

## MEDIA INFORMATION

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### INFINITI Project Black S: The ultimate test-bed for motorsport technologies, electrified performance and a potential sports grade

- Project Black S development prototype with world-first dual-hybrid powertrain
- Evolving collaboration between INFINITI and the Renault Sport Formula One™ Team
- Inspired by Formula One®, INFINITI is developing world-first dual-hybrid technology specifically for the road
- Smart energy management and supersport performance from an electrified, motorsport-inspired powertrain
- Performance-biased Project Black S prototype a springboard for high-performance engineering and a motorsport-inspired interior
- Full media information available from [www.INFINITIPressPacks.com](http://www.INFINITIPressPacks.com)

#### *Summary*

Based on the INFINITI Q60 sports coupe, 'Project Black S' is an engineering test-bed exploring how Renault Sport Formula One™ Team-inspired dual-hybrid powertrain technology could be deployed in a road car. The Q60 Project Black S development prototype represents the maximum level of performance, dynamic capability, effective aerodynamics and intelligent energy management offered by INFINITI.

Moving on from the Geneva 2017 design study of the same name, the Project Black S prototype now boasts many developments. These include weight reduction, a motorsport-inspired interior, an aero-effective and purposeful bodywork update, and significant powertrain advancements with a world-first energy recovery system that

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harvests energy under braking *and* acceleration. The result of INFINITI's Alliance partnerships, Project Black S represents an ongoing learning venture between INFINITI and the Renault Sport Formula One Team, exploring the potential for motorsport-inspired products and processes.

The world-first dual-hybrid technology is derived from Formula One and engineered specifically for the road to create a potential new performance flagship. It also illustrates INFINITI's commitment to developing exciting high-performance electrified powertrains.

A focused, agile team of designers and engineers has enabled the rapid development of early prototypes, with feasibility and performance testing due to continue into 2019. A test-bed based on the INFINITI Q60 and its 400 hp 'VR30' twin-turbo V6 engine, the Formula One®-inspired dual-hybrid system combines supersport performance with smart energy management. Recuperating heat and kinetic energy, the system could transform the performance of the brand's road cars.

The VR30 engine has been developed using two heat energy harvesting systems ('MGU-H': motor generator unit – heat) which develop electricity under acceleration. Paired with a kinetic harvesting system ('MGU-K': motor generator unit – kinetic), generating electricity under braking, Project Black S is a unique and exciting electrified performance hybrid prototype.

Designed and engineered in collaboration with the Renault Sport Formula One Team, the Project Black S prototype represents the ultimate expression of INFINITI DNA. The development prototype builds on the organic, artistic design of the Q60 sports coupe, giving it greater aerodynamic efficiency and high levels of downforce, as well as a functional motorsport-inspired look. Its high-performance design is matched by the creative packaging and engineering of its unique dual-hybrid powertrain.



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*"INFINITI has reached another milestone on its road to electrification. Building on the strength and success of the electric vehicle expertise of the Renault-Nissan-Mitsubishi alliance, INFINITI is showing the Project Black S, a high-performance prototype with F1 technology resulting from collaboration within the Alliance. The Project Black S represents the very top end of electrification in the Alliance portfolio, and is another example of INFINITI's entrepreneurial spirit on its journey to electrification from 2021 onward. 'Project Black S' utilizes high power and smart energy management from advanced powertrains, a thrilling dynamic capability on road and track, and a performance-oriented aesthetic. A collaborative venture between INFINITI and the Renault Sport Formula One Team, the Project Black S prototype is a test-bed for new ideas and technologies, demonstrating how our Alliance partnerships could make our ambitious visions a reality."*

Roland Krueger, President, INFINITI

## **An Alliance partnership**

**Evolving collaboration between INFINITI and the Renault Sport Formula One Team to develop innovative technologies for an electrified future**

*Alliance enables development of Formula One powertrain technology for the road*

- *Project Black S prototype draws on expertise from across Renault-Nissan-Mitsubishi Alliance*
- *Created in close collaboration between INFINITI design and engineering teams and the Renault Sport Formula One Team*

As the premium brand within the Renault-Nissan-Mitsubishi Alliance, INFINITI can call upon wide-ranging expertise in vehicle electrification from a partnership that sells more electric and hybrid cars globally than any other manufacturer. It is this partnership that makes possible the ongoing development of Formula One-inspired powertrain technology for the road.



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For the Q60 Project Black S, INFINITI has drawn on technologies from the Renault Sport Formula One Team to create a new performance prototype, which benefits from the breadth of electrification experience within the Alliance.

The team behind 'Project Black S' is truly global, and the result of collaboration across the Alliance. The initial brief and overall management for the project – from the creation of the show car revealed at the 2017 Geneva Motor Show, to today's development prototype – was issued by INFINITI's global headquarters in Hong Kong. The Renault Sport Formula One Team in Enstone, United Kingdom was tasked with designing the car, and worked alongside Renault Sport Racing in Viry-Châtillon, France, where INFINITI and Renault engineers developed the unique dual-hybrid technology. The Enstone team worked together with INFINITI Design London in Paddington, to implement the prototype's motorsport-inspired aerodynamics and develop its design using lightweight materials.

INFINITI's research and development center in Atsugi, Japan also played an important role, having developed the 'donor' Q60 sport coupe upon which Project Black S is based. The R&D center has assisted in the integration of the powertrain technology, advising on engineering proposals from the Renault Sport Formula One Team.

In this way, the creation of the Project Black S prototype is a true collaborative effort – overseen by François Bancon, INFINITI's Vice President for Motorsport and Connected Vehicles. To date, Bancon has enjoyed a career spanning more than four decades, with 20 years' prior experience at Renault, and the last two decades within Nissan and INFINITI.

*"Through the Renault-Nissan-Mitsubishi Alliance, we have been able to draw on the deep technical knowledge and spirit of innovation within the Renault Sport Formula One Team. Our eyes have been opened to the potential of rapid design and development, and a shorter gestation period for the creation of bespoke, highly advanced technologies. This*



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*partnership is as much about exploring efficient new production processes as it is about creating ground-breaking new powertrains."*

François Bancon, Vice President Motorsport and Connected Vehicle, INFINITI

***Project Black S: high performance, dynamic capability and smart energy management***

- *Potential new model grade from INFINITI, offering higher performance, updated chassis and unique design features*
- *'Project Black S' represents the maximum dynamic capability offered by INFINITI*

INFINITI believes there is potential for a new model grade that offers progressive levels of product enhancement, above and beyond the existing Red Sport 400 specification currently available on select models. This could include higher power, torque and performance from innovative powertrains, new or updated suspension systems, and unique design elements.

This higher grade would represent the maximum level of performance, dynamic capability and intelligent energy management offered by INFINITI. The Q60 Project Black S prototype is an investigation into the adoption of advanced dual-hybrid Formula One powertrain technology, with a performance bias.

***Forging a path towards performance-oriented vehicle electrification***

- *All new INFINITI models to feature electrified powertrains from 2021*
- *INFINITI electrified models to offer elevated performance and range confidence*

From 2021, all new INFINITI models will feature electrified powertrains. Electrification is a natural progression for INFINITI, as a brand with technological and powertrain innovation at its heart. In future, the company's vehicles will offer owners a range of advanced powertrains, including battery electric vehicles and unique e-POWER systems which deliver elevated performance and greater range confidence.



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The Project Black S test-bed represents the latest development initiative by INFINITI to electrify its cars, and the new prototype follows a series of concept cars and design studies from INFINITI – the Prototype 9 (2017), Q Inspiration Concept (2018) and Prototype 10 (2018). Each of these is indicative of the brand's path towards performance-oriented powertrain electrification.

With Prototypes 9 and 10, INFINITI created physical manifestations of its creative and ambitious plans for electrification. Revealing the potential for flexible platforms underpinning vehicles with advanced powertrains, both 'Prototype' models have benefited from greater freedom in design. What's more, they have sought to reflect the thrilling, high-performance driving nature that will characterize future electrified vehicles from INFINITI.

Through the 2018 Q Inspiration Concept, the brand revealed a new INFINITI form language for a future of smarter, lower-emissions powertrains. As 2021 and the launch of INFINITI's first electric vehicle approaches, the Project Black S engineering study proposes a route for technological innovations to deliver thrilling performance and intelligent energy management.

## Dual-hybrid powertrain

### Learning to develop world-first dual-hybrid technology for the road

*"A technical partner to the Renault Sport Formula One Team, INFINITI's experience of working with homologated hybrid powertrain technology was instrumental in the co-development of our dual-hybrid system. Making the leap from circuit to road is something we are incredibly excited to be involved in."*

Cyril Abiteboul, Managing Director, Renault Sport Formula One Team

### *Dual-hybrid system engineered in partnership with the Renault Sport Formula One Team*

- *Transfer of shared technical experience from track to road*



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- *Dual-hybrid powertrain based on INFINITI VR30 twin-turbocharged V6 engine*
- *Harvests heat and kinetic energy to enhance power delivery to rear wheels; electrically-assisted turbochargers eliminate lag*

INFINITI is technical partner to the Renault Sport Formula One team, with an engineering group embedded within the Renault Sport Racing powertrain development base in Viry-Châtillon, France, aiding the development of energy recovery systems. This partnership led to the co-development of the dual-hybrid technology in the team's Formula One race cars.

Now, the two partners are exploring the potential to transfer shared technical experience in high-performance electrified powertrains back to the road.

Engineered in collaboration between INFINITI and the Renault Sport Formula One Team, and under development specifically for road use, the Q60 Project Black S prototype features a world-first dual-hybrid powertrain technology. Not only does it harvest kinetic energy under braking; it also harvests heat energy from the engine's twin-turbo system, making it the first of its kind (technical regulations mean Formula One powertrains harvest heat energy from a single turbocharger).

The test-bed vehicle fuses high-performance dual-hybrid technology with INFINITI's award-winning VR30 3.0-liter V6 twin-turbo engine. Its unique 'energy recovery system' (ERS) contributes to greater power and torque than the engine upon which it is based. Where the conventional VR30 engine produces 298 kW (400 hp / 405 ps), the dual-hybrid powertrain prototype generates 420 kW – equivalent to 563 hp or 571 ps.

The prototype's powertrain employs three motor generator units (MGU). A single MGU-K ('K' stands for 'kinetic') unit harvests kinetic energy from braking. Uniquely, the engine's twin turbochargers are fitted with two MGU-H ('H' for 'heat') units, to harvest heat



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energy from exhaust gases. This enables the powertrain to generate electrical power under both braking and acceleration.

Electrical energy harvested by the three MGUs is stored in a high-rate discharge 4.4 kWh lithium-ion battery pack, located in the rear compartment. As in a Formula One powertrain, the power recovered by the MGUs and stored in the battery pack is deployed in two ways. Firstly, it acts as an electrically-assisted anti-lag system, spooling up the turbine blades within both e-turbos more quickly and rapidly increasing the amount of air recirculated back into the engine to boost power. Secondly, energy stored in the battery can be used to power the MGU-K, feeding up to 120 kW of additional electric power directly into the drivetrain. The dual-hybrid technology therefore enables a significant increase in performance, for instantaneous, lag-free acceleration.

In the development prototype, the extra electric power is applied to the rear axle through a newly-designed final drive assembly on the rear axle, which integrates the MGU-K.

The prototype is also the first INFINITI vehicle with full 'by-wire' driver controls. Alongside drive-by-wire acceleration and gear shifts, as well as INFINITI's steer-by-wire Direct Adaptive Steering system, the Q60 Project Black S features a new brake-by-wire (BBW) regenerative braking system. Optimized for track and road use, the new braking system replaces the Q60 Red Sport 400's standard brakes (355 mm front and 350 mm rear ventilated iron disc brakes) with new 380 mm and 360 mm carbon-ceramic drilled and ventilated brakes.

A legalized feature of Formula One cars since 2014, the BBW system is a better match for the Q60 Project Black S prototype's new powertrain packaging, compared to the donor car's standard brakes. Integrated with MGU-K regenerative braking, BBW also delivers a consistent, satisfying brake pedal feel and high heat capacity, despite repeated heavy use. The result is to give drivers ultimate confidence in the brakes' ability to rein the car in from high speeds.



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*"In 1977, the Renault RS01 was the first to introduce turbocharging to Formula One – a technology that would define an era for the sport. Today, the Renault RS18 uses a dual-hybrid powertrain, honed with INFINITI's assistance over several years. The Project Black S engineering prototype is the first indication of how cutting-edge motorsport powertrains could be used to create thrilling hybrid cars. Project Black S demonstrates a mutual passion across the Alliance in shaping the future of the sports car."*

Jérôme Stoll, President, Renault Sport Formula One Team

***Rapid prototyping and powertrain development from a small, focused and agile team***

- *Short 18-month development program for Q60 Project Black S prototype*
- *Collaboration between small design and engineering teams from INFINITI and the Renault Sport Formula One Team enables rapid development work*

*"Working with the Renault Sport Formula One Team means we can operate on incredibly short development cycles for different elements of the Project Black S prototype. In just 18 months, an agile cohort of designers and engineers from INFINITI and the Formula One team has turned a design study into a working demo car."*

Tommaso Volpe, Global Director of Motorsport, INFINITI

The Q60 Project Black S prototype has been developed to its current state far more quickly than any other vehicle produced by INFINITI in the company's existence. Beyond developing a unique new powertrain, this project embodies efforts by INFINITI to shorten the gestation period of new models. To-date, the Project Black S prototype has been in development for just 18 months.

Working in tandem with the Renault Sport Formula One Team has led to rapid prototyping and powertrain development from a small, focused and agile team of designers and engineers. The Renault Sport Formula One Team develops new race cars in under a year, making iterative improvements to aerodynamics, powertrains and energy



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management systems 'on-the-fly'. The team frequently adapts different elements of their cars in between race weekends.

The team has been a positive source for disruption in the development program for Project Black S, with more responsibility placed in the hands of teams often made up of only two or three engineers or designers. This has helped to accelerate the development process, particularly in devising creative design and engineering solutions to problems posed by powertrain packaging.

Replacing a process that could take many years, the two Alliance partners have been able to rapidly develop and validate new motor generator units, cooling systems, computing technology, and an electrically-assisted twin-turbocharger system that must be able to stand up to sustained use on road and track.

The adoption of the MGU-H and MGU-K units necessitates specific management of air flow to aid powertrain cooling, and it was incumbent on the engineering and design teams to work in close collaboration to find a solution. This resulted in the creation of wider cooling ducts in the front bumper, two outlets in the bonnet to draw heat away from the turbochargers and MGU-H units, and aerodynamics which contribute to cooling the MGU-K situated behind the rear axle.

In addition to challenging INFINITI's conventional development process, partnering with the Renault Sport Formula One Team has also given INFINITI access to more specialist development technologies. These include advanced digital validation tools for optimizing the car's aerodynamics. Vehicle packaging and suspension have also been adapted in this way. The team's experience with thermal management simulations proved critical in validating the durability and performance of the high-performance dual-hybrid system in its translation from track to road.



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The next stages of the project – through 2019 – will see the prototype's development shift from digital and dynamometer environments on to the track, for performance testing and validation in a range of real driving conditions.

Following the conclusion of 'Project Black S', INFINITI believes that elements of the prototype's highly efficient development and validation process could be incorporated into development programs for future road cars, reducing their time-to-market.

***Smart energy management and supersport performance from dual-hybrid powertrain***

- 420 kW power output from prototype powertrain – 41% higher than donor car
- 'Road', 'Race' and 'Quali' driving modes to adapt electric power use

*"The Project Black S prototype is a test-bed for innovative thinking, demonstrating our desire to introduce exhilarating electrified powertrains with smarter energy management than other hybrids. While still a prototype, this dual-hybrid system is a world first, harvesting both heat and kinetic energy, under braking and acceleration. By intelligently scavenging and recycling energy, the hybrid performance from the Project Black S powertrain would be smart, sustained and utterly satisfying to deploy."*

François Bancon, Vice President Product and Programs, INFINITI

The Q60 Project Black S development prototype produces more power and accelerates more quickly than any INFINITI road car to-date. Combining smart energy recovery systems with INFINITI's high-performance VR30 3.0-litre twin-turbo engine, the Project Black S hints at the potential for true supersport performance from a dual-hybrid powertrain.

With 420 kW (571 ps / 563 hp) – 41% more than the Q60 Red Sport 400 – the prototype can accelerate from 0-to-100 kph in under four seconds. Furthermore, the dual-hybrid system uses the MGU-K system to provide a high-response electrically-assisted launch control system. With the battery pack sufficiently charged, the low-down



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torque of the electric motor – paired up with a helical gear limited-slip differential to manage power delivery to the rear wheels – enables maximum acceleration from a standstill. The development car's new powertrain creates the potential for a top speed in excess of that of the Q60 Red Sport 400 upon which it is based. With additional development work planned for the coming months, the prototype's approximate weight of around 1,775 kg (approximately 3,915 lbs), means the car offers a power-to-weight ratio estimated to be 39% higher than the Q60 Red Sport 400: around 235 kW per tonne (320 ps per tonne, 315 hp per tonne).

However, Project Black S isn't simply about on-paper performance figures. Uniquely, it provides sustained and sustainable hybrid performance, delivering devastating electrically-assisted acceleration, lap after lap after lap.

It differs from every road car in existence by intelligently harvesting and managing electric power from two different sources. It allows a more sustained use of electric power to deliver its performance, harvesting heat energy under acceleration from the two turbochargers (via the twin MGU-H system), and kinetic energy under braking (via the MGU-K). The Project Black S prototype stores this energy and discharges it as the driver requires, spooling up the turbochargers instantaneously as the driver opens the throttle, and boosting power sent to the rear wheels via the MGU-K over continued periods of acceleration.

Befitting its development brief, the prototype offers drivers complete control over how the powertrain uses its electric power with three Formula One-inspired drive modes: 'Road', 'Quali' and 'Race'. Each alters the way in which the powertrain gathers and discharges energy.

'Road' mode offers the most flexible and efficient use of electric power, for use in conventional driving conditions. It recharges the battery on-the-go with low-level, non-invasive energy recovery, ensuring the driver can call upon a quick burst of acceleration to



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overtake another vehicle or gather speed when joining a highway. It can provide a small boost to the efficiency of the engine under acceleration, and the dual-hybrid system delivers its power to ensure the car can excel at road-legal speeds.

'Quali' Mode offers ultimate on-track performance, deploying as much power as possible under acceleration and enabling the prototype to carry on building speed, even on longer straights. In this mode, the prototype harvests more kinetic energy under heavy braking as the driver approaches a corner (compared to Road mode, where the increased kinetic braking effect would negatively impact the driver's ability to drive smoothly). Accelerating away from the turn, the battery then discharges energy to help the car gather speed quickly, even as the MGU-H continues to recover heat energy.

'Race' mode is designed to offer a sustained deployment of energy for use on the track. In this mode, in contrast to 'Quali' mode, the prototype releases energy under acceleration where its deployment can maximize on-track performance or lap times, and saves energy elsewhere if needed. Of the three modes available, 'Race' mode is most similar to that used by the Renault Formula One Team throughout the course of a full race. The development aim has been to minimize performance compromises relative to 'Quali' mode, and the deployment strategy to achieve this depends on track layout. The Project Black S prototype uses a mathematical approach derived from Formula One.

The sustainability of ultimate performance is a challenge in the development of any performance hybrid car – the dual-hybrid system in the Project Black S prototype addresses this. As it recovers energy under both braking and acceleration, the balance of energy use and storage can be improved significantly. Under testing by the Renault Sport Formula One Team, in a digital test program emulating the 4.655-km Circuit de Barcelona-Catalunya, the Q60 Project Black S discharged just 15% of its full battery power over the course of a lap, even in 'Quali' mode. Under the same conditions, INFINITI's earlier single-hybrid performance car, the Q50 Hybrid, discharged around 80% of its battery power.



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In addition to the three drive modes, drivers can also adapt the car's anti-lock braking (ABS) and traction control systems with adjustable modes for road and track driving.

*INFINITI's commitment to high-performance electrified powertrains*

- *Advanced dual-hybrid system delivers high power and rapid acceleration*
- *INFINITI to draw upon Alliance technologies to deliver high-performance electrified powertrains, including e-POWER and electric motors*

Project Black S represents INFINITI's commitment to high-performance electrified powertrains, and is a technological test-bed in which high power and blistering acceleration are the ultimate goals. It proposes one way in which INFINITI hopes to draw upon Renault-Nissan-Mitsubishi Alliance technologies to enable high performance, emissions compliance and range confidence.

The brand's partnerships will allow INFINITI to offer its customers a thrilling driving experience, whether supported by high-power electric motors, advanced e-POWER electrified powertrains, or even motorsport-inspired energy recovery systems.

## Packaging and design

### A springboard for performance engineering and a motorsport-inspired cabin

*"Building on the success of the Q60, and new culture icon in the Q60 Red Sport 400, our team in London has worked across the Alliance with our colleagues in the Renault Sport Formula One Team and brought Project Black S to life. Taking the Q60's mix of seductive artistry, skinned over pure power, Project Black S goes deeper, allowing the science of Formula One engineering to lead us to another level. The artistry we love in the Q60 has become sharper, and blade-like carbon and performance-focused cooling ducts have transformed the Q60 into a beast."*

Alfonso Albaisa, Senior Vice President for Global Design, INFINITI



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*Cross-Alliance collaboration to realize Project Black S design and aerodynamic efficiency*

- *Aerodynamics validated and optimized by Renault Sport Formula One Team*
- *New rear wing provides significant additional downforce for high-speed stability*

*"The earlier 2017 Project Black S concept car represented an early design vision for the development of a highly focused dual-hybrid super sports car. Now, with a functioning high-speed prototype ready to take to the track for further validation, we have fleshed out the design with real purpose."*

Karim Habib, Executive Design Director, INFINITI

It is not just the powertrain that has been designed in partnership between INFINITI and the Renault Sport Formula One Team. Project Black S also demonstrates how the two Alliance organizations could collaborate to optimize aerodynamic efficiency to benefit performance. Accordingly, there are a number of strong visual links between the Project Black S prototype and the Renault Sport Formula One Team's race cars.

The 2017 Project Black S show car proposed an initial vision for motorsport-inspired aesthetics and aerodynamics. The aerodynamics of the new 2018 prototype have been optimized by the Enstone-based Renault Sport Formula One Team, using computational fluid dynamics software to deliver more effective powertrain cooling and enhanced downforce.

Similarly, INFINITI has called upon the Renault Sport Formula One Team's expertise in production techniques and its use of more advanced materials. Many of the Q60's body panels, including the hood, fenders and roof, have been replaced with lightweight carbon fiber panels.



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Other elements of the exterior – such as the twin titanium exhaust tips – have been crafted using 3D printing technology, used by the motorsport team to rapidly create and trial new components for their race cars.

Celebrating the partnership with the Renault Sport Formula One Team, the prototype is finished inside and out in black with yellow highlights – inspired by the famous livery of the team's Formula One cars. The pared-back interior, still recognizably based on that of the Q60 donor car, also benefits from a 'lightweighting' approach, with features and functions evoking the minimalist operability of a Formula One car.

The Renault Sport Formula One Team's input is no more evident than in the high-tech design of the rear wing, which has been validated by the Formula One team's aerodynamicists and finished in carbon fiber. The wing has a similar aerodynamic profile to the Renault Sport Formula One Team's 'Monza' wing, which provides a relatively low level of downforce for a Formula One car around one of the faster circuits in the sport's calendar. Yet, for a development vehicle based on a homologated road car, the impact is significant.

Illustrating its collaborative development, the Enstone and Paddington teams responsible for aerodynamics and design have been able to hone the rear wing by testing a series of design iterations. Where certain configurations have maximized downforce levels around corners, others have enabled greater acceleration and high-speed, straight-line performance. Having access to the Renault Sport One Team's digital modelling technology allowed for subtle changes to the shape and proportions of the wing, which now offers a fine-tuned compromise between maximum straight-line stability and high-traction under cornering. In all, the team has tested four iterations of the wing so far, with further changes to its profile still possible before the car moves to its next stage of track testing and validation.

*Creative vehicle packaging and engineering to incorporate dual-hybrid technology*



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- *Significant packaging changes to accommodate intrusive dual-hybrid powertrain*
- *Lower center of gravity, improved weight distribution and lightweight materials to offset weight gain from powertrain components*

*"Given the compressed timescales for delivery of Project Black S, we have used predictive computer modelling to validate how to marry the car's design, aerodynamics, powertrain and dynamics together. Having a small, responsive team of experts involved in developing the prototype has meant we are able to make changes far quicker than going through a traditional testing and validation process."*

Tommaso Volpe, Global Director of Motorsport, INFINITI

The INFINITI and the Renault Sport Formula One Team did not have the luxury of working from a blank-page design, and instead were bound by the dimensions of the existing Q60. Despite being the most appropriate candidate for the technology, the donor car was not originally devised to accommodate a dual-hybrid powertrain.

The designers and engineers devised several creative ideas to integrate the highly-intrusive dual-hybrid powertrain within the existing body and platform. Rapid digital prototyping of imaginative packaging and engineering solutions became crucial to the success of the project, enabled by the close collaboration between the two Alliance partners and their pared-back design and engineering teams.

The engine bay of the Q60 donor car is packaged in such a way to accommodate the twin-turbo VR30 3.0-liter V6 engine. However, there was initially no space for either of the two MGU-H units, or the independent hybrid cooling circuits. This meant moving and repackaging the existing engine cooling system, and installing a new high-efficiency radiator. A small section of the body has been cut out to accommodate the MGU-H system, with the Atsugi R&D center using its knowledge of the body structure to reinforce the body elsewhere – making the front section of the bodyshell even stronger in the process.



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Further back in the car, the MGU-K system, lithium-ion battery pack and ancillary components required even more attention. The rear suspension crossmember has been modified to accommodate the MGU-K. A new cooling system for the MGU-K has been installed, placing the radiator core beneath the rear floor and channeling air through the center diffuser. Advanced computational fluid dynamics software enabled the development team to make a number of alterations to the design of the car's undercarriage to enable the diffuser and cooling duct to work in parallel with the rear wing to aid cooling and air flow.

One of the most visible change has been the deletion of the Q60's rear seats, creating additional space for the 4.4 kWh battery pack, energy inverter and hybrid electronic control unit. Following its track car development brief, designers have been free to eliminate the rear passenger compartment, instead creating more space to house the dedicated wire looms required to carry high-power outputs between the different power sources and outlets.

To maximize the impact of the new dual-hybrid powertrain – specifically, using the brakes to harvest kinetic energy – INFINITI and Renault Sport Formula One Team engineers have also replaced existing front and rear brakes with a new brake-by-wire system (as outlined above).

The powertrain itself adds around 200 kg to the overall weight of the vehicle – however, this presented engineers with the opportunity to find weight-savings elsewhere to lower its overall center of gravity, and even redistribute weight for more favorable driving characteristics.

With the introduction of so much additional weight, the development aim for engineers from INFINITI and the Renault Sport Formula One Team was 'weight neutrality' - to return the prototype as close as possible to its original 1,752-kg curb weight. The



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development team succeeded in bringing the curb weight of the Q60 Project Black S prototype back to 1,776 kg – just 24 kg more than the donor car – resulting in a 39% higher power-to-weight ratio.

The steel hood, boot lid, fenders and roof of the standard car have been replaced with lighter carbon fiber panels. As an example, the new hood is 3.02 kg lighter, while the boot lid also weighs 2.7 kg less. The powered glass 'moonroof' from the donor car has been removed, with the steel roof panel and assembly replaced with a carbon roof panel to reduce weight at the car's highest point by 10.2 kg.

The Q60 Red Sport 400's 20-inch aluminum alloy wheels have been replaced by new 21-inch forged aluminum wheels (275/30 R21 at the front, 295/30 R21 at the rear). Created specially for the Project Black S prototype, the lightweight structure of the wheels means they offset any potential weight gain from their larger dimensions. Wheels are shod in high-performance Pirelli P ZERO™ road tires. The drilled and ventilated carbon-ceramic brakes also offered a significant weight saving. Despite the discs being larger than the Q60's iron brakes, they provide a combined weight saving of 22 kg. With more powerful calipers fitted accordingly (adding 6 kg), the prototype's brake system is 16 kg lighter overall than that of the donor car.

Inside, the removal of the rear bench and other rear passenger creature comforts has saved 19.5 kg of weight. The new front seats are also built around lighter carbon fiber shells and feature a slimmer design.

The packaging of the dual-hybrid powertrain also improves the weight distribution of the prototype. The MGU-K and battery pack - located in the rear of the cabin and over the rear axle, respectively – shift more weight towards the rear of the car. Where the base car has a front-biased weight distribution of 58:42 (front-to-rear), the packaging of the powertrain components means the Q60 Project Black S offers a near-perfect 50:50 weight distribution, with mass distributed more evenly over front and rear axles.



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*An aerodynamic, high-downforce expression of INFINITI DNA*

- *Designed by INFINITI Design London and Renault Sport Formula One Team*
- *Technical, lightweight aesthetic and motorsport cues for exterior and interior*

*"We have drawn on the expertise of the Renault Sport Formula One Team to introduce high-strength, low-weight carbon fiber elements to the car. INFINITI Design is experimenting with these advanced materials to combine functional aerodynamics with a muscular, performance-inspired aesthetic."*

Karim Habib, Executive Design Director, INFINITI

Project Black S represents the ultimate aerodynamic, high-downforce expression of INFINITI DNA. The development prototype balances the organic, artistic design of the Q60 sports coupe with greater aerodynamic efficiency and high levels of downforce than any INFINITI road car to-date.

Adapted over the standard Q60 by INFINITI Design London, based in Paddington, the prototype proposed a stronger, more aggressive presence, commensurate with its performance focus. The ruthless, Formula One-inspired functionality hints at the more assertive, performance-enhanced design that could characterize future high-performance models from the brand.

The carbon fiber bodywork of the new prototype is finished in a black satin matte lacquer, with the chrome trim of the donor car finished instead in lacquered black and darkened chrome. Yellow highlights across the exterior provide a visual link to the Renault Sport Formula One Team, with subtle color accents on the rear wing, leading and trailing edges of the bumpers, and around the bonnet vents. The brake calipers are also painted in the team's iconic color.



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Optimized for genuine aerodynamic impact, the carbon fiber panels and body enhancements also elevate the prototype above homologated INFINITI road cars, alluding to its performance potential. The use of lightweight motorsport-grade materials has enabled the creation of blade-like design forms that would not be possible to complete with conventional materials, such as steel or aluminum.

Enlarged air intakes channel cooling air into the engine bay and brakes, and a large front splitter diverts air beneath the car. New hood vents help to evacuate excess heat from the powertrain. Air flowing beneath the car is channeled to provide additional air cooling for the MGU-K, evacuated smoothly from the rear via the new diffuser. The diffuser, fenders and side skirts are all constructed out of carbon fiber to minimize weight, while ultra-thin aero 'blades' in the side sills in front of the rear wheels channel air around the lower body. At the rear, the body is shaped to allow circulating air to escape as quickly and efficiently as possible, aided by vertical aero foils and the large rear wing for maximum downforce and high-speed stability.

The Q60's cabin has been transformed – while still offering a luxurious environment, the prototype's fully-developed cockpit takes on a more focused, lightweight look; as inspired by motorsport as the exterior design and the powertrain. The front seats have new lightweight carbon fiber shells, while the donor car's technical metal trim is replaced with carbon fiber. The lithium-ion battery pack isn't left on-display – the rear bench is replaced with a new carbon fiber panel, fitted with tethers for the four-strap racing harnesses.

As with the exterior, there are a number of visual links to the Renault Sport Formula One Team. The seats, doors and central arm rest are trimmed in laser-etched black leather, with a highly-technical hexagonal graphic finished in yellow, fading to black lower down in the cabin. The seats also feature a hollowed-out section between the shoulder and head rests, finished in yellow, which feed the sports harnesses through to the front compartment. The steering wheel features a yellow strip of leather at its highest point, giving the driver a clear visual cue for the rack's center point when driving on a circuit.



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A final powerful hint to its Formula One-inspired dual-hybrid powertrain and numerous driving modes, the base of the center console features yellow switchgear. Derived from the switchgear found on a Formula One car steering wheel, these let the driver adapt the car's powertrain, traction control and ABS characteristics on-the-move or engage the prototype's launch control function. These switches are accompanied by a plaque with INFINITI and the Renault Sport Formula One Team logos – technical partners in Formula One, and collaborators throughout every stage of Project Black S development.

## Technical specification

### Body and chassis

Two-door, two-seat prototype sports coupe, with carbon fiber and steel unitary construction bodyshell. Six-cylinder twin-turbocharged dual-hybrid engine driving the rear wheels via seven-speed automatic transmission.

### Powertrain

#### Prototype 3.0-liter 'VR30' twin-turbo dual-hybrid V6 gasoline

Type	Twin-turbocharged with dual-hybrid energy recovery system (ERS)
Displacement (cc)	2,997
Bore and stroke	86.0 x 86.0 mm
Cylinder angle	60deg
Cylinder layout	V6
Max power, engine	298 kW (400 hp / 405 ps) @ 6,400 rpm
Max torque, engine	475 Nm (350 lb ft) @ 1,600-5,200 rpm
Valves	24 (four per cylinder)
Fuel system	Multi-split direct injection gasoline
ERS	MGU-K (1), MGU-H (2)

#### Motor generator unit – kinetic (MGU-K)

Type	AC permanent magnet synchronous motor
Max power	120 kW

#### Motor generator unit – heat (MGU-H)

Type	AC permanent magnet synchronous motor, split-turbo
Max power	30 kW

### Battery

Type	Lithium-ion polymer
Voltage	400V



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Energy 4.4 kWh  
Power 120 kW

Total powertrain output

Max power 420 kW (563 hp / 571 ps)  
Max torque TBC

**Transmission**

Seven-speed automatic

**Drivetrain**

Rear-wheel drive

**Performance targets**

0-to-100 kph <4.0 seconds  
Top speed TBC

**Suspension and damping**

Front Fully-independent subframe-mounted double wishbone suspension, coil springs and gas-filled shock absorbers, with anti-roll stabilizer bar  
Rear Fully-independent subframe-mounted multi-link suspension, coil springs and gas-filled shock absorbers, with anti-roll stabilizer bar

**Steering**

Type Direct Adaptive Steering, steer-by-wire, variable ratio

**Brakes**

Front 380 mm, carbon-ceramic, drilled and ventilated  
Rear 360 mm, carbon-ceramic, drilled and ventilated

**Wheels and tires**

Front 275 / 30 R21, forged aluminum  
Type 295 / 30 R21, forged aluminum

**Weight**

Curb weight\* 1,775 kg / 3,915 lbs  
Power-to-weight\* 236 kW per tonne (322 ps per tonne / 317 hp per tonne)  
*\*based on current specification of prototype*

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-Ends-



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**About INFINITI:**

INFINITI Motor Company Ltd. is headquartered in Hong Kong with representations in 50 markets around the world. The INFINITI brand was launched in 1989. Its range of premium automobiles is currently built in manufacturing facilities in Japan, North America, United Kingdom and China. INFINITI design studios are located in Atsugi-Shi near Yokohama, London, San Diego and Beijing. INFINITI is in the middle of a major product offensive. The brand has been widely acclaimed for its daring design and innovative driver-assistance technologies. From the 2016 season, INFINITI is a technical partner of the Renault Sport Formula One team, contributing its expertise in hybrid performance.

More information about INFINITI and its industry leading technologies can be found at [www.INFINITI.com](http://www.INFINITI.com). You can also follow INFINITI on [Facebook](#), [Instagram](#), [Twitter](#), [LinkedIn](#) and see all our latest videos on [YouTube](#).

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