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Passenger Car CTP (Cell to Pack), CTC (Cell To Chassis) and CTB (Cell to Body) Integrated Battery Industry Report, 2024

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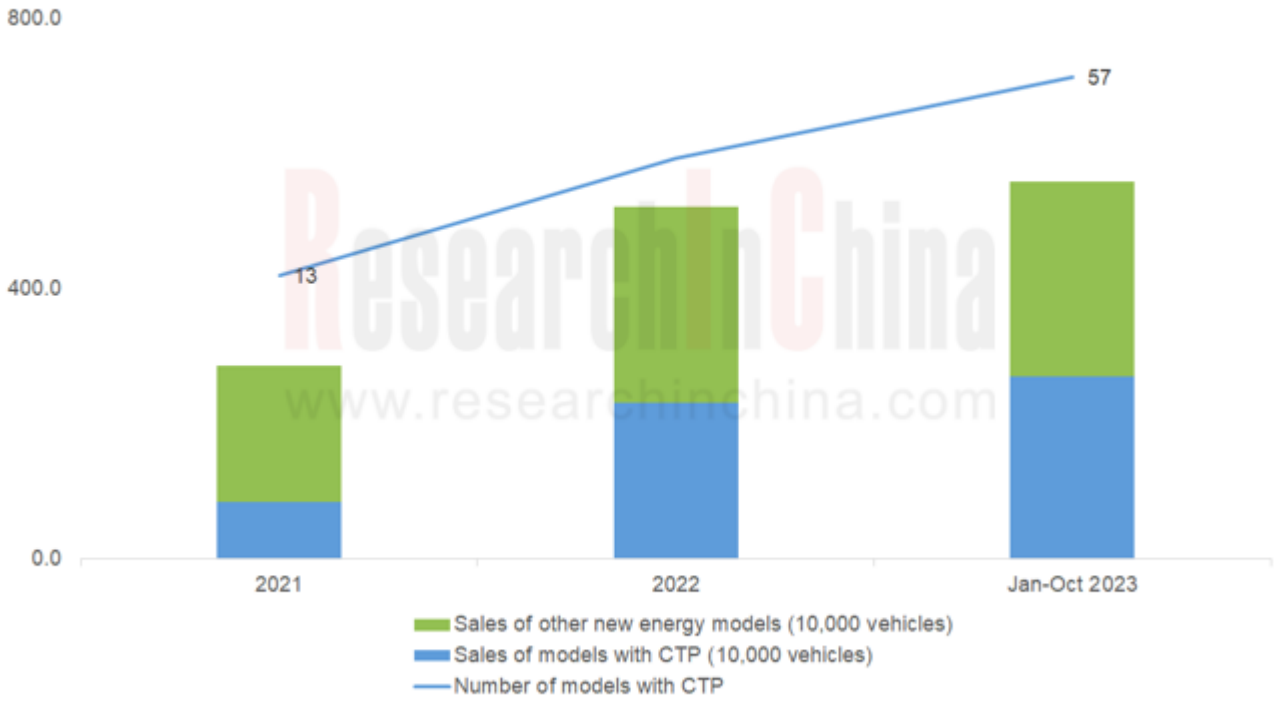
In 2023, CTP (Cell to Pack) technology was seen in nearly 50% of new energy vehicles sold

Passenger Car CTP, CTC and CTB Integrated Battery Industry Report, 2024 released by ResearchInChina summarizes and studies the status quo of CTP (Cell to Pack), CTC (Cell To Chassis) and CTB (Cell to Body) for passenger cars and the layout of OEMs and suppliers in related products, and predicts the future development trends of passenger car integrated batteries.

1. **In 2023, CTP (Cell to Pack) technology was seen in nearly 50% of new energy vehicles sold.**

In 2021, there were only 13 vehicle models equipped with CTP in China. As of October 2023, the number had increased to 57. Vehicles equipped with CTP shared 29.6% of the total sales of new energy vehicles (EVs, PHEVs and EREVs) in 2021, and made up 48.6% from January to October 2023, a figure projected to be higher than 50% in the whole year of 2023.

Number and Sales of Vehicle Models Equipped with CTP, 2021-2023



Source: ResearchInChina

CATL CTP

From the perspective of both suppliers and OEMs, CTP technology has entered a mature application stage.

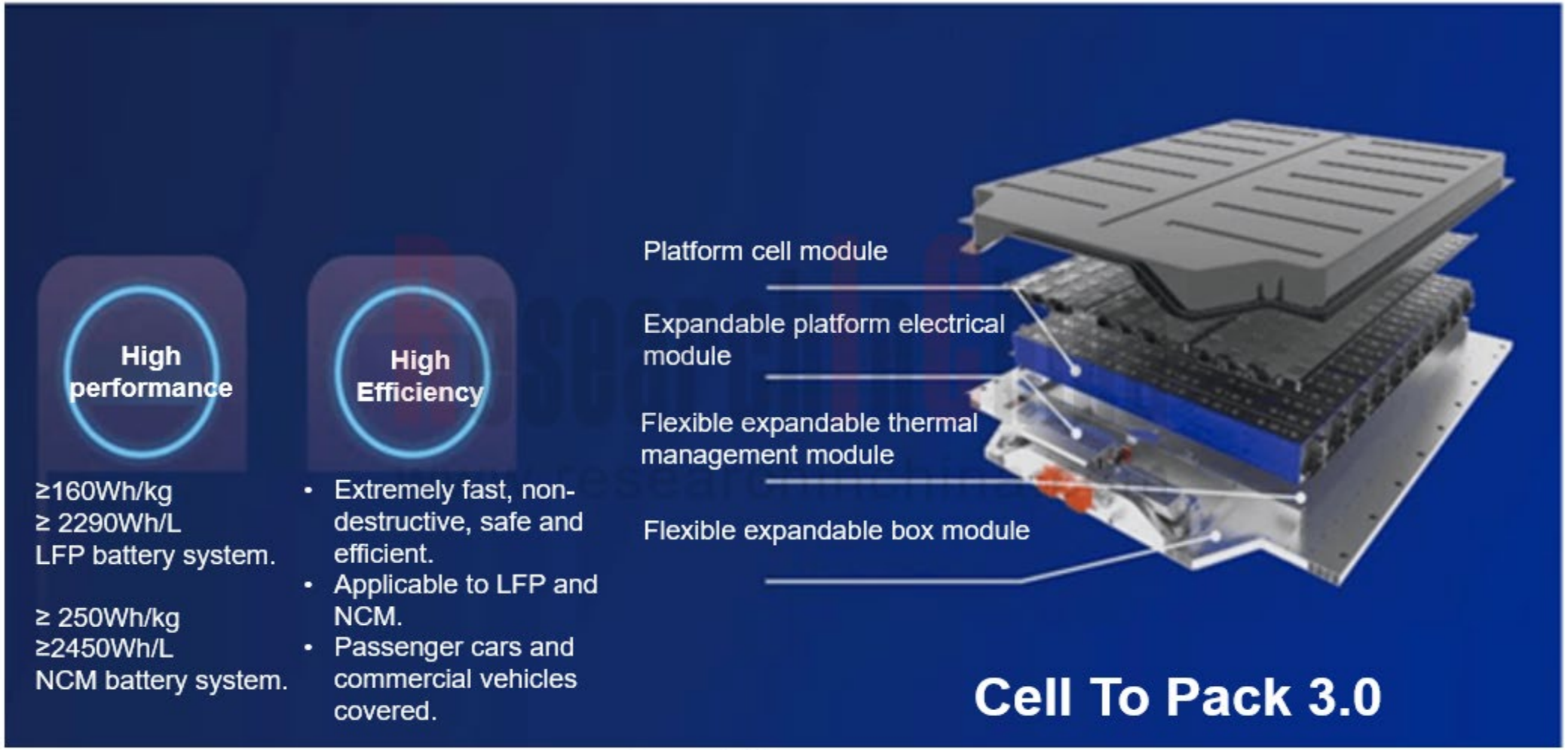
Among suppliers, CATL is a role model. In 2019, CATL released its CTP 1.0. By 2023, the technology has iterated to 3.0, and has been installed by brands such as ZEEKR, Li Auto and AITO.

CATL CTP 1.0-3.0

	CTP 1.0 (large model structure)	CTP 2.0 (without module structure)	CTP 3.0 (without module structure)
Launch time	Sept. 2019	Dec. 2021	Jun. 2022 (SOP in 2023)
Volume utilization (%)	55	60	72
Range (km)	500+	600+	1,000+
Energy density (Wh/kg)	180+	200+	250+
Structural parts	Remove module side panels and replace them with straps.	Further remove module end plates and replace them with cross members and longitudinal beams.	Further remove cross members and longitudinal beams and replace them with multifunctional elastic interlayers.
Cooling system	Water-cooling plate placed at the bottom	The water-cooling plate placed at the bottom is compatible with NP technology (non-thermal diffusion technology)	Multifunctional elastic interlayers (containing water-cooling plates) replace transverse and longitudinal beams of battery packs. Combined with double-layer cooling channels, they offer four functions: support, water cooling, heat insulation and buffering. The water-cooling plate is placed sideways, expanding the heat exchange area by four times, which facilitates high-rate fast charging.

Source: ResearchInChina

CATL CTP 3.0



Source: CATL

CTP Technology Layout of Some Battery Suppliers and OEMs

OEMs are represented by BYD. In 2020, BYD released its blade battery based on CTP technology, which was first mounted on Han EV in June of the same year. In 2023, with higher blade battery capacity, BYD began to supply batteries to other automakers after meeting its own demand. Both Tesla and Hongqi have some models equipped with the blade battery.

According to the statistics of ResearchInChina, there are more than 17 models using blade batteries. By the end of 2023, BYD had deployed 17 blade battery production bases with the planned capacity of over 460GWh.

CTP Technology Layout of Some Battery Suppliers and OEMs

Type	Vendor	Technology/product
Supplier	CATL	CTP 1.0, CTP 2.0, CTP 3.0
	SVOLT Energy	Cobalt-free battery, L600 short blade battery, "Dragon Armor Battery" (LCTP3.0), L400 short blade stacking battery.
	CALB	Rectangular CTP (high power LiFePO4), One-stop (LiFePO4, lithium ternary, lithium permanganate)
	AESC	Pouch CTP
	EVE	"n" battery system, 46 series large cylindrical battery
OEM	BYD	Blade battery
	SAIC	ONE PACK battery
	Neta	Tiangong Battery 2.0
	Hycan	Moduleless CTP (developed with CALB)
	Changan Automobile	Highly integrated CTP
	ZEEKR	Gold brick battery

Source: ResearchInChina

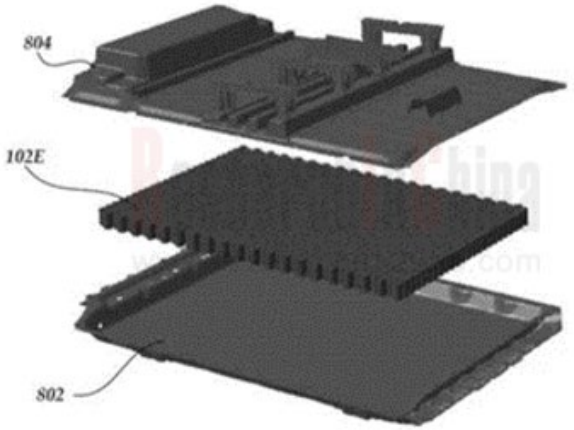
CTC/CTB technology is easier to implement under the leadership of OEMs

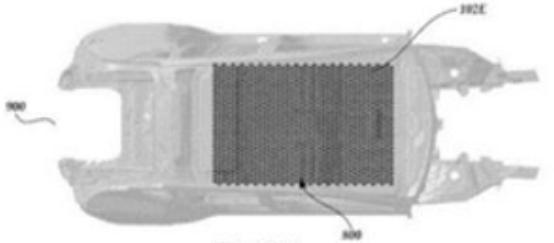
2. CTC/CTB technology is easier to implement under the leadership of OEMs

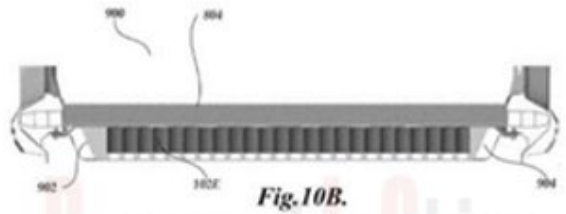
2.1 Currently only four automakers Tesla, BYD, Leapmotor and Xpeng have released CTC/CTB technology and applied it in production models.

① **Tesla:** In 2020, Tesla introduced the concept of CTC (Cell To Chassis) for the first time on its Battery Day, which cancels the floor of the vehicle body, integrates the battery frame with the underbody (rocker rail, transverse beam, longitudinal beam, floor, etc.), and then connects the castings at the front and rear ends of the body.

From the point of performance improvement, Tesla's CTC technology offers the benefits: a 10% reduction in vehicle weight, a 14% increase in cursing range, a reduction of 370 parts, 7% lower unit cost, 8% lower unit investment, and far higher automobile manufacturing efficiency. CTC technology has been applied to Model Y produced at Gigafactory Texas.





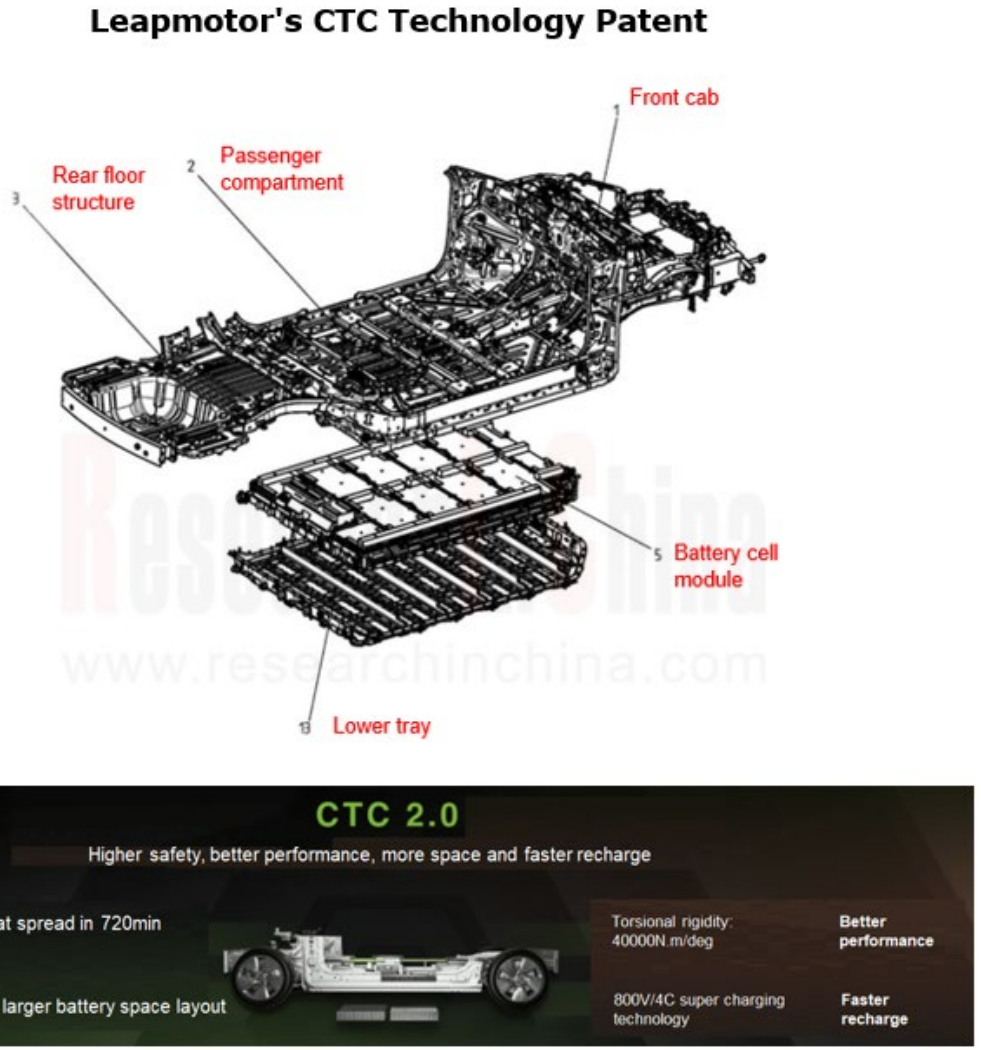


Source: Tesla

Leapmotor’s CTC technology

② **Leapmotor:** In April 2022 Leapmotor released CTC technology, and first applied it to the production model Leapmotor C01. Leapmotor’s CTC solution cancels the battery pack housing and upper cover, and retains the integrated battery module and lower battery tray.

Leapmotor’s CTC technology can increase the vertical space of the vehicle by 10mm, the battery layout space by 14.5%, the cursing range by 10% and the torsional stiffness of the body by 25% to 33897N·m/°, and reduce the number of parts by 20% and the weight by 15kg. CTC 2.0 unveiled by Leapmotor in 2023 enables 10% fewer parts and 5% less weight than CTC 1.0.



Source: Leapmotor

BYD's CTB Technology

③ **BYD:** In May 2022, BYD released CTB (Cell to Body), a technology using the upper shell of the battery pack to replace the body floor. It cancels the modules and the upper shell of the battery pack, and sticks the blade battery to the tray and upper cover to form a sandwich structure of "battery upper cover-cell-tray".

The volume utilization rate of BYD's CTB can be raised to 66%; the torsional stiffness of the vehicle body exceeds 40,000 N m/; the intrusion of the vehicle side column collision is reduced by 45%. The wind resistance of Seal, the first model equipped with CTB, is as low as 0.219, and the 0-100 km/h acceleration of the four-wheel drive edition only takes 3.8 seconds, with energy consumption per 100 kilometers as low as 12.7kWh.

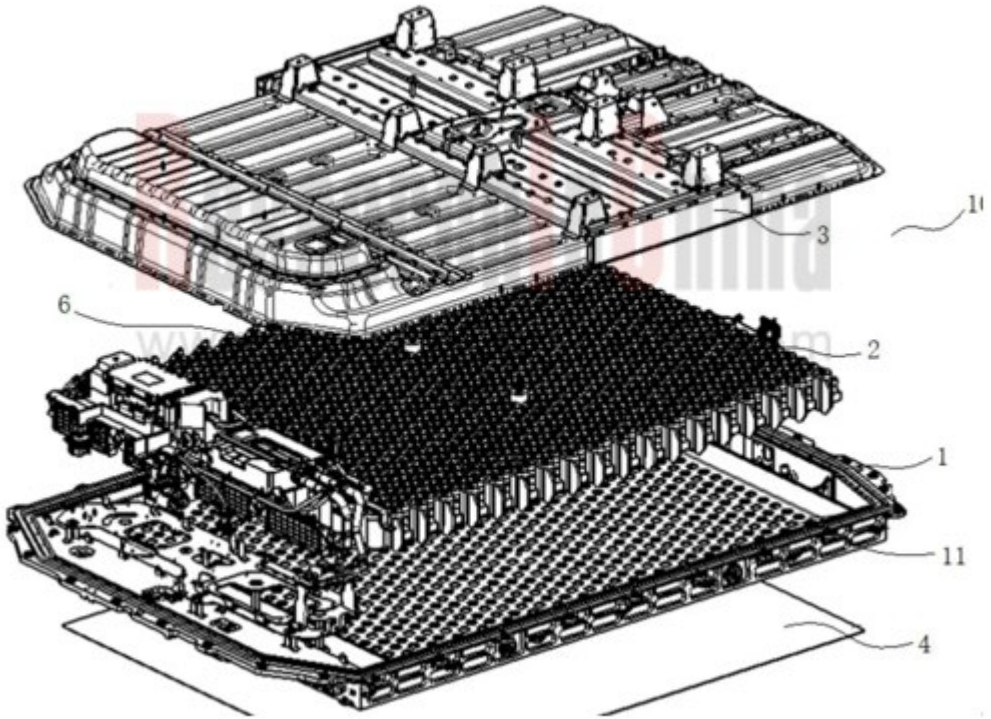
BYD's CTB Technology

Source: BYD

Xpeng’s CIB technology

④ **Xpeng:** In April 2023, Xpeng launched its "Fuyao" architecture, which adopts CIB technology that uses the upper cover of the battery pack as the body floor, thereby saving 5% vertical interior space. As with Tesla, Xpeng integrates the reserved mounting bracket on the battery pack upper cover, and installs seats directly on the battery pack.

Exploded-view Drawing of Xpeng's CIB Technology



Source: EV-AUTO.SOHU.COM

As per the technical features of CTC/CTB, OEMs cannot tolerate less say

2.2 As per the technical features of CTC/CTB, OEMs cannot tolerate less say.

In the conventional new energy industry chain, power batteries account for 30%~40% of the vehicle cost. In the promotion process of CTC technology, the use of CTC makes it easier for battery vendors to dabble in chassis and vehicle development. For automakers, this may lead to less say, which is unacceptable to them.

CTC technology however requires battery cells with high intrinsic safety, and this needs to enhance thermal stability of battery cell materials. As concerns process, it is necessary to ensure the reliability of battery cells in terms of design and manufacturing. These are the advantages of battery vendors. Amid a combination of multiple factors, the model that OEMs play a leading role and suppliers cooperate with them may be the main way to advance CTC technology in the future.

In the case above OEMs that have the ability to develop and produce battery cells by themselves, such as BYD and Tesla, can effectively avoid the technical restrictions from battery vendors and have greater advantages in technology application.

Technology Comparison between Tesla, Leapmotor, BYD and Xpeng

	Tesla CTC	Leapmotor MTC	BYD CTB	Xpeng CIB
Floor assembly structure	N/A	Available	Only crossmember retained	N/A
Battery compartment upper cover	Available, seat and crossmember integration	N/A	Available	Available, seat and crossmember integration
Sealing difficulty	★	★★★	★	★
Maintenance stability	★★★★★	★★★★	★★★	★★★★
Weight reduction	★★★★★	★★★★	★★★★	★★★★★

Source: Smart New Car, ResearchInChina

CTC technology layout of other OEMs

2.3 CTC technology layout of other OEMs

In addition to Tesla, BYD, Leapmotor and Xpeng, Xiaomi, Volkswagen, Volvo, JAC and SAIC all make layout of CTC technology. On December 28, 2023, Xiaomi unveiled SU7, a car that packs its self-developed CTB technology. The innovative designs such as floor-cover two-in-one, battery cell inversion, multifunctional elastic interlayer and minimalist wiring harness enable the volume efficiency up to 77.8% and release an additional height of 17 mm.

CTC Technology Layout of Some OEMs

OEM	Technology Route	Technology/Product
Xiaomi	CTB	SU7 released in December 2023 is equipped with Xiaomi's self-developed CTB technology.
SAIC	CTC	CTC was demonstrated on the concept pickup SAIC MAXUS GST. SAIC will cooperate with Tsingshan later to deploy CTC technology
Neta	CTC	In November 2023, released the Haozhi Skateboard Chassis Platform co-developed with CATL (Shanghai) Intelligent Technology Co., Ltd., a subsidiary of CATL. This platform uses CTC technology.
Volvo	CTC	Volvo cooperates with Northvolt to produce battery cells and introduce the rectangular CTC process.
Volkswagen	CTC	In August 2022, Volkswagen published its CTC structure patent which features cylindrical cells.

Source: ResearchInChina

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