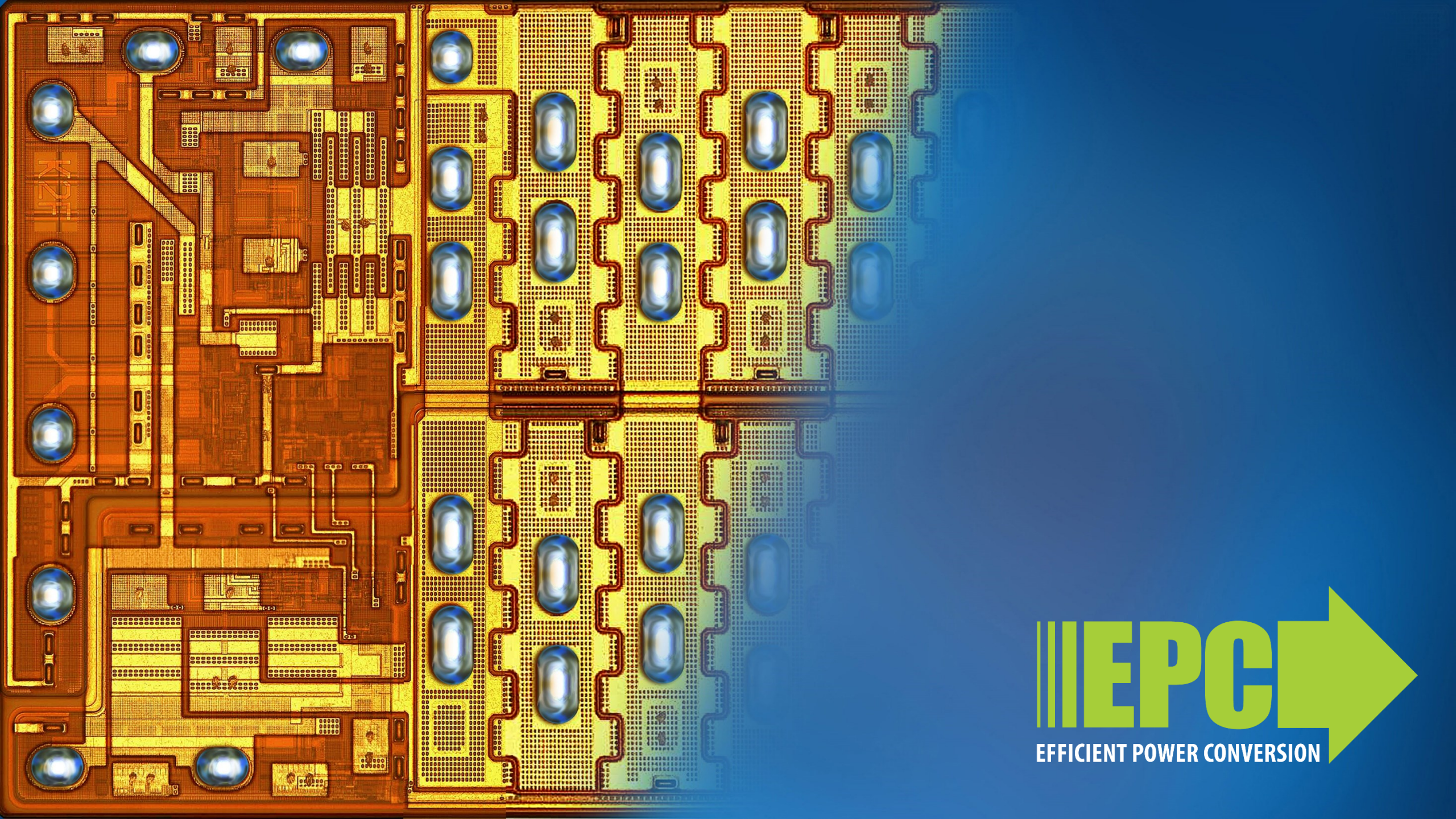
**Brain**





***Humanoid = GaN***





**EPC** 

EFFICIENT POWER CONVERSION