TOYOTA C-HR

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TOYOTA C-HR

A FRESH VIEW ON THE CROSSOVER MARKET

Designed to stand out both within the Toyota line-up and in its segment, the all-new C-HR – or Coupe High-Rider - represents Akio Toyoda's determination to allow greater stylistic freedom and promote engineering creativity in order to achieve eye-catching designs and enhanced driving pleasure.


C-HR

A FRESH VIEW ON THE CROSSOVER MARKET

THE TOYOTA C-HR remains remarkably true to the general features of the concept-cars that attracted so much public attention in Paris in 2014 and in Frankfurt in 2015. Its coupe-like lines are a testimony to the resolve of its designers to create a style that stands out in the Toyota range, and to establish a new direction amongst mid-sized crossovers.

With the C-HR, Toyota targets a clear and singular customer profile. Predominantly driven by emotional considerations, these customers want individuality, and to be the first to try new experiences and products. Style and quality are essential considerations in any purchase they make, and the car is an extension of their personality.

Inspired by what he learned from meeting with these customers, C-HR Chief Engineer Hiroyuki Koba focused persistently on their requirements throughout the development process, setting high demands for design and perceived quality.

The Toyota C-HR's unique character demonstrates the flexibility that the TNGA (Toyota New Global Architecture) gives to vehicle developers in the three key areas of design, powertrain and dynamics, enabling them to deliver a new and fresh take on the increasingly commoditized crossover segment.

WITH THE C-HR, TOYOTA TARGETS A CLEAR AND SINGULAR CUSTOMER PROFILE.

A NEW DESIGN DIRECTION FOR THE CROSSOVER SEGMENT

The all-new Toyota C-HR introduces a distinctive styling that brings newfound dynamism and sensuality to the crossover market, combining a coupe-like upper body with the powerful underpinnings of an SUV.


TOYOTA
C-HR

A NEW DESIGN DIRECTION FOR THE CROSSOVER SEGMENT

4,360 MM LONG, 1,795 mm wide, 1,555 mm high (Hybrid) and with a 2,640 mm wheelbase, the production vehicle remains remarkably true to the concept car's exterior which was first shown at the Paris Motorshow in 2014, and which registered extremely well with target customers.

Under the concept of "Sensual Speed-Cross", and featuring a diamond architectural theme with wheel arches projecting prominently at all four corners to emphasise the new crossover's strength and rigidity, the C-HR modulated structure combines a powerful lower body and raised ground clearance with the slim and sleek cabin profile of a coupe.

Viewed from any angle, the C-HR's combination of facetted gemstone-like shapes with fluid surfaces and elegantly integrated detailing create a delicate balance of precision and sensuality.

The front represents a further development of Toyota's Under Priority and Keen Look design identity. The slender upper grille flows from the Toyota badge into the sleek, aggressive wing extremities of the headlamp clusters and wraps fully around the front corners of the vehicle.

The movement of the blacked out rocker panel towards the front and rear wheels, along with the shoulder axis that runs through to the front and rear, emphasise the fast-looking, 'lift-up' feel of the thin body.

The C-HR's coupe-like styling is further enhanced by disguised rear door handles integrated within the C pillar and, essential to the representation of speed within the design, the powerful projection of the sweeping roofline into a large, highly aerodynamic, skeletal frame rear spoiler.

To the rear, the strongly tapered cabin integrates a top-hinged tailgate giving access to the loadspace that can accommodate luggage for 5 people. This contrasts with the pronounced flaring of the wheel arches, which give the new crossover a wide and extremely powerful stance.

Standing proud of the tapering body work, prominent rear light clusters may also be equipped with LED lamp technology to give the rear view of the C-HR an equally expressive visual signature.

THE C-HR'S COMBINATION OF FACETTED GEMSTONE-LIKE SHAPES WITH FLUID SURFACES AND ELEGANTLY INTEGRATED DETAILING CREATE A DELICATE BALANCE OF PRECISION AND SENSUALITY.


C-HR

SOPHISTICATED INTERIOR DESIGN WITH OUTSTANDING SENSORY QUALITY

A new departure for Toyota, the interior styling represents a new ‘Sensual Tech’ design concept combining high-tech functionality with a sensual and fashionable style. It embodies a driver focused area within an airy, expansive cabin space.


C-HR

SOPHISTICATED INTERIOR DESIGN WITH OUTSTANDING SENSORY QUALITY

THE WARM, welcoming ambiance of an airy, expansive cabin space was created by the seamless layered architecture of the instrument panel that continues through to the door trim with a stylish ornamentation and a piano black panel. It offers a contrast between sensual surfacing and crisp lines to deliver a fresh, yet comfortable environment.

The driver oriented area incorporates innovative details and intuitive, approachable high technology. All operating switchgear, and an 8" display audio touch-screen featuring a redesigned and improved HMI (Human Machine Interface) with Toyota's Multimedia '16 navigation platform and enhanced connected services are slightly oriented towards the driver.

In conjunction with the asymmetrical centre console design, this brings all controls within easy reach of the driver, whilst still allowing front passenger access to the relevant switchgear.

Because the touch-screen stands proud of the instrument panel rather than being enclosed by it, the upper dashboard is considerably lower in depth, further helping driver visibility.

A unique new two-tiered front seat design combines a slender, sporting upper section with a more strongly bolstered and supportive lower area, these differences emphasised through the use of differing tones, textures and patterns within the upholstery.

Targeting class-leading sensory quality (SQ), and knowing that C-HR customers will also have competitors from premium brands on their shopping list, the C-HR interior represents the earliest involvement yet of Toyota's European SQ team in the design process.

Working closely with the headquarters design team to maintain the original interior styling concept, the SQ team have focused painstakingly on component quality, and the consistency of grain, texture, shape, colour and illumination in every element, even the stitch groove radii of the seats.

Reinforcing the link between interior and exterior design, many switches use a similar shape, reflecting the diamond motif of the exterior body shell. The same diamond theme is also visible in the door trim pattern, the headliner, the JBL speaker grilles and tweeter shape, and even the needles of the driver's analogue instrument dials.

THE C-HR INTERIOR REPRESENTS THE EARLIEST INVOLVEMENT YET OF TOYOTA'S EUROPEAN SQ TEAM IN THE DESIGN PROCESS.

A carefully considered choice of finishes is essential to the harmonious, consistent, one-piece look of the new interior. There are three main surface finishes – leather-like for all background surfaces, a smooth Nappa grain for all touching surfaces and technical grain for all functional elements such as switchgear.

Decorative elements are finished in high quality piano black and satin silver trim, and the clear blue instrument and switchgear illumination has been carefully fine-tuned to ensure consistency of hue, even on adjacent reflective surfaces of differing colours.

This outstanding new interior design is available in a choice of three colour schemes: Dark Grey, Black/Blue and Black/Brown.

EQUIPMENT LEVELS TO SUIT THE MOST DEMANDING CUSTOMERS

Reflecting the demands of its target customer, the Toyota C-HR can be equipped with a wide variety of features.


HYBRID

EQUIPMENT LEVELS TO SUIT THE MOST DEMANDING CUSTOMERS

AS PART OF TOYOTA'S commitment to democratise advanced safety equipment, Toyota Safety Sense is standard across the range. The system includes a Pre-Collision System (including Pedestrian Recognition), Adaptive Cruise Control, Lane Departure Alert with steering control, Automatic High Beam and Road Sign Assist[1].

Top-of-the-range customers will be able to specify heated seats, a smart entry system, privacy glass, bespoke upholstery including part-leather seats, Toyota's revolutionary S-IPA system (Simple Intelligent Park Assist), 18" alloy wheels and Bi-tone metallic paintwork.

TOYOTA SAFETY SENSE

Toyota Safety Sense helps to reduce the risk of a collision and delivers additional benefits by making life easier for the driver and reducing fatigue.

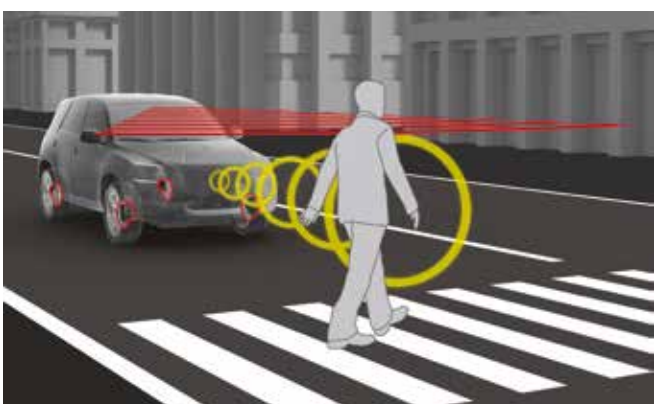
Pre-Collision system

At speed ranges of between 10 km/h and the vehicle's top speed this system uses a front-mounted monocular camera sensor and millimeter-wave radar sensor to detect vehicles and pedestrians on the road ahead. If it calculates a risk of a collision, it automatically warns the driver with a buzzer and alert in the multi-information display. At the same time the Pre-Collision Brake Assist engages to provide extra braking force the moment the brake pedal is pressed. If the system determines that the possibility of a frontal collision with a vehicle or pedestrian is extremely high, the brakes are automatically applied to help avoid the collision or help reduce the impact of the collision.

Toyota's improvement of the technology has enabled it to recognize and react to the presence of pedestrians as well as vehicles and to function across a wider range of speeds.

Adaptive Cruise Control

The Toyota C-HR's Adaptive Cruise Control with Full Speed Range Following Function makes use of the same millimeter-wave radar as the Pre-Collision system to maintain a safe distance from the vehicle ahead, slowing the car to a standstill if necessary and accelerating smoothly back to the pre-selected cruising speed once the way is clear.



[1] Road Sign Assist is not available on the entry grade

Lane Departure Alert

Lane Departure Alert uses the camera on the windscreen to track the vehicle's course between lane markings painted on the road surface. If it judges that the Toyota C-HR is about to move out of its lane without the turn indicator being used, the system sounds a buzzer and lights up a warning on the multi-information display. If the vehicle is still moving outside the lane, it will apply light steering force to assist the driver to bring the vehicle back on course.

Automatic High Beam

Automatic High Beam uses the same windscreen-mounted camera as the Lane Departure Alert. This recognizes the lights of oncoming vehicles or traffic ahead, automatically switching the headlights to low beam to avoid dazzling other road users and returning them to high beam as soon as the road is clear, maximizing night-time illumination and the driver's field of vision.

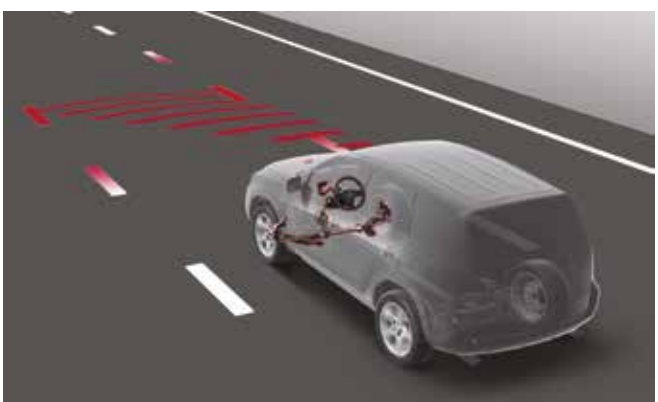
Road Sign Assist

Road Sign Assist uses the front camera to recognize principal highway/motorway warning and command signs. These are then repeated on the multi-information display, reducing the risk of the driver not being aware of speed limits, lane closures and other important information.

Advanced safety and driver assistance systems

The Toyota C-HR is available with additional systems that support safer driving by giving the driver better real-time information about the area immediately around the car, including a Blind Spot Monitor and Rear Cross Traffic Alert.

The Blind Spot Monitor uses radar sensors mounted on the rear corners of the vehicle to detect nearby vehicles in adjacent lanes as they move into the driver's blind spot. The driver is alerted to their presence by LED warning indicators in the door mirror on the appropriate side of the car. The LED indicators will remain illuminated as long as the vehi-



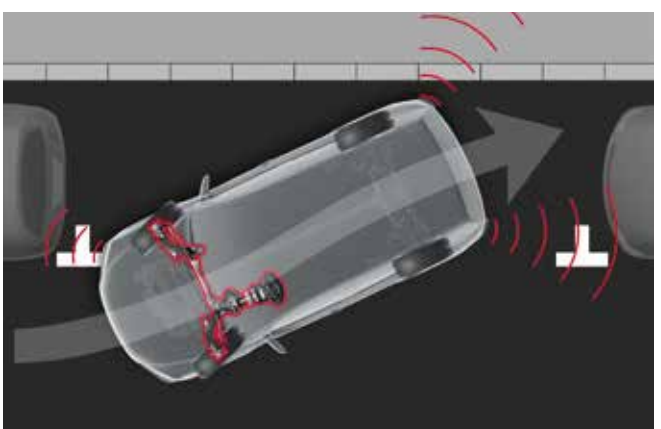
cle remains in the blind spot. If the driver operates the turn indicators, intending to move into path of the vehicle, the LEDs will flash rapidly to draw further attention to the hazard.

The same radars are used to provide the Rear Cross Traffic Alert, monitoring approaching traffic from either side as the vehicle is reversed out of a parking space and warning the driver if any vehicles are detected.

Simple Intelligent Parking Assist system

The Toyota C-HR offers Toyota's new Simple Intelligent Parking Assist (S-IPA) system, which uses an array of sensors to identify viable parking spaces and surrounding objects. Improvements to the technology allow it to work in parking spaces up to 22 per cent smaller than previously.

The driver stops the car next to the parking space and pushes a single button to engage S-IPA, which guides the car to the correct position for reverse maneuvering into the space. This system was developed to utilize the corner sensors for the parking assist.



CONCERT HALL SOUND

Recognizing the importance that the Toyota C-HR target customer attaches to the quality of the in-car entertainment system, the car can be equipped with a tailor-made JBL premium audio system comprising an 8-channel, 576 Watt stereo amplifier and 9-speakers, including two newly patented acoustic JBL wave guides, known as horn tweeters. It provides the ultimate sound reproduction in the C-crossover segment.

Because various elements of the interior such as the windows and upholstery, as well as the rigidity of the body structure surrounding each speaker, can have a significant impact on system sound quality, the system is the result of particularly close collaboration between JBL and Toyota's engineers from early in the design process.

An in-depth customer analysis was taken into account for the system design and resulted in the orientation of the speaker layout and the use of a precisely integrated, A pillar-mounted horn tweeter -a JBL system signature- to deliver crisp, clear sound.

As well the two 25 mm horn tweeters and acoustic wave guides, the system further features two 80 mm wide-dispersion units and two 17 cm sub-woofers in the front of the C-HR, and, in the rear, two 15 cm full-range speakers and a 19 cm sub-woofer in a dedicated, 10-litre, ported enclosure in the boot.

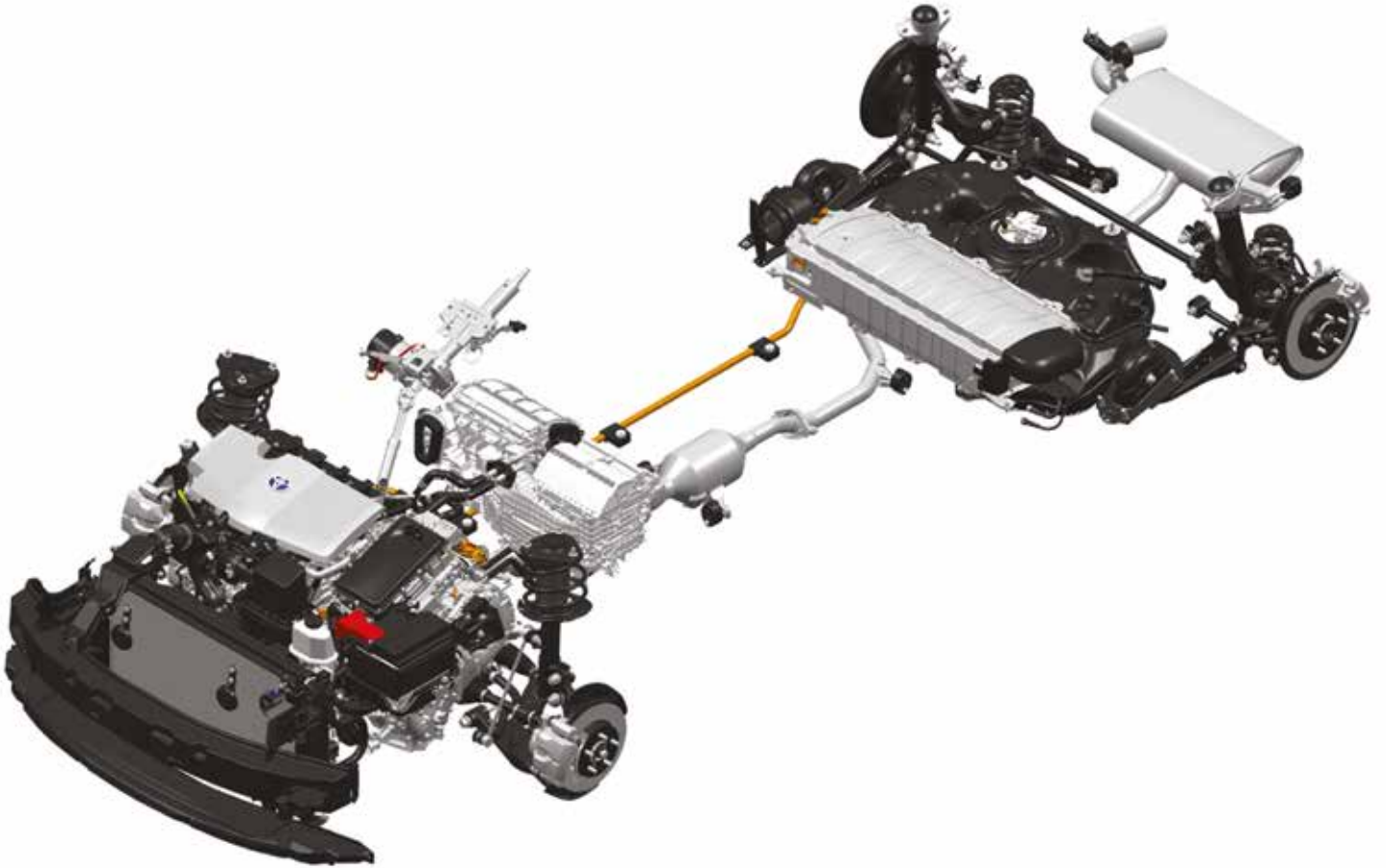
Available in combination with the navigation option, the JBL premium audio system also incorporates lossless audio encoding.

The partnership between Toyota and JBL started in 1996 and has been successfully expanded since that time. Trusted by music professionals, JBL audio systems are used in major concert halls, venues and stadiums throughout the world (80% of live concerts, 70% of all recording studios and 90% of all THX-certified movie theatres).

Quality is the common focus of both companies, which has resulted in the all-new, uncompromised premium audio system specifically tailored for the C-HR.

STATE OF THE ART POWERTRAINS

The Toyota C-HR is equipped with an engine-range that is designed to deliver exactly the fluent, engaging driving behaviour that its customers are looking for. This is most powerfully expressed by the segment-unique, range-topping, full hybrid version, the intrinsic characteristics of which guarantee a smooth, jolt-free ride.



Toyota's latest Hybrid Powertrain

STATE OF THE ART POWERTRAINS

FITTED WITH THE LATEST-GENERATION hybrid power plant, the Toyota C-HR generates CO_2 emissions as low as 82 g/km – a figure unrivalled within its segment – and returns combined fuel consumption of only 3.6 l/100 km.

Delivering 90 kW/122 DIN hp, this new hybrid powertrain is not only more efficient and lighter than the previous system, but also offers sharper performance. Detailed design changes to the engine have resulted in a thermal efficiency of 40% – a world-beating performance for a petrol unit.

Other hybrid system components have been made lighter and smaller, and have been repositioned for optimum packaging, further contributing to the car's low centre of gravity.

This new hybrid powertrain offers the response and the fluidity of a dynamic driving style that particularly suits the Toyota C-HR's dynamic design philosophy.

The Toyota C-HR is also available with a new 1.2 litre turbo engine, which debuted in the Auris. Delivering 85 kW/116 DIN hp and 185 Nm of torque, this unit generates CO_2 emission from 125 g/km and returns combined fuel consumption from 5.5 l/100 km. It may be mated to either a 6-speed manual gearbox or a Continuously Variable Transmission. CVT equipped versions are available with either front- or all-wheel drive.

And finally, a 2-litre 144 DIN hp/107 kW, 188 Nm CVT-only model will be available for certain markets (Ukraine and Caucasus).

NEW HYBRID SYSTEM

The Toyota C-HR is equipped with the new generation of Toyota's signature hybrid powertrain.

Toyota has focused its efforts on making this next generation of hybrids even easier and more intuitive to drive. The system has been set up so that it gives a natural, immediate, but smooth response to any accelerator pedal input. Refined and confident, it delivers the right level of performance.

But of course, fuel economy has been improved as well, as demonstrated in new Toyota C-HR's combined cycle economy starting from just 3.6 l/100 km. The new hybrid system comes in a more compact package that is lighter in weight and lower in cost. It reflects significant advances in battery, electric motor and petrol engine technologies.

THIS NEW HYBRID POWERTRAIN OFFERS THE RESPONSE AND THE FLUIDITY OF A DYNAMIC DRIVING STYLE THAT PARTICULARLY SUITS THE TOYOTA C-HR'S DYNAMIC DESIGN PHILOSOPHY.

The new hybrid battery offers higher energy density. Whilst its total power was maintained, its size could be reduced by 10%. And what's more, it can now absorb 28% more energy in the same amount of time, which means that it charges faster than before. The electric motors are smaller in size, yet also provide a better power-to-weight ratio. And the thermal efficiency of the petrol engine reaches more than 40 per cent, a world's best for a petrol unit.

Improved petrol engine

The Toyota C-HR's hybrid system features a 1.8-litre VVT-i Atkinson cycle petrol engine. Compared to the third generation Prius, the unit has been completely re-engineered to deliver significantly better fuel economy. The gas flow, combustion, cooling and knock control have all been improved and much more effective use is made of exhaust gas recirculation.

Toyota has developed a heat recovery system that uses spent exhaust gas to speed the warming up of engine coolant. This means fuel can be saved because the hybrid system is able to stop the engine earlier and more often when it isn't needed to power the vehicle. The engine is also helped to reach its optimum operating temperature more quickly thanks to a new dual-passage cooling system that can reduce the volume of coolant flowing into the engine, when required. This helps improving efficiency during cold weather.

Further work has been done to reduce energy losses, particularly through eliminating friction. Measures include the use of thin-section, resin-coated connecting rod bearings and a low-friction camshaft chain. Friction created by the piston skirts, rotating parts and oil pump has been reduced and a new electric water pump has helped cut the level of losses.

Conical "beehive"-type springs have been adopted to reduce the valvetrain load. And, to ensure comprehensive improvement, the entire engine underwent CAE analysis to achieve the best rigidity and to reduce noise and vibration.

The intake and exhaust systems came under particular scrutiny, resulting in an engine that enjoys better breathing, air filtration, packaging efficiency, reliability and quietness. The air filter has been made smaller and reduced in height, which helped the designers bring down the line of the hood. The new intake system has a resonator that creates less noise at noticeable frequencies and the intake duct is made of a porous material that suppresses resonance.

A fresh air inlet duct has been added to make sure ample air volume is obtained at motorway speeds and a clever air/fluid separating structure has been added to keep water and snow from mixing with the intake air. Should the fresh air duct fill with water or snow, a secondary inlet serves as the air intake.

A thinner silencer secures optimum performance and noise reduction, while also improving the underbody aerodynamics and avoiding any intrusion on the space available in the trunk.

The engine block has V-shaped drilled paths that reduce losses in water jacket pressure. There is also a new water jacket spacer which helps control cylinder wall temperatures in the combustion chamber, reducing friction and preventing engine knock, which in turn supports optimum ignition timing.

Engine cooling has been improved with a new cooling module structure and attachment, and a redesign that accommodates a lower hood line and helps reduce the car's centre of gravity. There is a new grille shutter behind the radiator which automatically closes when full airflow isn't required, improving aerodynamic performance and saving fuel.

While engine cooling helps improve anti-knock performance, it can lead to an increase in cooling heat loss. To help counter this, Toyota engineers have developed a new water jacket spacer to control temperature on the surface of the cylinder. This keeps engine oil warmer with lower viscosity and reduces the temperature fluctuation. This helps reduce friction and allows more engine torque to be generated. At the top end of the temperature scale it reduces temperatures in the combustion chamber.

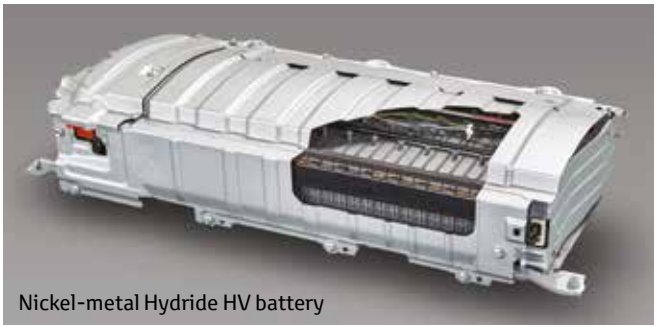
The engine's maximum output of 98 DIN hp/72 kW is delivered at 5,200 rpm, with peak torque of 142 Nm at 3,600 rpm.

World-best thermal efficiency

Thermal efficiency is a measurement of how well an engine converts the energy available in its fuel into usable energy to power the vehicle.

As a result of the large-volume exhaust gas recirculation system, improvements in combustion efficiency and innovative ways of managing heat and reducing friction, the new engine has a maximum 40 per cent thermal efficiency, the highest level in the world for a mass-produced petrol engine. This surpasses the 37 per cent of the first Prius' 1.5-litre unit and the 38.5 per cent level of the 1.8-litre engine in the third generation Prius.

Fully redesigned power control unit



Nickel-metal Hydride HV battery

Improved exhaust gas recirculation

The exhaust gas recirculation system has an EGR cooler which lowers the temperature of the gas being circulated, thereby reducing the temperature of the intake mixture and reducing risk of engine knock. This allows ignition timing to be fully optimized, which contributes to better thermal efficiency.

Multi-shaft transaxle – a hybrid first

The new generation hybrid system has a redesigned transaxle that offers more efficient performance and packaging and reduced weight. A gear train with the two electric motor-generators placed on multiple axes has been adopted to shorten the overall length by 47 mm compared to the previous generation hybrid system.

The transaxle houses four components: two electric motor-generators (MG1 and MG2); a single planetary gear; and a reduction gear to the final drive. MG1 serves primarily as a generator, converting any surplus power from the petrol engine into electricity, which can be stored in the HV battery. It also serves as the engine's starter motor. MG2 is the electric drive motor, which also acts as a generator when the car is in regenerative braking mode. It drives the car from start-up, at low speed and in EV (electric vehicle) mode and is the sole propulsion method when the vehicle is in reverse.

Improved hybrid software

Updates to the hybrid system software allow the Toyota C-HR to draw more on its electric drivetrain, allowing it to accelerate in a low engine rev range. It also has permitted the speed range of the electric motor (the range in which the electric motor can be used exclusively) to be increased by 60 per cent, compared to the third generation Prius. This means there is less dependency on the petrol engine at higher speeds, improving fuel economy.

Smaller, better electric motors

The two motor-generators are all-new and are smaller and lighter than before to suit the new multi-shaft transaxle design, with no negative affect on fuel economy.

Higher motor speed and new forced water-convection cooling in place of air cooling improve the efficiency of the electric-drive motor (MG2), which delivers 53 kW of power and 163 Nm of torque.

Fully redesigned power control unit

The power control unit (PCU) has been totally redesigned, resulting in a 33 per cent reduction in size, a six per cent weight saving and a 20 per cent reduction in electrical losses.

The PCU is the multi-purpose electrical heart of the vehicle, housing the inverter/voltage booster, a DC/DC converter for auxiliary power and the electronic control for the motor-generators.

In place of a belt-driven alternator the Toyota C-HR uses a DC/DC converter to recharge the 12-volt auxiliary battery by using the HV battery energy.

Nickel-metal Hydride HV battery

The nickel-metal hydride (NiMH) battery is more compact, and is located entirely beneath the rear seats, avoiding any intrusion in the

load space. It has increased cooling efficiency and a wider regeneration range.

1.2T ENGINE: GOOD PERFORMANCE AND LOW CONSUMPTION

The 1.2T engine uses advanced technologies that allow the engine to change from the Otto-cycle to the Atkinson cycle under low loads, it has vertical vortex high tumble air flow intake ports, an exhaust manifold integrated in the cylinder-head and advanced heat management. To this, the 1.2T adds a direct injection system, as well as a water-cooled turbo and heat-exchanger. Furthermore, the VVT-i (Variable Valve Timing – intelligent) system known from the AYGO and Yaris 1.0 engine, is upgraded to a VVT-iW (Variable Valve Timing - intelligent Wide) system, which allows even more flexibility in the valve-timing.

The combination of these technologies results in outstanding performance and efficiency. For a displacement of 1.197cm^3, the engine delivers 116 DIN hp (85kW) and a constant torque of 185 Nm between 1.500 and 4.000 rpm. It will push the Toyota C-HR from 0 to 100 km/h in 10.9 seconds and the top speed is set at 190 km/h. All of this is achieved despite a strong focus on fuel consumption and CO_2 – the car achieves 5.5/100 km on the combined cycle, and delivers just 125g/km of CO_2.

Advanced heat management

The key to achieving outstanding fuel consumption without compromising performance, is to apply a higher compression. But generally, as the compression increases, so does the risk of uncontrolled combustion, also known as knocking.

The 1.2T's high compression ratio of 10:1 was made possible thanks to the adoption of a series of key technologies that improve control over the combustion process. That way, the risk of knocking could be avoided.

First of all, the intake ports have been designed to generate a more intense flow and a 'vertical vortex', and also the shape of the piston has been optimized to improve in-cylinder turbulence. As a result, fuel and intake air mix faster, and a more homogeneous mixture is formed. This leads to a higher combustion speed – which helps prevent knocking.

Advanced heat-management is in itself a great way to improve fuel economy, but it is also another way of reducing the risk of knocking.

The engine was designed in such a way, that the temperature of each individual part can be optimized. For example, the bottom of the pistons is cooled by oil-jets and the cooling of the cylinder head is separated from that of the engine block. This allows to reduce the temperature in the combustion chamber, whilst keeping the block itself hot enough to reduce friction.

Direct injection contributes as well, as it helps to dissipate the heat in the combustion chamber. And the charge air passes through the intercooler, which uses an independent low temperature cooling circuit.

Low-end torque and quick response

A low-inertia turbocharger, the VVT-iW valve system and the D-4T direct injection system work hand in hand to ensure excellent torque delivery from the lowest engine speeds. Together with the limited volume intake system, this ensures an immediate response to the accelerator pedal.

The injection system has been newly developed for the 1.2T engine. Compact in design, it is perfect for utilisation in a small displacement engine. It allows multiple injections per cycle, and the optimized width and reduced length of the fuel spray ensure the quality of the combustion, regardless of the engine regime and load.

From Otto to Atkinson

The VVT-i (Variable Valve Timing - intelligent) system operates on both the intake and the exhaust side, and allows maximizing torque at all engine speeds. In addition, the new VVT-iW (Variable Valve Timing - intelligent Wide) allows for the intake valve closing to be delayed, which means that the engine can operate in both the Otto and the Atkinson cycle. The latter is used in extremely low load conditions, when the intake valve remains open for a fraction of time, after the compression stroke has set in, allowing part of the gas charge to be pushed back into the intake. As a result, the effective compression stroke is shortened. Pumping losses are reduced, since the pressure on the piston is lower, and also the throttle valve can be opened wider.

LIKE A HEEL/TOE MASTER: INTELLIGENT MANUAL TRANSMISSION

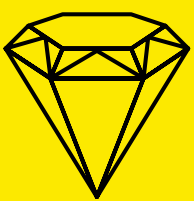
For the first time in the Toyota range a new system called “Intelligent Manual Transmission” is fitted to the Toyota C-HR 1.2T. Just like a heel/toe master, the system automatically increases the engine revs when downshifting ensuring a smooth gear shift. The system also works when shifting up in order to improve comfort for driver and passengers by reducing clutch shock. A smooth start is also ensured and the risk of stalling is almost null – particularly good news for all the learner-drivers out there.

Quick and smooth Stop & Start

A new start control was developed to ensure a quick and smooth engine restart. When the system shuts down the engine, it controls the stop position to leave the piston half way in the compression stroke. Then, upon restart, it applies stratified injection in the first compressed cylinder to counter vibrations. And by retarding the ignition, torque increase is kept in check, preventing the engine from revving excessively, hence ensuring a confident and tranquil take-off.

THE 1.2T’S HIGH COMPRESSION RATIO OF 10:1 WAS MADE POSSIBLE THANKS TO THE ADOPTION OF A SERIES OF KEY TECHNOLOGIES THAT IMPROVE CONTROL OVER THE COMBUSTION PROCESS.

DYNAMICS THAT BELIE A CROSSOVER



The design and development of the Toyota C-HR chassis has received the full attention of the Chief Engineer Hiroyuki Koba, himself a keen driver.

DYNAMICS THAT BELIE A CROSSOVER

FROM THE VERY outset of the project, Hiroyuki Koba travelled thousands of kilometres along European roads in order to understand not only the requirements of the road network, but also the way that Europeans drive.

"I have noticed, for example, that Europeans have a much more fluid driving style, based on a more acute observation of traffic" observes Hiroyuki Koba. "They avoid obstacles simply by adapting their trajectory and speed and will focus to carry on speed aiming for efficient progress, while elsewhere in the world the preferred approach is very often to stop. This has prompted us to work with our European team on driving precision in all aspects of the vehicle. We wanted to achieve performance on a par with a good C-segment hatchback."

With its low centre of gravity and double-wishbone rear suspension, the new TNGA-based platform has formed an ideal starting point from which to ensure that all of the features of the chassis could be designed to obtain an immediate and natural response to the driver's actions. Chief Engineer Hiroyuki Koba has been engaged in each key dynamic assessment and decision, assuring that his vision "Response, Linearity and Consistency" fully came to life.

In particular, steering has been designed to be perfectly linear which, together with the optimum limitation of rolling motion, gives the Toyota C-HR remarkable driving precision for a crossover. Limiting body movement, which generally affects tall cars in particular, also has a direct influence on comfort. Even on European often battered roads, the car remains remarkably composed and accurate, adding to the confidence and joy of driving.

Response, Linearity and Consistency

During the entire development phase, Chief Engineer Hiroyuki Koba has stayed true to his vision of 'Response, Linearity and Consistency'. 'Response' refers to the fact that the car needs to react immediately to any driver input. 'Linearity' means that the vehicle response must build up gradually, and precisely in line with the amount of driver input. And 'Consistency' relates to how the car reacts in the same predictable way, no matter what the speed or circumstances are. It is Koba's belief that by ensuring these three elements, the car can inspire true confidence, making every drive more fun.

DURING THE ENTIRE DEVELOPMENT PHASE, CHIEF ENGINEER HIROYUKI KOBA HAS STAYED TRUE TO HIS VISION OF 'RESPONSE, LINEARITY AND CONSISTENCY'.

ALL WHEEL DRIVE (AWD) SYSTEM

The Toyota C-HR 1.2T with CVT transmission can be equipped with the Dynamic Torque Control AWD System. The front and rear drive force distribution is precisely controlled via an electro-magnetic coupling. Depending of the circumstances the front-rear drive force distribution can vary from 100-0% to 50-50%. The system includes Cornering Control, a specific logic allowing the driver to track the intended driving line by adjusting the drive force depending on driving conditions. With Pre-torque Control, front-rear drive-torque distribution is adjusted to 90-10% as from the moment the driver operates the steering wheel. This ensures good response to changes in the steering angle when cornering. Thanks to the Yaw-rate feedback control, understeer and oversteer are corrected by optimal control of the front and rear drive-force, distributed every 6 milliseconds.

The new and rigid GA-C platform on which the Toyota C-HR is built, provided an excellent starting point. To ensure precision, a MacPherson Strut suspension was designed specifically for the Toyota C-HR. It includes a strut bearing rotation axis that has been defined to reduce steering friction drastically, allowing smooth and accurate steering. To ensure a hatchback-like roll-rigidity, the large-diameter stabilizer is directly linked to the strut via a stabilizer link.

At the back, a double wishbone suspension contributes significantly to the crisp driving experience. It lends most of its hardware from the latest generation Prius, the first car to be built on the GA-C platform. However, for the Toyota C-HR, it has been modified to meet Koba's demands in terms of controllability, stability and ride comfort. Thanks to the use of a specific sub frame, the suspension angles could be optimized – an element that was instrumental to give this C Crossover its hatchback-like handling in spite of its increased height. Different from Prius, the C-HR uses a ball-joint for the connection of the lower arm n°2. This provides a high level of twist rigidity, and enables compliance steer through the side forces that act on the rear wheels. The shock absorber is angled forward, reducing road load and improving luggage space.

TOYOTA NEW GLOBAL ARCHITECTURE

The Toyota C-HR reaps the benefits of being constructed on a new Toyota New Global Architecture-based platform ⟨TNGA⟩.


HOTEL
C-HR

TOYOTA NEW GLOBAL ARCHITECTURE

THE TOYOTA C-HR follows the new, fourth generation Prius as the second production model to use the GA-C platform, strategically adapted to suit the particular requirements of a stylish and dynamically rewarding C-segment crossover.

It demonstrates how Toyota's development of TNGA has ensured its new platforms are not rigidly standardized, but have a built-in flexibility that allows them to be engineered with ease to suit multiple vehicle types, from hatchbacks to SUVs.

The C-HR's use of a TNGA-based platform has proved central in supporting Chief Engineer Hiroyuki Koba's determination "not to compromise design or driving performance," contributing to the crossover's fun-to-drive quality, its individual styling and its fundamental safety performance.

Low centre of gravity

In terms of vehicle dynamics, the basic design of the GA-C platform allows for a low centre of gravity to be achieved – in the case of the C-HR, the lowest in its class, in fact. The benefit of this is realized in a more engaging drive and balanced handling, with much reduced body roll.

A low-set driving position is another direct benefit of TNGA, but with the C-HR the designers have raised the driver's hip point slightly compared to the new Prius, in line with the higher, commanding position at the wheel that crossover customers favour.

The adaptability of the GA-C platform is also witnessed in the C-HR's shorter wheelbase compared to Prius (2,640 vs 2,700 mm) and wider front and rear treads (+20 mm front, +10 mm rear). These changes reflect both the different packaging and handling requirements for the crossover.

Rationalized engine compartment

TNGA allows for the arrangement of the engine compartment to be rethought, with components relocated and set lower down in the space to support the vehicle's lower centre of gravity. In the C-HR it has enabled the engine to be angled slightly rearward, helping the designers secure a lower hood line as well as contributing to the lower centre of gravity.

Although the new Prius is exclusively powered by a full hybrid system, the C-HR offers both full hybrid and petrol powertrains, the latter with the option of both front and all-wheel drive. The GA-C platform is able to accommodate each of these powertrains without compromising the vehicle's packaging, styling or chassis balance.

SUPERIOR SAFETY PERFORMANCE IS INHERENT IN TNGA, WITH PRIORITY GIVEN TO ACHIEVING THE HIGHEST STANDARDS OF ACTIVE AND PASSIVE SAFETY.

High-rigidity for rewarding dynamics and ride comfort

The GA-C platform combines with the C-HR's highly rigid body to provide excellent responsiveness that is consistent and linear to the driver's inputs. The essential quality of the dynamic handling removes the need for the suspension to be firmed up to achieve the desired level of performance, thus avoiding any compromise in ride comfort.

Design freedom with reduced vehicle height

As well as the lower hood line made possible by the repositioning of the engine within the engine bay, the GA-C platform also enables a lower overall vehicle height to be achieved, This has been of particular value to the C-HR design team in producing the striking, coupe-like upper body that helps set the Toyota apart from its C-segment crossover rivals. At the same time, the low roofline does not call for compromise in headroom for front or rear seat passengers, thanks to the lower seating positions made possible by the new platform.

Safety performance

Superior safety performance is inherent in TNGA, with priority given to achieving the highest standards of active and passive safety. Toyota's new platforms and vehicle designs target the exacting standards set by the world's leading independent crash test programs, supported by the advanced performance of the functions and systems of Toyota Safety Sense, as featured on the new C-HR.

The Toyota C-HR on the GA-C platform being tested near Nürburg during its development

SPECIFICATIONS

ENGINE	1.8 VVT-I HYBRID
Engine code	2ZR-FXE
Type	4 in-line cylinders
Fuel type	95 unleaded petrol or higher
Valve mechanism	DOHC 16-valve with VVT-i
Fuel system	Electronic Fuel Injection
Turbocharger	-
Displacement (cm^3)	1,798
Bore x stroke (mm)	80.5 x 88.3
Compression ratio (:1)	13
HYBRID SYSTEM	
Hybrid battery	Nickel-metal hydride
Nomival voltage (V)	201.6
Capacity (kWh)	1.31
Motor Generator	1NM
Type	Permanent Magnet synchronous motor
Max Voltage (V)	600
Max output (kW)	53
Max. Torque (Nm)	163
Total system Max. power (DIN hp/ kW @ rpm)	122/90 @5,200
Max. torque (Nm @ rpm)	142 @ 3,600 (thermic engine only)
Emissions level	Euro 6

TRANSMISSION	FWD
Type	Planetary Gear System
Differential gear ratio (:1)	3.218
PERFORMANCE	
Max. speed (km/h)	170
Acc. 0 - 100 km/h (seconds)	11.0
FUEL CONSUMPTION (L/100)	
Urban 16"/17"/18"	3.3/3.4/3.5
Extra-urban 16"/17"/18"	3.8/4.1/4.1
Combined 16"/17"/18"	3.6/3.8/3.9
Fuel tank capacity (l)	43
CO_2 EMISSIONS (G/KM)	
Combined 16"/17"/18"	82/86/87

ENGINE	1.2T				2.0*
Engine code	8NR-FTS				3ZR-FAE
Type	4 in-line cylinders				4 in-line cylinders
Fuel type	95 unleaded petrol or higher				95 unleaded petrol or higher
Valve mechanism	DOHC 16-valve with Dual VVT-iW				DOHC 16-valve with VALVEMATIC
Fuel system	Direct injection				Electronic Fuel Injection
Turbocharger	single scroll turbocharger				-
Displacement (cm^3)	1,197				1,987
Bore x stroke (mm)	71.5 x 74.5				80.5 x 97.6
Compression ratio (:1)	10,0				10
Max. power (DIN hp/ kW @ rpm)	116/85 @ 5,200 - 5,600				148/109 @ 6,000
Max. torque (Nm @ rpm)	185 @ 1,500 - 4,000				189 @ 3,800
Emissions level	Euro 6				Euro 5
TRANSMISSION	**FWD**			**AWD**	**FWD**
Type	Manual	Manual ECO	Mutidrive S	Mutidrive S	FWD Multidrive S
Gear ratios (:1)					
1st	3.727	3.538	From 2.480 to 0.396	From 2.480 to 0.396	From 2.517 to 0.390
2nd	2.045	1.913			
3rd	1.310	1.233			
4th	0.971	0.916			
5th	0.764	0.675			
6th	0.619	0.590			
Reverse	3.333	3.333	From 2.604 to 1.680	From 2.604 to 1.680	From 2.517 to 0.390
Differential gear ratio (:1)	4.538	4.538	5.698	5.698	5.791

*East European markets

SPECIFICATIONS

PERFORMANCE	1.2 T FWD MANUAL	1.2 T FWD ECO	1.2 T FWD MULTIDRIVE S	1.2 T AWD MULTIDRIVE S	2.0 FWD MULTIDRIVE S*
Max. speed (km/h)	190	190	185	180	195
Acc. 0 - 100 km/h (seconds)	10.9	11,1	11.1	11.4	11.0
FUEL CONSUMPTION (L/100)					
Urban 16"/17"/18"	-/7.4/7.4	6.7/6.7/-	-/7.3/7.3	-/7.6/7.6	-/8.8/-
Extra-urban 16"/17"/18"	-/5.1/5.1	4.8/4.9/-	-/5.1/5.1	-/5.6/5.7	-/5.8/-
Combined 16"/17"/18"	-/5.9/6.0	5.5/5.6/-	-/5.9/5.9	-/6.3/6.3	-/6.9/-
Fuel tank capacity (l)	50	50	50	50	50
CO_2 EMISSIONS (G/KM)					
Combined 16"/17"/18"	-/135/136	125/126/-	-/134/135	-/143/144	-/161/-

CHASSIS	1.8 VVT-I HYBRID	1.2 T	2.0
Front suspension	MacPherson strut		
Stabiliser bar diameter (mm)	26,5		
Rear suspension	Double wishbone with coil spring		
Stabiliser bar diameter (mm)	24,2		
Steering	Rack & pinion, Electric Power Steering		
Overall ratio (:1)	13.6		
Lock to lock	2.76		
Min. turning circle tyre/body (m)	10.4/11.0		
Brakes			
Front (mm)	Ventilated discs (298.5)		
Rear (mm)	Solid discs (281)		
Tyres	215/65R16 98H - 215/60 R17 96H - 225/50 R18 95V		

*East European markets

EXTERIOR DIMENSIONS (MM)	1.8 VVT-I HYBRID	1.2 T	2.0*
Overall length		4,360	
Overall width		1,795	
Overall height (Hybrid)		1,565 (1,555)	
Wheelbase		2,640	
Tread front (17"/18")		1,550/1,540	
Tread rear (17"/18")		1,550/1,540	
Front overhang		905	
Rear overhang		815	
Cd Drag coefficient (17" wheels)	0.32	0.32 (AWD: 0.33)	0.33

CARGO	1.8 VVT-I HYBRID	1.2 T	2.0*
Capacity (dm³)		377	
Rear seats down (with repair kit)			
Space (mm)			

INTERIOR DIMENSIONS (MM)	1.8 VVT-I HYBRID	1.2 T	2.0*
Lenght		1,800	
Width		1,455	
Height		1,210	

WEIGHT (KG)	HYBRID	1.2T FWD MANUAL	1.2T FWD MULTIDRIVE S	1.2T AWD MULTIDRIVE S	2.0 MULTIDRIVE S*
Curb weight min/max	1,380/1,460	1,320/1,425	1,390/1,440	1,460/1,510	1,420/1,470
Gross weight	1,860	1,845	1,865	1,930	1,960
Towing capacity unbraked/braked	725/725	730/1,300	720/1,100	720/1,100	-

*East European markets

IMAGE BANK

TOYOTA C-HR

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