MM-FORCE® Technology

Enabling New Design Opportunities for Low-Frequency Loudspeakers

Powersoft

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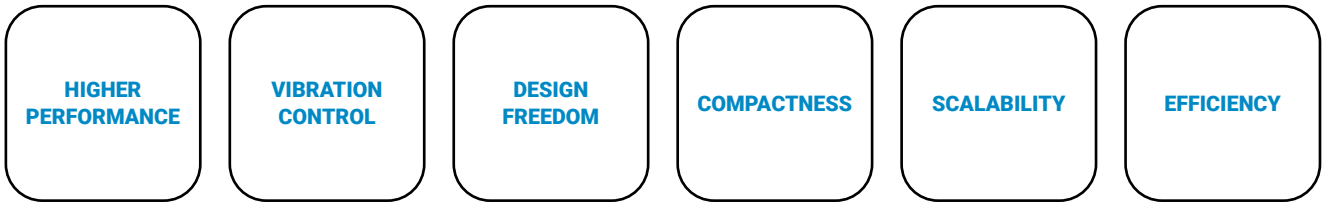
Overview & Executive Summary

MM-Force is Powersoft's patented balanced **Moving Magnet low-frequency driver**, developed for loudspeaker manufacturers and OEM partners.

Available in **8-inch** and **10-inch** formats, MM-Force is designed to deliver high-performance low-frequency reproduction with an **ultra-low profile 70 mm driver depth**, enabling compact, lightweight and integration-friendly loudspeaker designs.

Different from conventional moving-coil loudspeakers, MM-Force combines the following key technology principles

- **Moving Magnet Technology:** the magnetic cage moves while the coil remains stationary, reversing the conventional moving-coil paradigm.
- **High Motor Strength:** the motor is designed to maximize force generation and reduce resistive losses, improving the relationship between acoustic performance and size.
- **Inertial Balance:** moving masses are mechanically balanced to cancel vibration transfer to the cabinet, wall, panel, or installation structure
- **System-Level Optimization**: combines the driver with Powersoft Class-D amplification and DSP-based tuning to maximize performance.



MM-Force allow manufacturers to rethink low-frequency product design.

The value is not only in the driver itself, but in the new product architectures it enables: ultra-low profile subwoofers, flush-mount architectural products, compact modular cabinets, portable low-frequency systems, automotive bass solutions and products that scale output through multiple MM-Force building blocks.

It also enables **powerful low-frequency performance from cabinet volumes up to approximately ten times smaller than conventional designs**, opening new possibilities where space and integration constraints have traditionally limited bass reproduction.

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Technology Evolution and Context

Low-frequency reproduction has traditionally relied on moving-coil transducers, large enclosures and significant amplifier power. While these conventional designs remain effective, they often require compromises in cabinet volume, weight, thermal behavior, excursion, power efficiency and vibration management.

The evolution toward **MM-Force reflects Powersoft's long-term system-level approach to audio innovation**. Rather than looking at the amplifier and the transducer as separate components, Powersoft progressively explored how amplification, processing and driver design could work together to overcome the limits of traditional low-frequency reproduction.

This path can be understood through **four key development steps**:

1995 — High-efficiency Class-D amplification

Enabled compact, lightweight and efficient power delivery, reducing heat, weight and energy waste while increasing power density. Beyond efficiency alone, Powersoft Class-D platforms deliver high current, manage low-impedance and reactive loudspeaker loads, interact with DSP control and recover part of the reactive energy generated by the moving system.

2011 — Software and DSP control / IPAL

IPAL was an important step in that direction. It used amplifier-driven control to make conventional moving-coil transducers specifically designed, to work more effectively with Class-D amplification. The amplifier was no longer only a source of power. It became part of the optimization process, using zero-latency processing and control to improve the behavior of the loudspeaker system.

2013 — Moving Magnet topology / M-Force

M-Force marked a more radical move. Powersoft explored a Moving Magnet architecture, reversing the conventional moving-coil paradigm and proving that the driver itself could be redesigned around modern amplification and control. M-Force was physically extreme. It demonstrated that if the amplifier had changed, the transducer could change too.

2026 — High Motor Strength and MM-Force

MM-Force translates the High Motor Strenght factor using Moving Magnet principles into a compact, shallow, scalable and inertially balanced low-frequency platform for OEM loudspeaker manufacturers. It is not simply a thinner woofer. It is a building block designed to enable new cabinet formats, product categories and low-frequency architectures.

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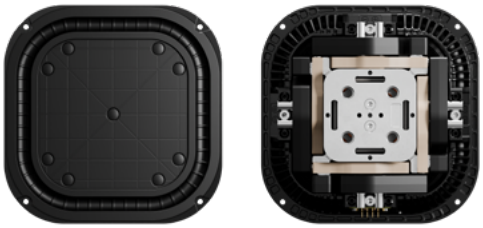
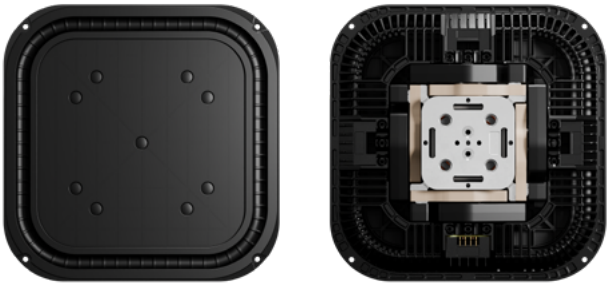
What MM-FORCE is

MM-Force is Powersoft's **Moving Magnet low-frequency driver platform**, available in 8-inch and 10-inch formats. It is developed for loudspeaker manufacturers and OEM partners seeking powerful LF reproduction in compact, lightweight and shallow systems.

Based on Powersoft's **Moving Magnet Technology,** MM-Force is designed to deliver high motor strenght while improving the relationship between acoustic output, cabinet size and mechanical control.

Thanks to its **inertially balanced architecture**, MM-Force **virtually cancels the structural effect of its moving masses**, eliminating vibration transfer to the cabinet, wall, panel or installation surface. This makes it suitable for low profile, architectural and vibration-sensitive loudspeaker designs, while giving manufacturers greater freedom to create compact, lightweight and integration-friendly products.





MM-FORCE 8”

Designed for extremely compact applications where available volume is very limited. With a minimum enclosure volume of 2.5 L, a depth of only 70 mm and a net weight of 2.5 kg, it is well suited for slim products, architectural loudspeakers, compact subwoofers, advanced soundbars and installations where physical integration is a priority.

MM-FORCE 10”

Designed for applications requiring greater radiating surface and higher air displacement. With a minimum enclosure volume of 6 L, a depth of only 70 mm and a net weight of 2.8 kg, it is well suited for compact high-performance subwoofers, premium systems, architectural solutions and installations where stronger LF output is required.

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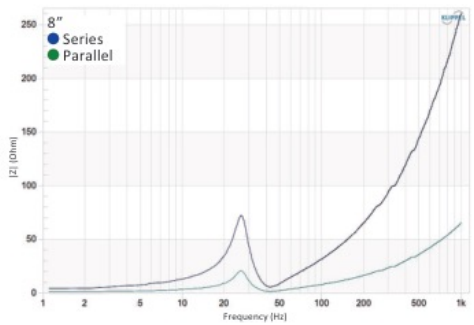
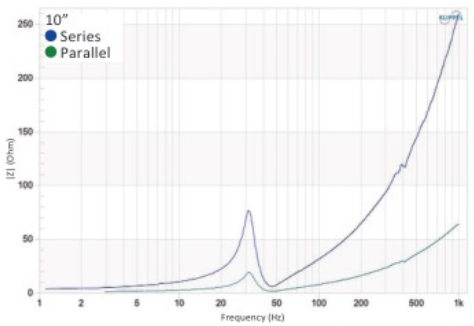
Technical Data

Parameter	MM-FORCE 8" IB 4+4 Ohm	MM-FORCE 10" IB 4+4 Ohm
Nominal diameter	8"	10"
Fs	26 Hz	31 Hz
Nominal impedance	8 Ohm series / 2 Ohm parallel	8 Ohm series / 2 Ohm parallel
Minimum impedance	5.5 Ohm series / 1.4 Ohm parallel	5.5 Ohm series / 1.4 Ohm parallel
Re	3.2 Ohm series / 0.8 Ohm parallel	3.2 Ohm series / 0.8 Ohm parallel
Qes / Qms / Qts	0.14 / 3.2 / 0.13	0.17 / 4.0 / 0.16
Vas	8.9 L	19.8 L
Sd	**270 cm²**	**483 cm²**
Xlin	± 8 mm	± 8 mm
Xmech±	± 12 mm	± 12 mm
Motor Strength beta	**500 N²/W**	**500 N²/W**
Frequency range	20 Hz - 160 Hz	20 Hz - 160 Hz
Continuous power handling	300 VA	300 VA
Active power handling typ.	90 W	90 W

Mechanical Data	MM-FORCE 8”	MM-FORCE 10”
Overall diameter	**208 × 208 mm, R 57.2 mm**	**262 × 262 mm, R 57.5 mm**
Bolt circle diameter	**167 × 167 mm**	**221 × 221 mm**
Baffle cutout	**193 × 193 mm, R 60 mm**	**246 × 246 mm, R 60 mm**
Depth	70 mm	70 mm
Flange and gasket	11.7 mm	11.7 mm
Minimum enclosure	2.5 L	6 L
Net weight	2.5 kg	2.8 kg
Piston material	Carbon Fiber Reinforced Polymer	Carbon Fiber Reinforced Polymer
Magnet material	NeFeB	NeFeB
Typical unbalanced	< 10 g	< 10 g
Peak force±	± 500 N	± 500 N

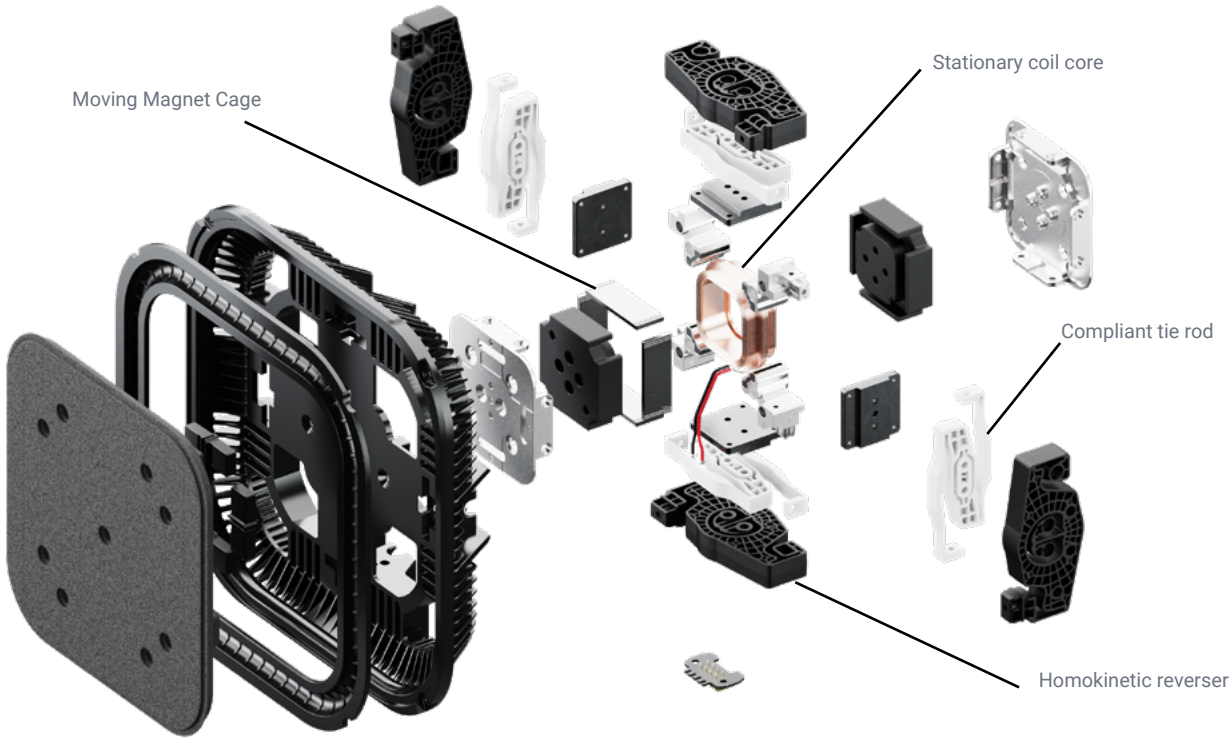




04

Moving Magnet Technology: how it works

In MM-Force, **the coil is stationary** while the **permanent magnet assembly moves.** A time-varying current in the coil induces a magnetic field in the core and external plates. This field interacts with the permanent magnets in the moving cage. The alternating attraction and repulsion between the magnetic fields generates a net force that drives the moving magnet cage along the air gap. This topology changes the way low-frequency force is generated and controlled. By keeping the **coil stationary**, MM-Force supports **improved thermal stability** and **reduced thermal compression**, while the moving magnet architecture allows the motor to be optimized for compactness, high force generation and system efficiency.



Motor Structure Assemblies

Moving magnet cage: composed of four high-grade neodymium magnets mounted on aluminium corners.

Stationary coil and core assembly: copper coil combined with symmetrical sintered metal cores to manage high magnetic flux.

External steel plates: provide flux circulation around the motor structure.

Radiant Surface: convert controlled motion into acoustic output.

Compliant tie rods and homokinetic reversers: support alignment, energy transfer and inertial balancing.

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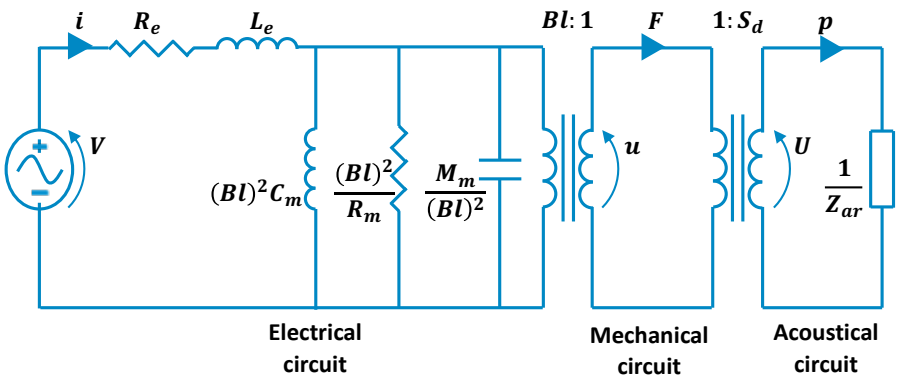
High Motor Strength, Efficiency and Class-D synergy

High Motor Strength is one of the key performance principles behind MM-Force. It describes the ability of the motor structure to generate force efficiently while reducing energy losses.

MM-Force reaches a motor strength value of 500 N²/W. This supports **high output capability** from compact volumes and helps enable **power-efficient low-frequency reproduction** when the driver is integrated with Powersoft Class-D amplification and DSP control.

MM-Force is designed as **part of a complete system approach**, where the transducer, enclosure, amplifier and DSP work together **to optimize output, efficiency and control**.

$$\frac{(Bl)^2}{R_e} \rightarrow \eta_0 \propto \frac{(Bl)^2 S_d^2}{R_e M_m^2}$$



In this context, MM-Force is particularly well suited to high-efficiency Class-D amplification topology, which can further support system-level performance depending on the overall amplifier and power supply implementation.

Technical principle	OEM meaning	Customer value
High Motor Strength	More force generation relative to resistive loss	Smaller cabinets without sacrificing efficiency
Low resistive losses	Reduced wasted power in the transducer	Better thermal behavior and efficiency potential
Class-D synergy	Efficient amplifier interaction with reactive loads	Compact active systems and reduced power waste
DSP control	Response shaping, linearization and protection	Predictable performance in different cabinet architectures

06

Inertial Balancing and Vibration Control

Moving magnet systems involve substantial moving mass. If left unbalanced, this mass could transfer vibration from the speaker into the cabinet, wall, vehicle structure or installation surface.

MM-Force addresses this challenge through inertial balancing at transducer level.

The architecture separates moving elements into a magnetic-end moving mass and an acoustic-end moving mass. Homokinetic reversers create synchronized opposite motion: when the magnet cage moves in one direction, the piston is driven in the opposite direction. The result is **eliminating almost entirely the net vibration transfer** compared with an unbalanced moving mass system.

For loudspeaker manufacturers, this is critical because it enables single-transducer products and ultra low-profile cabinet designs where vibration management would otherwise be a major limitation.

Key Design Benefits

- Reduced vibration transfer to cabinets, walls, panels and vehicle structures to near-zero levels.
- Easier integration in flush-mount, in-wall, on-wall and furniture-integrated designs.
- Better suitability for automotive and vibration-sensitive applications.
- Greater freedom to develop lightweight, ultra low-profile and modular loudspeaker concepts.

07

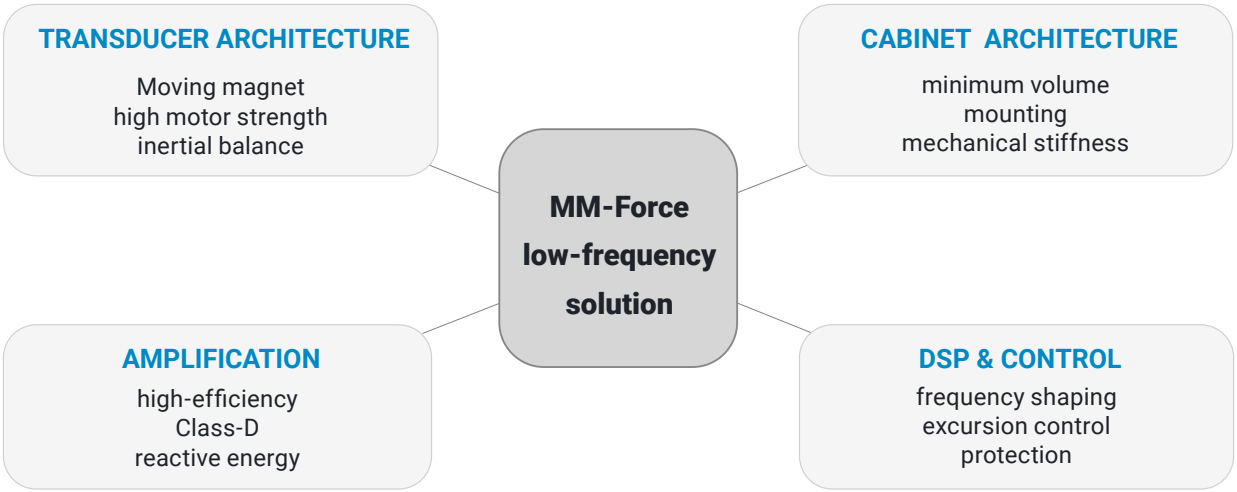
MM-FORCE as System-level Low-frequency Solution

MM-Force is conceived as a complete low-frequency platform, where the transducer, enclosure, amplifier and DSP are developed as part of a single system.

This system-level approach allows manufacturers to extract the full potential of the technology in terms of **output**, **efficiency**, **control** and **integration**.

MM-Force is not just a driver to install inside a cabinet. It is a compact and scalable low-frequency building block that enables new product formats, new cabinet architectures and new ways to design high-performance LF solutions.

System-level design: driver, cabinet, amplification and control



The system-level approach should consider:

- Cabinet volume and stiffness.
- Baffle design and cutout geometry.
- Number of MM-Force elements required for the target SPL.
- Amplifier capability and power delivery.
- DSP tuning, protection and excursion control.
- Thermal limits and continuous operating conditions.
- Environmental requirements, including outdoor or harsh-environment protection when applicable.

08

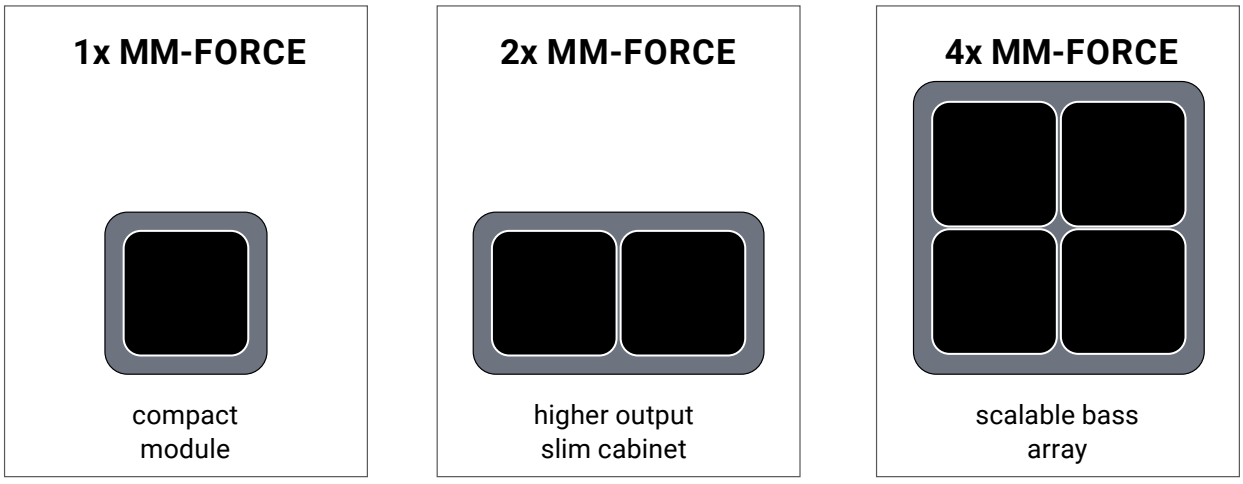
Building-block Scalability

One of the key benefits of MM-Force is the design flexibility it provides as a **scalable low-frequency building block**. Its compact, low-profile form factor makes it easier to combine one or multiple units according to the acoustic target, cabinet format and integration constraints.

The **square shape helps maximize radiating surface** and **reduce wasted baffle space** when multiple transducers are placed side by side.

Instead of designing around a single large conventional subwoofer, manufacturers can scale low-frequency output by integrating compact MM-Force elements into cabinets, panels, wall modules or custom acoustic structures, supporting product formats from single-driver modules to multi-driver bass systems and automotive hidden subwoofers.

Building-block scalability: one transducer platform, multiple product formats



Output can be scaled by multiplying compact MM-Force elements, instead of redesigning around a single large conventional subwoofer format.

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Application Opportunities and Benefits

MM-Force enables OEM loudspeaker manufacturers to r**ethink low-frequency product design,** opening new opportunities for compact, scalable and integration-friendly solutions beyond the limits of conventional subwoofer architectures.

Application area	Product opportunity	Why MM-FORCE matters
Architectural audio	In-wall, on-wall, ceiling or furniture-integrated bass modules	Shallow depth, reduced vibration transfer and flush-mount potential
Compact install products	Slim subwoofers, modular bass cabinets, discreet commercial audio products	High output from smaller volumes and scalable multi-driver layouts
Portable / modular systems	Featherweight compact touring or mobile bass units	Reduced size and modular building-block logic
Automotive audio	Hidden subwoofers in constrained spaces	Compact depth, low weight and reduced structural vibration
Outdoor / harsh environments	Protected low-frequency modules for demanding installations	Compact sealed architectures and potential high IP product development
Immersive environments	Integrated low-frequency and vibro-acoustic systems	Compact deployment and system-level control

OEM need / pain point	MM-FORCE contribution	Potential manufacturer benefit
Reduce cabinet size without losing bass capability	High motor strength and shallow moving magnet architecture	More compact products, easier integration, broader product design freedom
Control vibration in lightweight or integrated structures	Inertially balanced moving masses	Reduced cabinet/structure vibration and better suitability for wall, panel, vehicle, and furniture integration
Create scalable product families	Building-block architecture using one or multiple MM-Force elements	Shared technology platform across compact, modular, and higher-output product tiers
Differentiate from conventional shallow subwoofers	Patented Moving Magnet Technology and balanced low-profile design	Premium technology story and stronger OEM differentiation
Address installations with limited depth	70 mm driver depth and ultra-low-profile architecture	Flush-mount, in-wall, ceiling, automotive, and compact cabinet possibilities
Improve efficiency under demanding low-frequency conditions	High motor strength and synergy with high-recycling Class-D amplification	Better performance-to-size relationship and reduced system waste
Reduce exposure to magnet material constraints	Moving magnet topology designed to reduce rare-earth material impact for target performance	Potential cost and supply-chain resilience benefits compared with magnet-heavy conventional approaches

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