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The new Audi TT – the third generation of the compact sports car

Summary

Emotion powered by design and technology – The new Audi TT

A modern classic relaunched: Audi introduces the latest generation of the TT. The compact sports car enthralls with dramatic design, pronounced dynamics and groundbreaking technology.

Taut and muscular, athletic and poised to pounce. With the new TT, the Audi designers have delivered a modern interpretation of the unmistakable lines of the original TT from 1998 enriched with numerous dynamic facets. The Coupé is 4.18 metres long with a wheelbase of 2.51 metres and correspondingly short overhangs.

The front is dominated by horizontal lines. The Singleframe grille is broad and flat; struts structure the interconnected air intakes. The headlights are also structured with dividing struts, which constitute the daytime running lights. Audi also offers the headlights with LED or the innovative Matrix LED technology. The latter uses small, switchable, individual light-emitting diodes to produce the high beam. The dynamic turn signals run in the direction the driver intends to turn, providing additional information for other road users.

When viewed in profile, many details of the TT is intentionally evocative of the first-generation design classic. The sill contour forms a powerful light edge and the wide wheel arches constitute distinct geometrical entities. At the front, the wheel arch intersects the hood join, which continues over the door as the tornado line and extends all the way to the rear. The flat greenhouse gives the impression of being an independent unit, and the subtle kink in the rear side window emphasises the C-pillar. The fuel flap in the classic round TT design is press-to-open. There is no longer a cap beneath it – the driver inserts the nozzle directly into fuel tank neck.

In back, horizontal lines again underscore the sporty width of the new TT. The struts in the standard LED tail lights, which take up the motif of the headlights and also light up together with the daytime running lights, are another Audi innovation. The third brake light – a flat strip on the edge of the luggage compartment cover – ties together the light silhouette at the rear.

Intelligent composite construction: The body

The composite construction concept behind the body of the TT represents a new evolution of the Audi Space Frame (ASF) based on the modular transverse matrix. The front end and the floor of the occupant cell include numerous components of hot-formed steel; the superstructure of the occupant cell plus the exterior skin and all bolt-on parts are made of aluminium. Equipped with the 2.0 TFSI and manual transmission, the Coupé has a kerb weight (excluding driver) of just 1,230 kilograms – up to 50 kilograms less than before. This is the second time in a row that Audi has reduced the weight from one TT generation to the next.

The new TT initially will be available with a TFSI engine. The new engine developed more power, with 169kW, yet it consumes significantly less fuel than its predecessor. A start-stop system is standard. A sound actuator works in conjunction with the optional Audi drive select dynamic driving system to provide a sonorous sound.

In the standard configuration, the 2.0 TFSI is mated to a manual six-speed transmission, with the six-speed S tronic available as an option. The dual-clutch transmission shifts gears lightning-quick without any noticeable interruption in traction, and in manual mode it can be controlled by paddles on the steering wheel, if desired. In efficiency mode in the Audi drive select system, the S tronic coasts when the driver takes their foot off the accelerator.

Latest evolution: quattro permanent all-wheel drive

The latest evolution of quattro permanent all-wheel drive is available for the new Audi TT. Its electrohydraulic, multi-plate clutch sends the power to the front wheels during normal driving, but can divert power to the rear wheels virtually instantaneously upon demand. The electronic control system takes the combination of driving enjoyment and safety to a whole new level. During sporty driving, it is quicker to send the power to the rear axle and thus tends to do so more often, literally pointing the new TT into the corner. On low-friction surfaces, the quattro drive system allows safe, controlled drifts.

Also new is that management of the clutch has now been integrated into the Audi drive select system, which offers the modes comfort, auto, dynamic, efficiency and individual. Audi drive select controls the function of the

accelerator pedal and steering boost, and integrates multiple optional modules, including the adaptive damper control system Audi magnetic ride.

Highly elaborate: The chassis

The Audi TT features a McPherson front suspension. Aluminium components reduce the weight of the unsprung masses. The rack of the standard progressive steering is designed such that the ratio becomes more direct with increasing steering input. The four-link rear suspension can process the longitudinal and transverse forces separately.

With its elaborate chassis and firm setup, the new Audi TT offers dynamic, highly precise handling. Wheels sizes up to 20 inches are available as options.

The vented front brake discs measure between 312 millimetres in diameter, depending on the engine version. The new electromechanical parking brake acts on the rear wheels.

Rounding off the sporty handling is the ESC electronic stabilisation control system, which can be partly or completely deactivated. It also functions as an electronic limited slip differential, using carefully modulated braking of the wheel on the inside of the curve, which is under a reduced load, to transfer power to the outside wheel. With quattro drive, this same function is provided by the torque vectoring system, which includes the rear wheels.

Sporty look: The interior design

With its lightweight, almost floating lines, the interior also expresses the sports car character of the new Audi TT. The interior's central concept is focused on the driver. All control elements are grouped around the driver. Flowing, corresponding shapes characterise the console of the centre tunnel and the door trims. Seen from above, the slender instrument panel resembles the wing of an aircraft; the round air vents – a classic TT feature – are reminiscent of jet engines.

The air vents play an important role in the operating concept. They house the controls for the air conditioning or the optional deluxe automatic air conditioning system. The controls for the heated seats, recirculation mode, temperature, air flow distribution and air flow strength are located on their axes. The air vents are just one example of the high standards to which the premium brand aspires with respect to the function, design and

workmanship of all cabin components. Audi has completely revised the range of colours and materials to underscore the sportiness of the new TT.

The low-mounted sport seats – another new development – together weigh five kilograms less than the seats in the previous model. Audi also offers the option of S sport seats with integrated head restraints and deeply sculpted, pneumatically adjustable side bolsters.

The 2+2-seat TT is a sports car with a high degree of everyday practicality. The luggage compartment beneath the long rear hatch offers a capacity of 305 litres, 13 litres more than in the previous model.

New: The Audi virtual cockpit and the operating concept

The Audi virtual cockpit – a digital instrument cluster with highly detailed, versatile graphics – replaces the analog instruments and MMI monitor in the new TT. The driver can switch the 12.3-inch, all-digital display between two different view modes. The classic configuration features the speedometer and the tachometer in the foreground. In Progressive mode, aspects such as the navigation map move to the forefront and the instrument dials are shown smaller.

Developed from the ground up, the operating concept is fully focused on the driver. There are two variants of the multifunction steering wheel available. The MMI control element, which is also new, has just six physical buttons. In combination with MMI navigation plus, it includes the MMI smart touch wheel – the touchpad on the top of the rotary pushbutton – with which the driver can do such things as zoom on the navigation map and enter characters. The menu structure was inspired by a smartphone and includes a search function. All key functions can be reached with just a few clicks, and the buttons on the side provide access to intelligently linked functions and options.

At a glance:

The new Audi TT

Concept, exterior design and chassis

- 2+2-seat Coupé, 305-litre luggage compartment
- Length 4.18 metres, wheelbase 2.51 metres, short overhangs
- Athletically dynamic design with hints of the first-generation TT
- Optional LED or Matrix LED headlights
- Composite construction body of steel and aluminum
- Kerb weight starting at 1,230 kilograms, as much as 50 kilograms less than the previous model

Drivetrain

- New four-cylinder 2.0 TFSI engine that produces 169kW
- Six-speed S tronic available
- quattro permanent all-wheel drive available; newly developed multi-plate clutch with dynamic management

Chassis

- Elaborate suspensions with aluminum components at the front axle
- Progressive steering with electromechanical servo boost standard
- Optional Audi drive select dynamic driving system and Audi magnetic ride adaptive damping system
- ESC stabilisation control, torque vectoring or electronic limited slip differential can be deactivated
- 18-inch lightweight wheels, optionally up to 20 inches

Interior design, operating concept and equipment

- Flowing, lightweight lines in the interior, slender instrument panel, uncompromising focus on the driver, newly developed lightweight sport seats and S sport seats
- Digital Audi virtual cockpit and newly designed MMI terminal, plus improved voice control, air conditioning controls in the air vents
- High-performance driver assistance systems available as options
- Numerous infotainment modules, including MMI navigation plus and Bang & Olufsen sound system
- Improved electronics architecture with second-generation modular infotainment platform
- Completely revised range of colours and materials

Full version

Third-generation dynamics – The new Audi TT

The Audi TT has been renowned for its sporty and progressive design for over 15 years. Now the brand with the four rings is presenting the third generation of the Coupé. It embodies dynamics, emotion and technology in their purest forms – in design, the engines, chassis and the innovative operating concept.

From study to successful sports car

In 1995, Audi presented the first Audi TT as a concept study for a sports car with high everyday practicality. Prof. Dr. Ulrich Hackenberg, today Member of the Board of Management of AUDI AG for Technical Development, was the concept developer and project manager responsible for the show car. He and his team of Audi designers developed the concept for a sporty Coupé in just four weeks. A Roadster variant was also created in 1995. The compact sports car was extremely well received as a forward-looking concept and the epitome of revolutionary automotive design.

The first-generation Audi TT was launched on the market in 1998. Closely based on the show car, the production model with its formally coherent design language was a milestone of innovative automotive design. Its aspiration was clear in the tiniest of details: aluminum elements in the interior, progressive wheel design, a short, spherical gear knob and round, closely spaced tailpipes. It also marked the first time that Audi used the fast-shifting S tronic in a production model. Power output ranged from 110kW to 184kW.

The second generation of the successful sports car followed in 2006. Its design was more tightly integrated into the Audi design language; its driving dynamics those of a mature sports car. The forced-induction engines developed between 118kW and 155kW. Audi expanded the lineup with an S version producing 200kW and a true model athlete, the Audi TT RS with 250kW. The later TT RS plus version even produced 265kW.

Groundbreaking technologies such as Audi Space Frame (ASF) lightweight construction, TFSI engines and the sonorous five-cylinder engine played key roles in the car's success. The second Audi TT was the first sports car with TDI technology.

2014 marks the launch of the third generation of the Audi TT. It is even sportier, more dynamic and more innovative than its predecessor. One characteristic feature has remained across all three generations: the round fuel flap with the typical TT logo.

Driving enjoyment

The new Audi TT is a driving machine – powerful, lightweight, efficient and consistent. A drive down winding country roads or a quick detour to the racetrack allows this character to shine. The Coupé turns into corners spontaneously, virtually instantaneously, and powers through them with unwavering calm, guided throughout with utmost precision by its sensitive steering. As the car approaches its high limits, it begins to understeer ever so slightly – the effortless controllability is another character trait of the TT.

Thanks to the newly developed quattro all-wheel drive system, the compact Audi sports car combines dynamics and safety for a totally new driving experience. The all-wheel drive software controls the hydraulic multi-plate clutch differently depending on the driver's style and the setting of the control systems for handling that ranges from stable to highly emotional.

The driver just has to turn sportily into a corner and the clutch can direct a portion of the torque from the front to the rear axle. As soon as the driver steps on the accelerator, the forces literally press the car into the corner – spontaneously, with no trace of initial understeer. The Coupé turns precisely into the corner in the event of a load change. The clutch works together with the torque vectoring system under load to permit safe, controlled drifts à la rear-wheel drive on low-grip surfaces. The front axle straightens out the car when exiting the corner.

The 2.0 TFSI four-cylinder engine offers tremendous power even at low engine speeds.

Exterior design

One glance is all it takes to see that the third-generation Audi TT is a compact, muscular and powerful car. Its designers have returned to numerous ideas from the first TT and placed them in a new, multi-faceted context.

The first-generation Audi TT

When the first-generation Audi TT was launched in 1998, its design was a sensation. It adhered to the laws of geometry, with a formal consistency harking back to the Bauhaus style of the 1920s. The central motif was the circle: the arcs of the roof, the front and the rear stood in contrast to the strictly horizontal lines. This puristic and timeless architecture made the TT a modern design icon from the outset, while at the same time giving the Audi brand powerful impetus for its further development.

The exterior design of the new TT

Powerful horizontals at the front of the new TT underscore the sporty appearance. As with the R8 high-performance sports car, the Singleframe grille with its six corners is extremely broad and flat. A thick crossbar divides it into two zones. The lower edge of the headlights virtually extends this bar. Sculpted surfaces join the grille and the headlights. These small facets are typical for the design of the new TT and impart it with even greater concision.

Two contours run in the shape of a V from the upper corners of the grille across the bonnet, which bears the four Audi rings – another point in common with the R8. Two vertical bars, tilted ever so slightly, are located inside the two large air intakes. A flat opening beneath the Singleframe joins the intakes together and forms the third horizontal line at the front.

The new Audi TT has a hunkered down road stance as if it were poised to pounce. Its taut, muscular character is particularly evident when viewed from the side.

At 4,177 millimetres, the Coupé is 21 millimetres shorter than its predecessor. The wheelbase, however, grew by 37 millimetres to 2,505 millimetres. The overhangs are correspondingly short. Width has been reduced 10 millimetres to 1,832 millimetres; the height remains unchanged at 1,353 millimetres.

When viewed from the side, many details of the new Audi TT are intentionally reminiscent of the first-generation of the classic. The sculpted sill contour, also known as the dynamic line, together with the door forms a thick light-refracting edge; the rear corners of the door are gently rounded. The wide wheel arches form distinct geometric bodies that appear to be superimposed. The front wheel arch intersects the hood join. The join resumes above the door as the shoulder line and runs nearly horizontally to the rear, where it transitions elegantly into the tail light. The door handles are designed as thick stirrups; the side mirrors with the LED blinkers are mounted on the body's shoulder.

In the style of the first TT, the flat greenhouse appears to be an independent unit; a slight kink in the rear side window accentuates the C-pillar. The fuel flap on the right shoulder sports the characteristic design with the embossed TT logo and opens with a light tap. There is no cap under the cover – the fuel nozzle is inserted directly into the tank neck, just like with a race car. Six bolts connect the ring of the fuel flap to the body.

At the compact rear of the new TT, the play between light and shadow intensifies the sculpted impression. Three horizontal lines – below the tail lights, below the space for the license plate and above the diffuser – underscore the width of the car here as well.

The two large, round tailpipes with their chrome tips are closely spaced and another reminiscence of the first Audi TT. The same is true of the rounded rear window, the monolithic tail lights perfectly integrated into the body, and the three-dimensional logo.

The S line exterior package makes the design of the bumpers, air intakes, Singleframe, side sills and the rear diffuser even sharper.

The headlight design

The flat headlights give the new TT's face a determined look. Audi installs Xenon plus units as standard. Their LED daytime running lights form a homogeneous arc at the upper edge. The indicator signal is located between this arc and a horizontal design trim.

Headlights using LED or groundbreaking Matrix LED technology are available as options. The daytime running lights here have a whole new signature – the light is emitted via three struts that divide the headlights like a grille and are illuminated by light-emitting diodes via thick-wall optics for a homogeneous light pattern. The indicator signal strip is located at the lower edge of the headlights. The LED headlights include the cornering, all-weather and highway lights.

The Audi TT introduces a new standard to the segment with the Matrix LED headlights. Here the high beam is broken up into twelve small light-emitting diodes per headlight. There are two reflectors for two groups of five LEDs; two LEDs use another reflector. The control unit, which communicates with a camera in the rear view mirror, switches the individual light-emitting diodes on and off or dims them in 64 steps, depending on the situation. The headlight system can produce several hundred million light patterns. It prevents other road users from being blinded by glare and ensures that the road is always brightly illuminated.

Another function of the Matrix LED headlights is the intelligent cornering light, which is created by a shift in the light centre position. The control unit works together with the optional MMI navigation plus and uses the navigation data to illuminate the curve shortly before the steering wheel is turned.

In conjunction with the Matrix LED headlights, the new TT also has dynamic indicators signals front and rear. When the driver activates the turn signal, individual LEDs light up sequentially from the inside out. They are all bright after 150 milliseconds and remain illuminated for another 250 milliseconds. The LEDs then go dark before repeating the lighting sequence. The high-tech indicator signals send a clear signal that other road users can quickly understand even in poor visibility and from a great distance.

The tail lights, which feature LED technology standard, echo the design of the headlights. The rear light is emitted through their struts, which are made of a homogenising polymer. The third brake light – a subtle strip on the edge of the luggage compartment cover – ties together the light silhouette at the rear.

The brake lights and rear fog lights are located in the large upper segments of the tail lights. In an emergency braking situation, the brake lights flash as a warning to drivers behind. The turn signals – which are dynamic with LED headlights or better – are located at the lower edge of the tail lights.

Body

Audi was already able to reduce the weight of the second-generation TT thanks to the high aluminium content of the ASF (Audi Space Frame) body. This has been carried over to the third generation of the sports car. The Audi TT 2.0 TFSI with manual transmission and front-wheel drive (excluding driver) weighs just 1,230 kilograms, 50 kilogram less than its predecessor. Audi, the leading brand in lightweight construction, has thus once again set a new best mark in this segment.

At Audi, lightweight construction is by no means limited to one specific material. The motto is “The right amount of the right material in the right place for optimal function.” True to this maxim, the new TT features a body in intelligent multimaterial hybrid construction. The front end and floor assembly are made of high-strength and ultra-high-strength steel components, while the superstructure comprises aluminum castings, extruded sections and panels.

The Audi TT uses components of the modular transverse matrix (MQB). At just 2,505 millimetres, it has the shortest wheelbase in the matrix. The MQB underbody enables the use of many lighter-weight technical components, from the subframes for the front and rear axles to the air conditioner. The

new multimaterial hybrid construction lowers the centre of mass by 10 millimetres, which benefits driving dynamics.

The underbody comprises the longitudinal members, parts of the A-pillars, the bulkhead, the floor, the rear wheel arches and the rear end. At 39.5 kilograms, hot-formed steels make up roughly a quarter of the weight of overall structure. Before shaping, they are heated to nearly 1,000 degrees Celsius and are then cooled to about 200 degrees in a water-cooled stamping press. This abrupt change in temperature creates an iron-carbon structure with extreme tensile strength. Hot-formed steels are able to perform with relatively thin walls, and this makes them lightweight.

The hot-formed components serve as the backbone of the occupant cell. They are used for the transition zones between the front longitudinal members and the bulkhead, the complete centre tunnel, the reinforcing section between the B-pillars and the rear longitudinal members. Ultra-high-strength, cold-formed steel components, extruded aluminium sections for the outer sills and aluminium panels for the rear wheel arches complete the underbody.

The occupant cell superstructure, which at 68 kilograms sets a new standard in lightweight construction, is a multi-element aluminium structure. Four castings comprise its nodes. Large nodes at the A-pillars provide the connection between the roof arch, the sills, the windshield cross-member and the upper longitudinal section in the front end. Below the rear window, two smaller cast nodes connect the roof arch with the flat C-pillars and the rear cross-member of the roof. The aluminium section forming the roof arch is produced by hydroforming, in which a straight extruded section is first stretch-bent and then placed into a closed shaping die. There it is brought into its final shape under 2,000 bar of oil pressure and calibrated.

The complete outer skin of the new TT is made of aluminium – the front fenders, the side walls and the roof as well as the bonnet, doors and rear hatch. The last two components alone save a total of 15.5 kilograms over steel. All together, the complete body with all bolt-on parts weighs 276 kilograms.

Body assembly at the plant in Győr, Hungary, is a high-tech process requiring 3,020 weld points, 1,113 rivets, 44 punch rivets, 128 self-tapping screws, 199 clinch points, 1.9 metres of MIG/TMAG welded joints and 4.9 metres of

laser-welded seams. The bonded seams have a total length of 76 metres. Robots use hybrid laser welding to produce the seams between the roof and the side panels. The invisible zero-joint on the roof is an expression of Audi's uncompromising quality philosophy.

No matter what the criterion, composite construction is the ideal concept for the new Audi TT. Static torsional stiffness has been increased by 23 percent compared with the previous model, which was already very stiff. At the same time, the new TT retains its predecessor's very high dynamic stiffness. The latter is the foundation for the dynamic handling and superior vibrational comfort.

Uncompromising crash safety

The new Audi TT makes no compromises when it comes to crash safety. The hot-formed components form a strong structure of the occupant cell, and the seats can withstand the highest of loads. In a frontal collision, the longitudinal members and the sections in the upper plane absorb a majority of the forces. The bumper cross-members, the rear longitudinal members and the luggage compartment floor work together in the event of a rear-end collision.

In a side-impact collision, the side sills brace against the other vehicle involved in the accident. The solid cross-member section below the rear seat compensates for the lack of a continuous B-pillar. The roof frame offers excellent rollover protection.

Lowest Cd value in the segment

With a coefficient of drag (Cd) of 0.29 (with the S line exterior package), the new TT has the best value in its segment. Audi has combined the characteristic design with excellent aerodynamics surpassing even the previous model. Lift at the front and rear is very low. At 120km/h, a powered spoiler extends from the rear hatch. At 250km/h, it generates roughly 50 kilograms of downforce on the rear axle. The spoiler retracts again when the speed falls below 70km/h.

All exterior details of the new TT have been precisely tuned to the aerodynamic requirements. The outer vertical struts in the air intakes serve as a pre-spoiler, ensuring that a portion of the slipstream flows cleanly against the flank. A tailored cooling and induction air concept was developed for each engine version. In the TT 2.0 TFSI, the lower zone of the

Singleframe is closed. Sealing lips and covers where the air flows in ensure that it is routed to the radiator with virtually zero losses.

A polymer capsule beneath the engine compartment of the TT reduces lift while at the same time improving the flow of air. Below the occupant cell is a large aero-panel, which is supplemented with apertures in the sill region and small spoilers at the fuel tank and in front of the rear wheels.

Made of a lightweight fibre fleece, the aero-panel dampens noise and saves one kilogram of weight compared with PP polymer. The foams that block noise in the pillars and sills, the luggage compartment lining and the floor insulation are also very light.

The slim pedestals for the exterior mirrors also have a positive effect on the aeroacoustics. Seals surround the door openings and the doors. A new, additional seal, seals the cavity above the hinges of the rear hatch – another key contribution to the low interior noise level. Depending on frequency, Audi has reduced noise by as much as 6 dB versus the previous model.

Engines

The new TT generation will launch with a powerful 2.0 TFSI four-cylinder engine that produces 169kW and 370Nm.

The engine reflects the Audi philosophy of rightsizing. Forced induction replaces displacement and together with direct injection provides for high efficiency with the support of the standard stop-start system. Theengine complies with the Euro 6 emissions standard. Another point in common is the sound actuator that comes in combination with the optional Audi drive select driving dynamics system. In the dynamic setting, it makes the exhaust sound sportier and more sonorous.

As mounted in the car, the engine’s intake side is at the front of the car, and the vertical axis is tilted twelve degrees to the rear. This solution from the modular transverse matrix offers substantial advantages associated with the compact dimensions of the new engine. The developers were able to shift the front suspension far forward to the benefit of crash behavior, the design and the distribution of axle loads.

2.0 TFSI

The 2.0 TFSI produces 169kW , and has been improved in numerous areas compared with the previous engine, which an international panel of journalists named Engine of the Year in its category five years in a row, The only thing left unchanged is the displacement of 1,984 cc (bore x stroke 82.5 x 92.8 millimetres.

It produces a constant 370Nm of torque between 1,600 and 4,300rpm. With the six-speed manual transmission and front-wheel drive, the Coupé accelerates from 0 to 100km/h in 6.0 seconds. Top speed is 250km/h, and average consumption is 5.9 litres of fuel per 100 kilometres, corresponding to 137 grams CO_2 per kilometre. With the six-speed S tronic and quattro all-wheel drive, the key figures are 0 to 100km/h in 5.3 seconds; top speed of 250km/h and 6.4 litres per 100 kilometres and 149 grams CO_2 per kilometre.

The 2.0 TFSI also uses highly sophisticated thermal management, the heart of which is two electrically powered rotary valves combined in a single module. After a cold start, they quickly bring the motor oil to temperature. Depending on the driving situation, they maintain coolant temperature between 85 and 107 degrees Celsius. The exhaust manifold is located in the cylinder head, where it is bathed in water. This solution also contributes to fast warmup. At full load, it reduces the temperature of the exhaust gas and thus fuel consumption because there is no need to enrich the mixture for cooling purposes.

Another major innovation in the 2.0 TFSI is the addition of indirect injection. Complementing FSI direct fuel injection at part load, it injects the fuel at the end of the induction pipe in the vicinity of the tumble flaps, where it is intensively tumbled with the air.

The improved mixture formation boosts fuel economy and reduces particulate emissions. Direct FSI fuel injection, with its maximum 200 bar pressure, comes into play in the starting phase and at higher loads.

The combustion chambers of the new 2.0 TFSI are always well-filled. The intake and exhaust camshafts are adjustable; on the exhaust side, the Audi valvelift system also varies the stroke of the valves to further minimise charge changing losses. The turbocharger develops its relative charge pressure of up to 0.8 bar very dynamically. Its electric bypass valve is

particularly fast-acting and precise. The turbine wheel can withstand exhaust gas temperatures of up to 980 degrees.

Despite this dense package of technologies, the two-litre petrol engine only weighs a little over 140 kilograms – a value that is due in part to the thin walls of the grey cast iron crankcase. They are only about three millimetres thick, saving about 2.4 kilograms. The pistons are made of a new, high-strength alloy, a lightweight polymer is used for the oil pan, and many screws are made of aluminium.

An innovative coating for the piston skirts, roller bearings for the balance shafts and the reduced diameter of main bearing for the crankshaft keep internal friction low. The lightweight crankshaft requires just four counterweights. The regulated oil pump requires little energy itself and at higher loads cools the piston heads with jets of oil.

Transmissions

The new Audi TT comes standard with a manual six-speed transmission with a lightweight magnesium housing. It features short throws for easy and precise gear changes. It is optionally available with the six-speed S tronic, which is likewise very efficient. As with the manual transmission, its internal gearing features sportily short ratios. The tall top gear helps reduce fuel consumption.

Six-speed S tronic

The six-speed S tronic makes the new TT even more dynamic. It changes gears within a few hundredths of a second and with no noticeable interruption of power. Gear changes are very comfortable. The driver can choose between automatic or manual mode, in which it can be controlled using either the selector lever or paddles on the steering wheel. In automatic, D mode is designed for low fuel consumption and long ratios. In S mode, the driving style is sporty and the revs are higher.

Another special feature of the six-speed S tronic is fuel-saving freewheeling function. It is activated when the Audi drive select system is set to efficiency mode and the driver lets off the accelerator. The Launch Control start program with the S tronic manages full acceleration from a standstill with controlled wheel slip.

Like all dual-clutch transmissions, the new six-speed S tronic comprises two independent transmission structures. Two radially arranged multi-plate clutches actuate the gears. The large K1 clutch directs the engine torque via a solid shaft to the gear wheels for the odd-numbered gears 1, 3 and 5. A hollow shaft rotates around the solid shaft. It is connected to a second, smaller K2 clutch, which is located inside its larger sibling and acts on the gear wheels for gears 2, 4, 6, and reverse.

Both transmission structures are continuously active, but only one of them is connected to the engine at any one time. Shifts are performed by switching the clutches. When the TT is accelerating in third gear, for instance, fourth gear is already selected and the K2 clutch is disengaged. As soon as the command to shift gears is given, K1 disengages while K2 engages. Every transmission speed is assigned a conventional switching unit, as a result of which it is also possible to change directly from sixth to fourth gear, for instance.

quattro permanent all-wheel drive

quattro permanent all-wheel drive gives the compact sports car a powerful unique selling point in its segment. The latest-generation quattro drive is used. Audi has vigorously updated the electrohydraulic multi-plate clutch, which now uses software tailored to the TT. Its slim design, which eliminates the pressure accumulator used in the previous generation, reduces the unit's weight by 1.5 kilograms.

The clutch is located at the end of the propshaft, in front of the rear axle differential – an installed position that benefits the axle load distribution. When the all-wheel drive software calls for torque, the electric axial piston pump develops up to 38 bar of hydraulic pressure. When the friction plates are pressed together, the torque is transferred seamlessly to the rear axle.

The TT marks the first time that the all-wheel drive system has been integrated into the Audi drive select system. Its control philosophy strongly considers driving dynamics-relevant variables such as the steering angle while at the same time orienting on the status of Audi drive select and the electronic stabilisation control (ESC).

Under this new, dynamic philosophy, the clutch can already begin sending a portion of the torque to the rear axle when the driver turns sportily into a corner. As soon as the driver steps on the accelerator, this torque presses

the Coupé smoothly into the corner with no initial understeer. During load changes, the distribution of torque allows the TT to be turned precisely into the corner. When drifting on a low-friction road surface, it provides for maximum control and reliability. The front axle straightens the Coupé out again when exiting the corner. The multi-plate clutch works here in close conjunction with torque vectoring, an intelligent software function of the ESC.

Another focus during the development of the software was to increase efficiency. The control unit can compute the optimal distribution of torque with respect to efficiency based on the precise determination of the driving situation, road properties and driver type. In efficiency mode it can even be deactivated temporarily. Once the driving situation changes, quattro all-wheel drive is reactivated before torque is once again required at all four wheels. This concept reduces CO_2 emissions by up to 1.5 grams per kilometre.

Chassis

The technological competence with which Audi developed the new TT is also reflected in the chassis. The pivot bearings and subframe of the McPherson front suspension are made of aluminium. The rear suspension uses four steel links per wheel in order to process the longitudinal and lateral forces separately. Their springs and dampers are separate from one another and respond very precisely. The body is lowered 10 millimetres with Audi magnetic ride.

The new Coupé comes standard with progressive steering. Its rack is specially geared to produce different boost ratios depending on the steering angle – somewhat less direct on centre and very direct when the wheel is turned far. This solution provides for easy maneuvering, agile handling and smooth straight-line stability. The electromechanically generated servo boost, which decreases with increasing speed, harmonises perfectly with this character. The progressive steering works in close conjunction with three assistance systems – the standard rest recommendation and the optional Audi active lane assist and park assist systems.

Twelve different wheels are available. The TT 2.0 TFSI comes standard with 18-inch lightweight wheels and 245/40 tyres. Audi and quattro GmbH offer 18, 19 and 20-inch wheels in attractive designs including matte titanium-

look as options. Weighing just 10.6 kilograms each, the 19-inch forged wheels are very light. A tyre pressure indicator is standard.

Powerful brakes are located behind the large wheels; the front discs are internally vented. The new electromechanical parking brake acts on the rear wheels.

Audi drive select

The Audi drive select dynamic driving system is standard on the new Audi TT. The driver can choose at the push of a button whether the accelerator, the sound actuator and steering boost should be active in comfort, auto, dynamic or efficiency mode. If an MMI navigation system is on board, a fifth individual mode is added that is largely freely configurable. The system also accesses multiple modules – S tronic, quattro all-wheel drive, cruise control and automatic air conditioning.

Another module controlled via Audi drive select is the Audi magnetic ride damper control system. A synthetic oil containing microscopically small magnetic particles circulates within the damper pistons. Each of the front dampers contain 140 millilitres; the rear dampers 290 millilitres each. When a voltage is applied to a coil, a magnetic field is generated in which the alignment of the particles changes so that they are perpendicular to the oil flow, thereby inhibiting its flow through the shock absorber channels.

The control unit continuously analyses the driver's style and the condition of the road. Depending on the setting in Audi drive select, the ride of the new Audi TT can be set in three modes: comfortable, balanced or decidedly taut. Dynamic mode unveils its full dynamic potential. The targeted bracing of the individual wheels during fast cornering ties the Coupé tightly to the road. It largely suppresses roll and makes steering response even more spontaneous. Audi magnetic ride reduces body pitch during braking.

Electronic limited slip differential/torque vectoring

The electronic stabilisation control (ESC) rounds out the sporty handling characteristics of the new TT. The driver can deactivate it entirely or in part via a switch on the centre console. The system remains active in Sport mode, but responds later and in combination with quattro all-wheel drive permits controlled drifts because it rarely intervenes. If the driver presses the corresponding button for longer than three seconds, ESC is deactivated

completely. This may be chosen for a fast lap around a race track, for example.

In TT models with front-wheel drive, the electronic limited slip differential – a function of the ESC – brakes the inside front wheel slightly while cornering at the limit. In the TT quattro, torque vectoring affects both inside wheels. The excess torque is transferred to the opposite wheel. Thanks to the difference in traction forces, the car turns slightly into the corner. This dramatically increases the dynamism and stability of front-wheel drive TT models, in particular.

Interior design

The interior also expresses the puristic sports car character of the new Audi TT. Strongly accentuated horizontals emphasise the width. All elements are clearly structured and have taut surfaces. They are framed by clean contours. The lines are light and almost seem to float. The sinewy arcs of the armrests in the door trims correspond visually with the center tunnel console, which in classic TT style supports the calves.

When viewed from above, the instrument panel resembles the wing of an aircraft and is strongly inclined toward the driver. The round air vents – another TT characteristic – are reminiscent of jet engines. They house all of the air conditioning controls. The controls for the heated seats, temperature, recirculation mode, air flow distribution and air flow strength are located on their axes. With the deluxe automatic air conditioning, small displays indicate the chosen setting. The axes are always straight regardless of the position of the rings.

The elimination of the traditional air conditioning control unit gave the Audi designers the freedom to implement the instrument panel as part of a slim, elegant architecture. The same effect drove the decision for the Audi virtual cockpit, which combines the instrument cluster and MMI monitor into a digital unit, thus allowing the central display to be eliminated. The interior of the new Audi TT is entirely focused on the driver – a logical expression of sports car character.

Below the three centre air vents are the switches for the hazard warning lights, Audi drive select and additional functions. The console of the centre tunnel – an independent structure with no visual connection to the instrument panel – is home to the shift lever/gear selector lever, the start-

stop button, the audio volume dial, the new MMI control terminal and the button for the electromechanical parking brake.

The three-spoke sport steering wheel has also been redesigned. The rim of all versions is flattened at the bottom, and the broad, open spokes are in aluminium look. The S line models bear a special badge on the bottom spoke and coloured contrasting stitching. It includes 14 functions and rollers. The multifunction steering wheel, the Audi virtual cockpit and the road are on one visual axis.

Nearly every function can be controlled via the steering wheel, enabling a sporty-dynamic driving style.

New sport seats

The all-new sport seats with the standard integrated head restraints hold the body firmly and offer optimal support. The new sport seats are mounted even lower than the seats in the previous model; they each also weigh 2.5 kilograms less. Aluminium window controls shave off another kilogram of weight in the interior, and the lightweight lining of the door panels save another half kilogram.

Audi offers the slender S sport seats with their strongly contoured side bolsters as an option. These seats also offer height and pitch adjustment, and a loop makes it easier to fold down the seat back. The S sport seats feature pneumatic side bolster adjustment.

The 2+2-seat Audi TT is a sports car with a high degree of everyday practicality. The luggage compartment has a capacity of 305 litres, an increase of 13 litres. Folding down the split rear seats increases capacity to 712 litres.

Colours and equipment

The materials used in the TT are a further confirmation by Audi of sportiness in the premium segment. This is reflected in such things as the innovative exterior paint finishes, the all-new palette of colours for the interior and the design selection.

The new Audi TT offers a far more distinct range of colours than its predecessor. There are eleven exterior colours, one of which is exclusively for

the S line. Seven of the colours in the palette are new for the TT, and two of these are completely new for Audi: Nano Grey and Tango Red.

Alcantara and leather are standard coverings for the seats; there are also three leather packages. The S sport seats have characteristic diamond patterning in the centre section.

Supreme workmanship

Numerous details in the interior demonstrate the high standards that Audi places on the quality and function of all control elements. These include the round air vents with the narrow chrome rings and the finely ridged rotary wheels, plus the new split gear knob or selector lever.

The speaker grilles in the optional Bang & Olufsen sound system are another highlight. Instead of holes, they have fine grooves. The specially designed frames for the woofers are adorned with authentic anodised aluminium elements bearing the logo of the Danish hi-fi specialists. This high-end sound system also features a white LED light guide that makes it visual highlight even at night.

The LED interior lighting package sets precise accents in the area of the doors and the tunnel, for instance.

Operating concept

The driver-oriented operating concept of the new TT has been redesigned from the ground up. The Coupé features two major innovations from Audi – the new MMI and the Audi virtual cockpit, which is a digital instrument cluster.

Audi virtual cockpit

The brand with the four rings is setting new standards with the Audi virtual cockpit. Its 12.3-inch, high-resolution display with 1,440 x 540 pixels produces tack sharp, brilliant and high-contrast images. Behind it all is a Tegra 30 chip from the Tegra 3 series of venture partner Nvidia; Audi is the first carmaker worldwide to use the high-speed graphics processor. With a clock speed of over one gigahertz, the four-core chip can work together with a special 3D graphics program to perform more than eight billion computing operations per second.

Elaborate detail effects round out the state-of-the-art look. The tachometer, for example, is rendered at 60 frames per second so that the virtual needle moves smoothly and very precisely. Fresnel effects – the varying reflectance of the display glass depending on the viewing angle – are reproduced realistically. Scrolling processes, for example through lists, are based on a physical model that considers such theoretical factors as inertia, elasticity and damping.

The driver can switch between two interfaces using the 'View' button on the top-of-the-line multifunction steering wheel. In "Progressive" mode, a central window dominates the view – it offers a big stage for the navigation map or for lists in the Phone, Radio and Audio areas. The tachometer and speedometer are displayed as small dial instruments on the right and left. In the Classic view, the middle window is smaller, and the instruments – with black scales, red needles and white numerals – are about as large as today's analog instruments.

The Audi virtual cockpit provides for the comprehensive, attractive and versatile display of all types of information, from the navigation arrows and dynamic animations to the graphics for the assistance systems. The display changes its context-related colour scheme according to the main menu selected. In the Media menu, for example, it is orange, while green is used for the Phone menu. Indicators with fixed positions are displayed along the lower border; they show the outside temperature, time and odometer readings as well as warning and information symbols. LEDs indicate the coolant temperature and fuel level.

The new MMI

Just as groundbreaking as the Audi virtual cockpit is the new MMI system in the new Audi TT, which shows its full potential in the MMI navigation plus with MMI touch. The developers have completely redesigned the terminal on the centre tunnel console and its menu structure. The result is an operating concept with flat hierarchies strongly geared toward the needs of the driver. Their structure is reminiscent of modern smartphones – an intelligent, easy-to-use logic replaces static menu trees, and frequently used functions can be reached with just a few clicks.

The centre of the terminal continues to be the round rotary pushbutton, its surface is equipped with the touch-sensitive MMI touch. The touchpad is used to input characters and now also processes finger gestures. The driver

can zoom on the map like with a smartphone. An optical sensor with a sensitivity of one one-hundredth of a millimetre monitors the rotary motions of the highly precise dial for virtually stepless motion.

The toggle switches for the most important basic menus Navigation/Map, Phone, Radio and Media are located above the rotary pushbutton. The generic Menu button and the Back function are located below the dial, to the left and right of which is only a single button on each side.

The driver uses the left button to call up the redesigned function menus assigned to some of the basic menus. In the Radio menu, for example, this is where the band selection function is found; in the Map menu, traffic information.

The right button provides context-dependent options and settings. In the Navigation menu, for instance, the driver can get directions to an entered destination or display nearby parking lots and save the destination to the Favorites list. The function and context menus can also be opened by pushing the rotary pushbutton to the left or right.

Free-text MMI search

A major highlight of the new system is MMI search, which is available for all basic menus and like a search engine uses free text entry. It generally answers queries after just a few letters, taking into consideration the car's current location. When searching for a place to eat, for instance, the driver only has to enter the name of the restaurant and the first letters of the city and a list of hits in the area appears together with the addresses. Searching for songs, albums and radio stations works similarly.

Voice control has also undergone intensive further development so that the system now understands many phrases from everyday language usage. Commands like "I have to talk to Peter" or "I would like to call Peter" are now sufficient to call a contact. The multifunction steering wheel with its buttons and rollers is another control instrument. Other than touch gestures, the driver can perform the same steps here as with the MMI terminal, all without taking his eyes off the road.

The new MMI navigation plus with MMI touch is backed by all the computing power of the Audi modular infotainment platform. Now in the second generation, it also uses the quad-core Tegra 30 processor from Nvidia. It

constantly checks back with its counterpart in the Audi virtual cockpit as it goes about its work.

MMI navigation plus with MMI touch is a highly networked media centre. It includes two card readers, the Audi music interface (AMI), a DVD drive, an Aux-in jack and a Bluetooth interface for hand-free telephony and streaming audio. Incoming emails and text messages from compatible mobile phones are displayed and read aloud. 10GB of flash storage for music files, eight speakers and a speed limit indicator based on the navigation map round out the spectrum.

Driver assistance systems

The assistance systems follow the philosophy under which Audi developed the new TT: they are tailored to the driver and relieve him of certain tasks so that he can concentrate fully on the road.

Among the standard equipment in the new Coupé is the secondary collision brake assist, which is activated in the event of an accident. In many situations, it prevents the car from continuing to roll in an uncontrolled manner, and it also activates the car's interior lighting and hazard warning system. Another standard feature is the rest recommendation, which lets the driver know when he is starting to get fatigued.

The optional Audi side assist helps the driver when changing lanes. At speeds of 30km/h and above, its radar sensors monitor the road behind to a distance of roughly 70 metres. As soon as the system classifies another vehicle in the blind spot or approaching rapidly as critical for a lane change, it warns the driver via a bright LED on the relevant exterior mirror. If the driver still activates the indicator signal, the indicator flashes several times.

The optional Audi active lane assist becomes active at speeds of above roughly 65km/h. A video camera in the interior mirror identifies the lane markings on the road surface. If the new Audi TT begins to approach one of the lane markings without a turn signal being activated, it guides the driver back into the lane with a gentle pulse of the electromechanical steering system. In the MMI user control system, it is possible to configure a vibration in the steering wheel as feedback and define the time of the intervention. In the 'early' setting, the system assists the driver in driving down the centre of the lane.

There is a choice of three systems for safe and easy parking. The top version – park assist – can steer the new TT backwards into parking spots. At moderate speeds, it measures the spaces using its ultrasonic sensors. A notification appears in Audi virtual cockpit when the system finds a suitable spot. As soon as the driver now puts the car into reverse, the system assumes control over the steering via the electromechanical steering system and the driver only has to accelerate, shift gears and brake.

The park assist will maneuver forward and back multiple times if necessary. It provides similar support when exiting parallel parking spaces. The 360° display warns of obstacles to the sides.