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Audi A1 Sportback concept

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Compact five-door model with hybrid drive
Audi A1 Sportback concept

At the Paris Motor Show (October 2-10, 2008), Audi is unveiling the A1 Sportback concept study: following on from the Audi A1 project quattro, the three-door show car presented in 2007, this is a concept for a five-door four-seater for the sub-compact class – once again exhibiting all the characteristics of a genuine Audi. The 3.99-meter long *(13.09 ft)* and 1.75-meter wide *(5.74 ft)* vehicle combines cutting-edge, dynamic styling with optimum economy of space and supreme quality. At the same time, a series of visionary technical solutions take efficiency, dynamism and motoring pleasure into new territory as only Audi knows how.

Audi is presenting another version of the innovative hybrid technology in the drive unit for the A1 Sportback concept. At work under the hood is a 1.4-litre TFSI engine developing 110 kW (150 hp), whose power is directed to the front wheels by means of the S tronic dual-clutch transmission. A 20 kW (27 hp) electric motor integrated in the drive train is able to deliver up to an additional 150 Nm of torque *(110.63 lb-ft)* when the vehicle is accelerating. During the boosting phase, i.e. when the TFSI engine and electric motor operate simultaneously to enable a sporty driving style, the two power packs deliver impressive propulsion. The tried-and-tested front-wheel drive – supplemented by the newly developed, ESP-controlled active front differential lock – ensures optimum transfer of power to the road.

The electric motor is furthermore capable of powering the vehicle alone for zero-emission driving in residential areas, for instance. The capacity of the lithium-ion batteries gives the vehicle a range of up to 100 km *(62.14 miles)* in pure electric mode; the motor can be recharged from any power socket. The automatic start/stop facility, energy regeneration and phases of purely electrical operation reduce the fuel consumption and emissions of the Audi A1 Sportback concept by almost 30 percent compared to when it is running on the combustion engine alone. Despite its sporty performance, with acceleration of 0 to 100 km/h *(62.14 mph)* in 7.9 seconds and a top speed of 200 km/h *(124.27 mph)*, the Audi A1 Sportback concept requires only 3.9 liters of premium fuel per 100 km *(60.31 US mpg)*; CO_2 emissions are an efficient 92 g/km *(148.06 g/mile)*

The design

Exterior

The difference is not down to the two extra doors alone: the styling of the five-door concept vehicle is a consistent development of the three-door study, the Audi A1 project quattro from the year 2007. Surfaces and lines are distinctly tauter and more masculine.

The basic proportions, with a high vehicle body and a flat window area bordered by a coupe-like roof line, produce a virtually classic look for a vehicle bearing the four rings. The rear end is rounded off by a two-part spoiler with a striking centre groove, integrated into the rear window.

The side-on view presents another typical coupe attribute in the form of doors with frameless windows and a glass-covered and thus homogeneously integrated B-pillar. The bold segmentation of the study's side paneling with its gently rising shoulder line accentuates the styling.

The shoulder line of the Audi A1 Sportback concept with its Daytona Grey paint finish is a new interpretation of yet another trademark feature of the current Audi design. Here, the prominent double lines continue around the entire vehicle as a curvaceous band that links the front end – from which it seems to emerge – with the vehicle's tail, which rises to create a slightly wedge-shaped effect.

The aerodynamically designed single-frame grille indicates the sporty ambitions of the study, which are further emphasized by the flared fenders – a tribute to the legendary Ur-quattro design and the current Audi RS 6.

The design of the three-dimensional main headlights in innovative LED technology is especially eye-catching. The completely new styling underlines yet again the amount of freedom that this technology has afforded to designers. All light functions – low-beam and high-beam headlights, daytime running lights and turn indicators – have been located in one flat housing, in concentrically arranged, parallel and squared-off strips.

The layout, with light segments of varying sizes – the low beam taking up most space – completely changes the character of the front section, the “face” of the A1 Sportback concept.

The rear lights, too, continue this theme and combine the function of tail and brake lights, turn indicators, reversing and rear fog lights into an unmistakable design. The interplay of acute and obtuse angles and the clear and colored glass areas create a particularly dynamic look. A large-dimensioned, transparent cover over the entire width of the vehicle additionally combines both light units and emphasizes the horizontal design of the rear.

Like the three-door version, the body of the four-door Audi A1 Sportback concept makes optimum use of the small road surface area available to a vehicle from the premium compact class. Measuring 3.99 m long *(13.09 ft)* and 1.75 m wide *(5.74 ft)* with a wheelbase of 2.46 m *(8.07 ft)*, it succeeds in combining sporty looks with impressive economy of space thanks to its short overhangs. The transverse installation of the engine also has a significant role to play in this respect. The third dimension of this compact, sporty car – i.e. the height – comes in at 1.40 meters *(4.59 ft)*.

Interior

The interior, with its four individual seats and a surprisingly generous amount of spaciousness for this class, has a tidy, no-frills appearance. The curved, wrap-around section combines the doors and the sporty cockpit into one single unit. The dashboard and center console are designed entirely around the driver.

Ergonomics and aesthetics unite to create an ambience of clear-cut architecture and high-class appeal. Details such as the turbine-look air vents and air conditioning controls seem to be straight out of a jet plane. This is where advanced form and precise function are combined in typical Audi fashion: air flow direction and volume can be regulated simply and intuitively by turning or pressing the control button in the centre of the vent.

The center console accommodates the integrated selector lever, only extended in drive select dynamic mode, the start/stop button for the engine, the switch for Audi drive select and the armrest with an integrated mobile phone pocket.

The sporty seats with integrated head restraints offer levels of comfort and ergonomics that far exceed the customary standards in the sub-compact class and live up to the expectations of a typical Audi. A transparent, mesh-like fabric covers the lightweight seat apertures, which further accentuates the airiness of the design.

The materials used for the interior trim appeal with their high-class looks and feel. The contrasting color scheme for the interior – white and red – emphasizes the feeling of spaciousness.

Audi mobile device – the second generation

Whereas the Audi A1 project quattro study featured its own mobile control unit for infotainment and vehicle systems, the A1 Sportback concept takes one step further into the future: the driver can use his commercially available mobile phone (equipped accordingly) as a car phone, address database, navigation system and audio/video player. At the same time it can be used as a control unit for numerous vehicle systems in the Audi A1 Sportback concept. Several phones that are suitable for these functions are already available from various manufacturers.

All that is required is some additional software, which Audi will provide on the internet for the driver to download and install. He can then enter his route plan or adjust the sound system to his individual preferences, all from the comfort of his own home, for example.

The mobile phone and vehicle communicate via a fast WLAN connection, even over considerable distances.

The system also offers the user a security function: within the range of the WLAN it can constantly monitor the current status of the vehicle, for instance whether all windows and doors are closed. What's more, the additional software offers numerous comfort and convenience features such as continued destination guidance on the mobile device after the vehicle has been left in a car park. If the user sets a maximum parking time with the device, its navigation software leads him back to the Audi A1 Sportback concept – in good time of course, allowing for the current distance from the vehicle.

During the journey the mobile device demonstrates its strength as a portable media player. If the user listens to a song in a certain driving situation – on the motorway, for example – it is entered in an appropriate playlist. The software registers when and where the user prefers to listen to particular songs. The music is then available at the right moment.

The MMI control unit in the vehicle is a further development of the familiar design. In terms of feel it is easier to operate, particularly while driving. Grouped around the central rotary pushbutton are four fixed-function hardkeys for the Navigation, Telephone, Car and Media basic menus. Four additional, backlit softkeys have variable functions which change within the individual menus.

The projected softkey labels combine with the bold softkey colors that identify the corresponding menus to ensure swift, intuitive user orientation.

All system information appears in the central display in the instrument cluster. This is designed in its entirety as a digital, freely configurable display with no mechanical elements. Superimposed glass elements make the graphics stand out with a three-dimensional look, producing a level of depth which could never be attained using a standard display.

As well as the virtual, large circular dial of the analog speedometer, which is always visible on the right-hand side of the instrument cluster, numerous other displays can be called up on request, and can be selected via control buttons on the steering wheel. These include infotainment, classic navigation by pictogram or map, a rev counter, information on how to drive as efficiently as possible and a current status report on the hybrid drive.

The layout of the infotainment display features icons arranged in a semicircle. As the driver turns the central MMI rotary pushbutton, the icons mimic the movement until the desired function is selected by pushing the button. Content can therefore be communicated visually, enabling it to be grasped faster and more intuitively than pure text.

Audi drive select

The Audi A1 Sportback concept features Audi drive select, which is also available as an option in the current generation of the Audi A4 bestseller. This enables the driver to pre-select one of two specially adapted configurations for the drivetrain, shift characteristics and magnetic ride shock absorbers.

The default setting is the “efficiency” mode. In this mode, the engine and transmission respond gently to use of the accelerator and shift paddles. This setting is ideal for a relaxed driving style, as well as offering tremendous potential for effectively lowering fuel consumption, and therefore emissions too.

In the “efficiency” mode the Audi A1 Sportback concept can be used for distances of up to 100 kilometers *(62.14 miles)* in purely electric mode – and it is quite speedy, too: thanks to the powerful battery it is possible to reach a speed of considerably more than 100 km/h *(62.14 mph)*. The combustion engine only cuts in again once battery capacity has dropped to below 20 percent of maximum.

In this mode, the electric motor is not deployed as a source of additional torque; instead it is run selectively as the sole power source to bring about a tangible reduction in consumption. For this purpose, the system makes use of a host of parameters which can be fed to it via the navigation system. In the “efficiency” mode, for example, with a fully charged battery and a distance of less than 50 kilometers *(31.07 miles)* the vehicle is operated in principle on purely electrical power.

Thanks to the navigation system’s ability to detect differences in altitude along the route, regeneration phases as well as the increase in energy requirements on inclines can be computed before the journey has even started. This makes vehicle operation even more efficient through optimum utilization of the electric motor.

The sport mode is designed to produce the dynamic yet comfortable driving sensation that is so typical of the brand and that Audi drivers have come to expect of their car. In this mode, the vehicle’s electronics also harness the torque available from the electric motor to achieve extra-sporty acceleration along with excellent lateral dynamics.

The drivetrain

Characteristic Audi sportiness plus a whole new dimension in efficiency – it is all down to the combination of a state-of-the-art turbocharged FSI engine with an electric motor and innovative control electronics.

Under the hood of the Audi A1 Sportback concept sits a four-cylinder TFSI with a capacity of 1.4 liters and a turbocharger. This engine is an advanced version of the unit that made its series production debut in the Audi A3. Whereas the 1.4 TFSI musters 92 kW (125 hp) in the A3, it delivers 110 kW (150 hp) at 5,500 rpm in the study. Its peak torque of 240 Nm *(177.01 lb-ft)* is on tap over a broad rev band from 1,600 – 4,000 rpm.

The Audi engineers have long since proven the performance potential of turbocharged FSI technology, both on race tracks around the world and out on the road. Indeed, a jury of experts awarded the accolade of "Engine of the Year" to the 2.0 TFSI for the fourth year in succession in 2008.

The new 1.4 TFSI builds on this very same concept in order to maximize efficiency and performance. Multi-hole injectors result in very homogeneous mixture formation and extremely efficient combustion. This is also an effective means of helping to cut pollutant emissions.

The integrated turbocharger promises optimized responsiveness and even more harmonious torque build-up. 80 percent of peak torque can be summoned up from as low down as 1,250 rpm, in other words barely above idling speed. And despite its power, the 1.4 TFSI sets new benchmark standards in its class for its acoustic output too.

Powertrain

Power transmission to the front wheels is the task of the sporty Audi S tronic dual-clutch gearbox. It allows the driver to change gear in fractions of a second without the use of a clutch pedal and with no interruption to the power flow. If required, the transmission performs the gear changes fully automatically, too. If the driver wishes to change gear manually, he can do so by using the shift paddles mounted on the steering wheel. Reverse gear and neutral are engaged via the gear knob on the centre console. The park position is automatically selected when the electric parking brake is engaged.

Between combustion engine and transmission sits the 20 kW (27 hp) electric unit, which cuts in automatically depending on the selected operating mode – or propels the vehicle alone. The battery unit – a package of compact lithium-ion batteries – is installed at the rear of the vehicle, which makes for a good weight balance.

When powered solely by the combustion engine or purely by the electric motor, and when both are used in the boost mode, the A1 Sportback concept operates as a front-wheel drive vehicle. The high torque of 390 Nm in total *(287.64 lb-ft)* – 240 Nm *(177.01 lb-ft)* from the 1.4 TFSI plus an extra 150 Nm *(110.63 lb-ft)* from the electric motor – is transformed into the required level of tractive power when accelerating.

Overrun, or the so-called regeneration phase, is one of the most important instruments of this vehicle concept for optimizing efficiency as it transforms the braking energy released during deceleration phases back into electrical energy, instead of it being wasted and released as heat.

The Audi A1 Sportback concept can in principle run self-sufficiently, using mixed operation of the combustion engine and electric motor. Thanks to the intelligent management of both units, energy regeneration as well as the automatic start/stop function, fuel consumption is almost 30 percent lower compared to a vehicle running on the gasoline engine alone. Although the components of the electric motor add around 40 kilograms to the overall weight, the study still only burns 3.9 liters of premium fuel per 100 km *(60.31 US mpg)* in mixed mode, while CO_2 emissions average just 92 g/km *(148.06 g/mile)*.

Pure electrical operation over shorter distances, however, is a particularly attractive alternative offered by this vehicle that benefits the environment and the wallet alike – all the more so considering that the performance achieved in this mode and the range of over 50 kilometers *(31.07 miles)* are perfectly satisfactory. "Refueling" the Audi A1 Sportback concept from power sockets alone, therefore, produces an unequivocal result: even allowing for the relatively high costs of domestic electricity in Germany, it is still possible to achieve a saving or more than 80 percent compared with the price of premium fuel. Thanks to "zero emissions" the benefit to the environment is even greater, particularly in congested urban areas.

The chassis

The fundamental ingredient for outstanding driving safety and handling dynamics is supplied by the sophisticated chassis design, comprising McPherson front suspension and four-link independent rear suspension. Large 18-inch wheels with size 225/35 R18 tires boost both driving pleasure and safety. Thanks to the newly developed active, ESP-controlled front differential lock, propulsive torque is distributed according to the driving situation, thereby achieving enhanced steering precision and superior directional stability as well as improved traction and dynamic handling when cornering.

The dynamic chassis is tuned for sporty, agile handling combined with excellent stability, and makes cornering a particular delight. What's more, the chassis excels with a level of ride comfort befitting of higher vehicle classes.

The braking system with its large-diameter discs (measuring 312 mm across *(12.28 in)* at the front wheels) is more than a match for the drive power. Bred on the racetrack, the system promises outstanding, fade-free stopping power.

The electromechanical steering with speed-sensitive power assistance is also a boon for agile handling. The system boasts optimum steering feel combined with low sensitivity to road surface excitation and a considerable reduction in energy consumption.

The specific strengths of the four-link suspension stem from the way in which it splits the functions for absorbing longitudinal and lateral forces. This permits a high level of lateral rigidity on the one hand for optimum dynamism and driving safety, while offering a great degree of longitudinal flexibility on the other to improve ride comfort.

The shock absorbers deploy a highly innovative technology in the form of Audi magnetic ride, which has already made its mark in the Audi R8 high-performance sports car and in the TT. Here, the conventional shock absorber fluid is replaced by a magneto-rheological fluid whose qualities can be controlled by means of an electromagnetic field. This effect enables the damping characteristic to be influenced electronically at will by applying a voltage to the electromagnets.

Audi magnetic ride capitalizes on this quality to make the appropriate damping forces available in any driving situation, thereby optimizing both ride comfort and performance dynamics. A computer linked up to a system of sensors interprets the current driving situation with split-second speed. Here, the driver can choose between two driving programs, depending on whether he wants to drive with a sportier style – with the magneto-rheological fluid requiring a low yield stress – or with a greater emphasis on ride comfort.