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2008 MITSUBISHI LANCER EVOLUTION OFFERS SUPERCAR HANDLING

The 2008 Lancer Evolution succeeds a model that was considered one of the best-handling performance cars on the market, able to match or exceed the dynamics of far more expensive high-performance vehicles and dedicated sports cars. The new-generation 2008 Evolution model raises the bar for handling while providing better ride compliance for everyday driveability.

The combination of an all-new global platform with proven suspension designs, along with the Super All-Wheel Control dynamic handling system, gives the 2008 Lancer Evolution handling capability beyond that of its predecessor. Quick steering, an Evolution hallmark, is employed, now with a stronger rack.

The Evolution's basic vehicle platform also underpins the regular Lancer models and the Outlander SUV, models that provide especially energetic driving responses for their segments. The basic all-new Lancer platform – which already exhibits 56-percent better torsional rigidity and 50 percent better bending rigidity than the previous-generation Evolution IX – was designed from the outset to accommodate modifications for the highest-performance variant. The 2008 Lancer Evolution benefits from further structural enhancements to accommodate the much higher performance capability and the dynamic handling goals set for it.

Extensive use of high-tensile and super high-tensile steel builds in strength, while wide use of aluminum helps keep vehicle weight in check. In the 2008 Lancer Evolution, the roof, hood, front fenders and both the front and rear bumper beams are aluminum. As in the previous Evolution, aluminum is also used for a number of key suspension components to reduce unsprung weight.

Wider, Road Hugging Stance

The new Lancer Evolution's aggressive road stance is not just a result of the striking design, but also reflects key dimensional changes that play a direct role in the enhanced handling capability. The 2008 Lancer Evolution is built on a one-inch longer wheelbase than the Evolution IX, now 104.3 in. vs. 103.3 in., and a 1.2-inch increase in front and rear track brings that measurement to 60.8 in. Overall width is up by two inches to 71.2 in.

The standard 18 x 8.5-inch wheels (Enkei cast-alloy on GSR and BBS® forged-alloy on MR) carry 245/40R18 Yokohama ADVAN asymmetrical performance tires, a change from the 17 x 8-inch wheels with 235/45R17 ADVAN directional tires used on the previous model.

Safety-Optimized RISE Body Structure

The 2008 Lancer Evolution is built around Mitsubishi's next-generation Reinforced Impact Safety Evolution (RISE) unibody design. The highly rigid structure makes extensive use of high-tensile steel, a material that was not used in the previous-generation Lancer. The stiffer body structure, reinforced in the Lancer Evolution by additional bracing, allows aggressive suspension tuning and at the same time improves ride compliance.

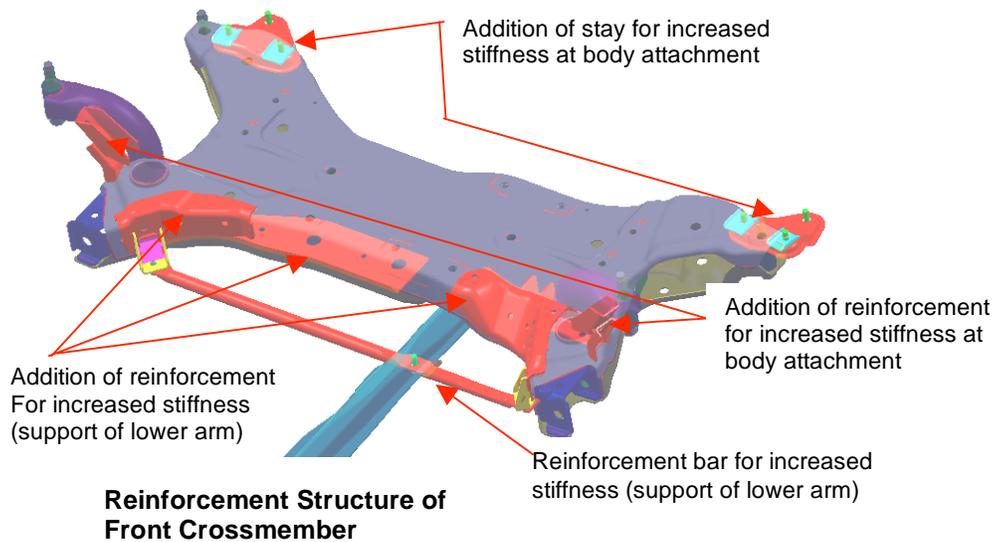
Straight front side members with an octagonal cross-section and a three-leg support structure, as well as increased application of high-strength steel, are designed to help Lancer Evolution meet the highest crash test standards. The side pillars, roof joints and cross-car structure – combined with the standard front seat-mounted side air bags, driver knee air bag and standard front and rear curtain side air bags – give the new Lancer Evolution a higher degree of collision protection.

Special Reinforcement Where Needed

Mitsubishi applied learned from reinforcing the structure of the previous-generation Lancer Evolution to the new-generation model. As shown in the table, structural modifications to the Lancer for the Evolution model affect mainly torsional stiffness.

Lancer and Lancer Evolution Body Rigidity Comparison	Twist	Bending
2008 Lancer Evolution	4.3 MNm ² /rad	5.4 MNm ² /rad
Vs. 2008 Lancer (standard models)	3.8 (+13%)	5.3 (+1.9%)
Vs. 2006 Evolution IX	3.1 (+39%)	3.3 (+64%)

The rear-mounted exhaust manifold allowed use of a flat front suspension crossmember, as on the standard Lancer models. (The previous models required a saddle-shaped crossmember to provide clearance for the exhaust pipe.) A flat front crossmember can directly receive lateral loads from the front lower arm. The crossmember in the 2008 Lancer Evolution is reinforced at a number of key points, as shown in the diagram:



Using lower-arm pillow ball bushings instead of rubber mounts provides sharper steering

response and smooth confident feel. Strut tower, side and lower braces enhance lateral rigidity for precise steering response, and lower control arm attachment points and steering knuckles are strengthened.

Lancer Evolution Unique Structural Enhancements and Benefits Areas				
	Steering Stability	Ride Comfort	Vibration and Noise	Weight Optimization
Aluminum body panels (roof, hood, front fenders)	x			x
Aluminum front bumper beam	x			x
Unique front strut tower bar	x			
Rear strut mount structure	x	x		
V-shaped brace behind back seat	x	x		
Floor upper crossmember	x	x	x	
Additional spot welding in door openings	x			
Modified rear floor crossmember	x	x	x	

Engine Mount System

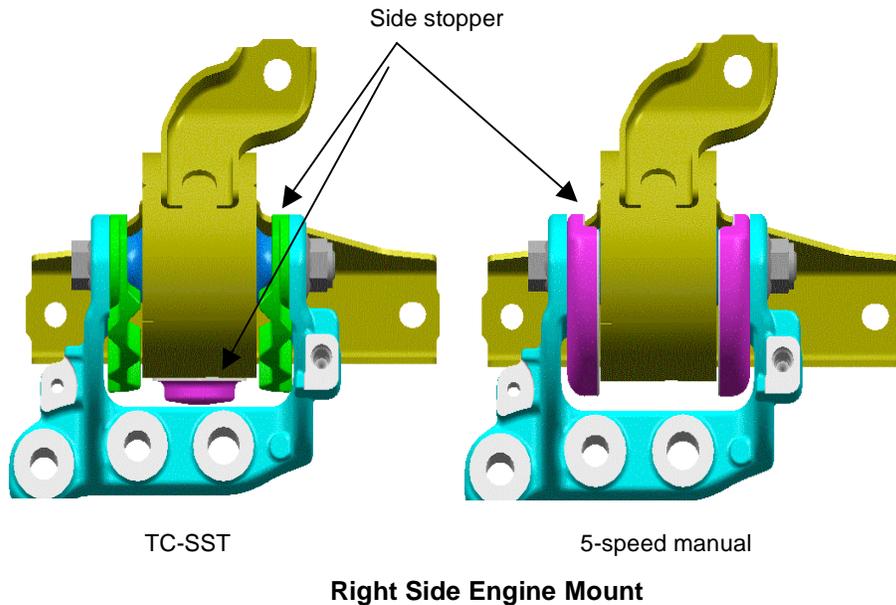
The 2008 Lancer Evolution uses a 4-point inertial axis engine mount system. Because the new 4B11 engine does not use a counter-balancer shaft (as the 4G63 did), noise, vibration and harshness – although at lower levels in the new engine – must be controlled by other means. Where the previous Lancer Evolution had fully rubber mounts on the left and right, the new Lancer Evolution uses hydraulic mounts. The hydraulic mounts provide an optimal combination of preventing engine movement under acceleration, vibration absorption, and improved ride quality.

Optimizing bracket material results in a lighter engine mounting system compared to the Evolution IX: 18.7 lbs. for the MR model (TC-SST) and 18.3 lbs. for the GSR (5-speed) vs. 20.0 lbs. for the previous Lancer Evolution with 6-speed manual transmission.

In the 2008 Lancer Evolution MR, which is equipped exclusively with the Twin-Clutch Sportronic Shift Transmission (TC-SST), a stopper is installed on the right engine mount, configured to lightly hold down engine movement in the early stages of acceleration and subsequently suppress it more firmly.

In the Evolution GSR, which has a 5-speed manual transmission, a stopper installed on the

right mount is configured to firmly suppress engine movement right from the start of acceleration. The TC-SST type uses an additional, separate stopper to prevent power plant movement without sacrificing a ride quality. This additional stopper regulates excessive lateral engine movement during high G-force cornering and protects engine auxiliary equipment.

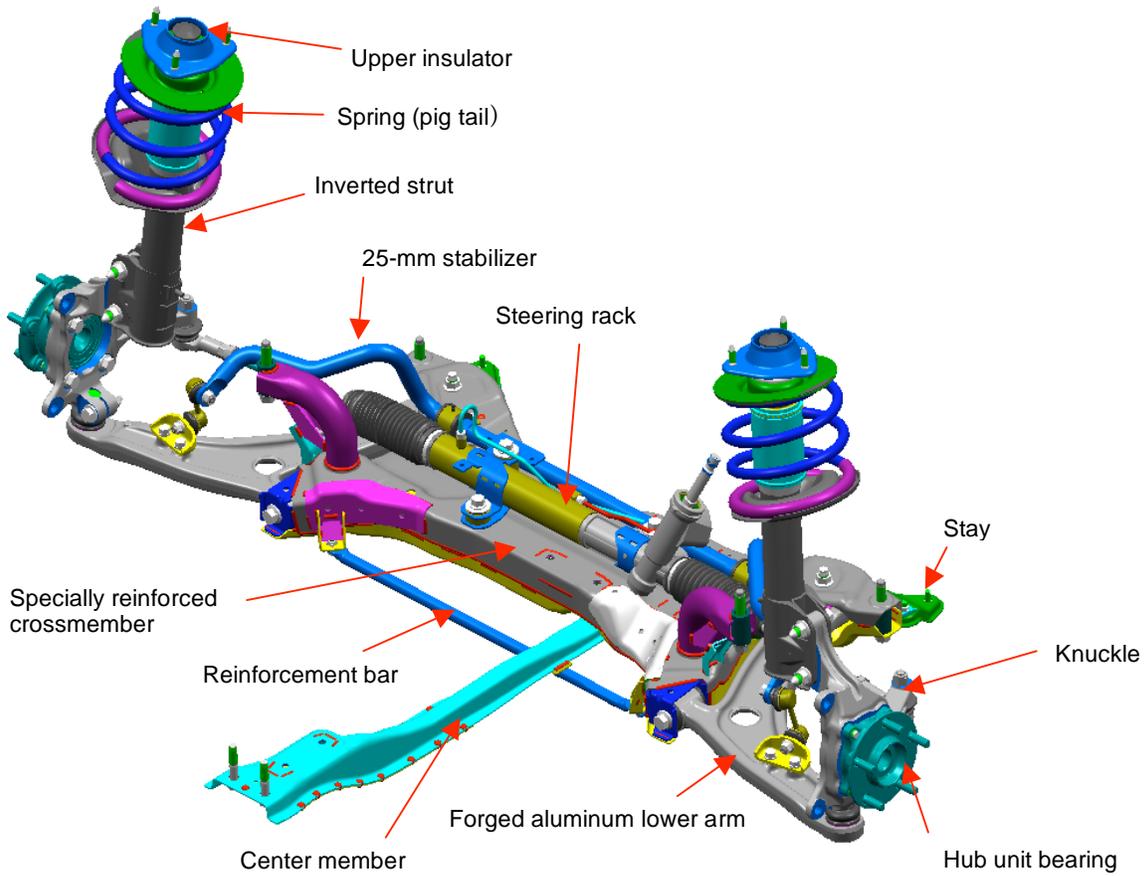


Inverted-Strut Front Suspension

The MacPherson strut suspension uses the proven inverted struts and forged aluminum control arms, as on the previous Lancer Evolution IX. The layout underwent further development to accommodate the adoption of 18-inch lower-profile tires and to enhance steering stability. Parts and geometry are new for this model. The Evolution MR model employs Bilstein struts and Eibach springs. High spring rates are achieved through use of “pigtailed” (coil narrows at top), enabling a wider gap between coils for reduced suspension noise.

Suspension rigidity is improved at key points. The strut upper insulator is optimized to handle camber input that increases with improved cornering performance. Increasing the size of the deep-grooved upper bearing that supports vehicle weight enhances reliability.

Using the highly rigid full-flat cross members from the Outlander as a base, and applying significant reinforcement, increases individual cross-member rigidity by 40 percent at the lower arm attachment section compared to the previous Lancer Evolution IX MR. Forged suspension knuckles, optimized through computer analysis, reduce knuckle twisting caused by road surface inputs. New hub bearing units provide a seven-percent increase in camber stiffness and a 23-percent increase in lateral stiffness.



Front Suspension

Revised Suspension Geometry

Suspension geometry is revised to provide increased caster angle, resulting in a more negative camber angle at a higher steering angles. The front stabilizer bar diameter is increased to 25 mm from the previous model's 24 mm to provide an optimal roll profile for the car's increased cornering limits. Wheel stroke has been altered and is now 90 mm for jounce and rebound, vs. 80/95 mm in the previous model.

Front Suspension Geometry	2008 Lancer Evolution	Evolution IX
Caster angle	4° 25'	3° 55'
Camber angle	- 1° 0.0'	- 1° 0.0'
Caster trail	24.2 mm	21.1 mm
Kingpin inclination	13° 50'	13° 45'
Kingpin offset	0.7 mm	- 0.3 mm
Toe-in	0 mm	0 mm
Wheel stroke (jounce/rebound) mm	90/90	80/95
Track (mm)	1,545	1,515

Enhanced Quality Feel

Adopting the new 18-inch low-profile tires improves cornering performance and, along with the increased caster trail (now 24.2 mm vs. 21.1 mm before) improves steering response and also contributes to a more direct steering feel. A change from a rubber bushing to a pillow ball bushing at the lower control arm crossmember forward attachment point improves suspension feel. The rubber bushing at the rear attachment point is further tuned for reduced vibration.

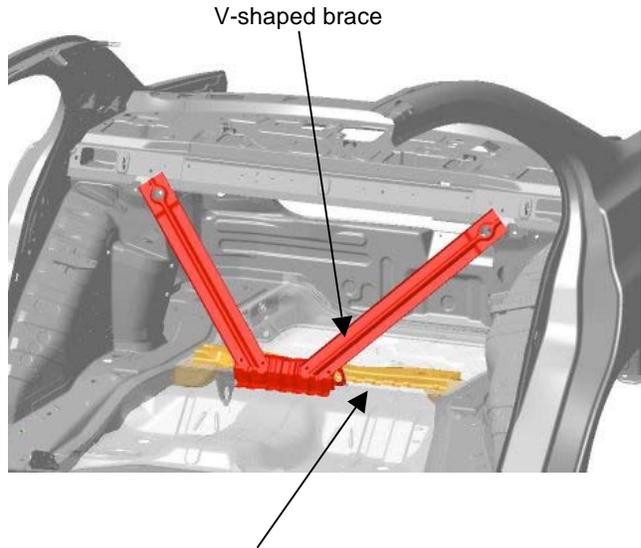
Suppression of Brake Knock-Back

The forged knuckle geometry was optimized using computer-aided engineering analysis (CAE). Improving brake caliper support stiffness handles the extra suspension inputs produced by changing to the 18-inch wheels (due to the increased amount of caliper attachment offset from the main knuckles) and prevents occurrence of brake knock-back.

Multi-link Rear Suspension

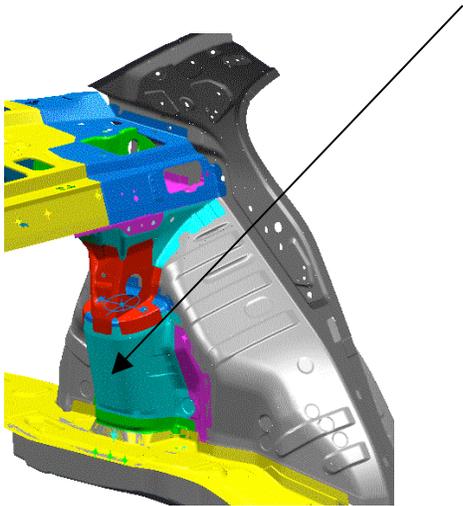
The low-mount multilink rear suspension is redesigned for the 2008 Lancer Evolution's new RISE body structure, applying and enhancing proven techniques from the previous Lancer Evolution model. The body structure, already stiffer than that of the Evolution IX in the standard Lancer, is reinforced in the rear by the following: (1) a V-brace behind the rear seat, (2) reinforcement between rear suspension mount and rear shelf, and (3) raising the trunk floor surface under the spare tire well and using a straighter crossmember.

Rear body structure reinforcement

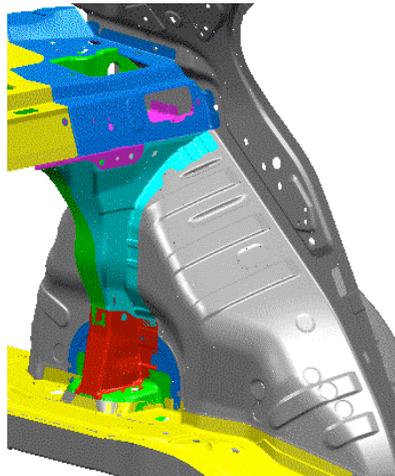


Floor upper cross member

Improved joint rigidity between rear suspension mount and rear shelf



2008 Lancer Evolution

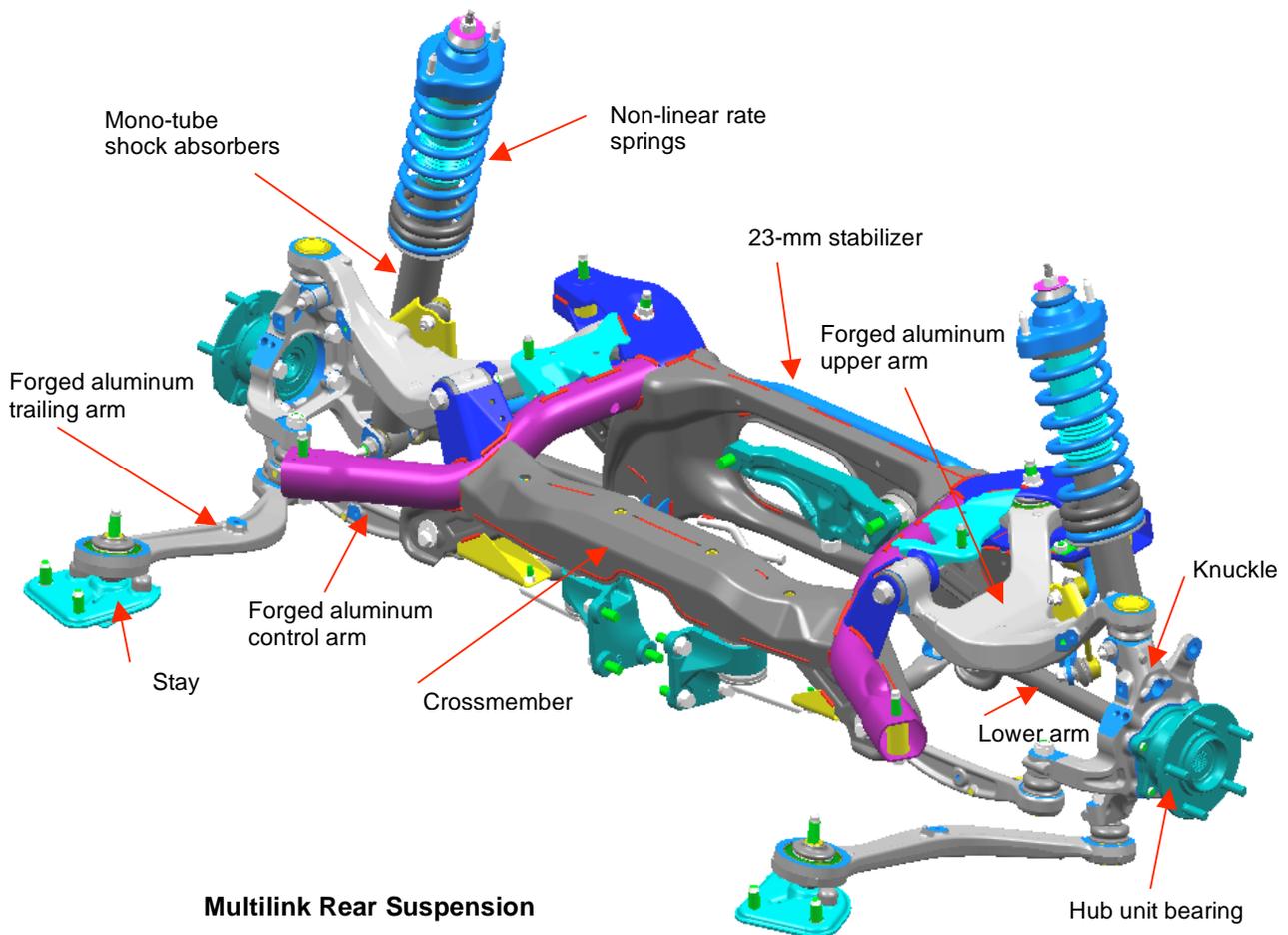


2008 Lancer

Forged aluminum is used for the upper and trailing arms, which are curved due to layout requirements, and for the toe control arm, which has a rather complex mounting structure. The simple, straight lower arm structure was made of light, steel pipe with a good balance of strength, rigidity and weight. Extra wall thickness on the press-fit portion of the aluminum bushing improves reliability under extreme conditions.

Enhanced Stiffness via Suspension Layout

Suspension rigidity is enhanced through layout optimization, including an enlarged arm support span, stiffer arm attachment due to the crossmember rigidity and adoption of third generation hub unit bearings. Together, these changes increase camber and toe stiffness by no less than 50 percent over the Evolution IX model.



Enhanced Cornering Performance

The use of 18-inch wheels, a wider track (by 30 mm) and stiffened suspension enhances cornering stability and raises cornering limits. The rear stabilizer bar diameter is increased to 23 mm, up from 22 mm in the Evolution IX, optimizing roll profile for the increased cornering limits. Using non-linear springs and increasing wheel travel enables better cornering stability over rough surfaces. Meanwhile, Active Yaw Control (AYC) helps suppress any tendency for the inner wheel to lift during high-speed cornering.

Improved Suspension Stroke

Increasing the number of locations that use a pillow-ball bushing and ball joint that make the arm attachment rotatable further improves the suspension's road-following capability. The new Evo's rear suspension has seven such points, vs. five for the Evolution IX.

Improved Damping, Reduced NVH

Damping operation is improved by the following: (1) Installing the shock absorber on the same shaft as the spring in the knuckle improves lever ratio (efficiency) and enables more efficient damping force operation. (2) The shock absorber attachment angle is optimized for efficient absorption of road surface inputs. In the Lancer Evolution MR model, Bilstein® monotube shock absorbers are used at the rear. The change to a compact three-point support type differential mount, in addition to optimal bushing placement, reduces NVH in the 2008 Lancer Evolution.

Weight Reduction and Safety

Even with the use of 18-inch wheels, overall weight is reduced in the rear suspension by optimizing suspension structure and material usage. Against a 16 percent increase in road inputs, rear suspension weight is reduced by 18 percent. A 3-point supported differential mount, and mounting on a square-shaped cross-member, rationalized the structure and reduced weight. Adopting a curved upper arm compatible with the RISE crash-safety body structure results in significant weight reduction and high stiffness.

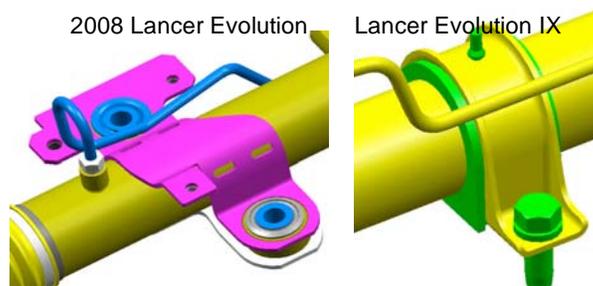
To help protect the fuel tank in a rear-end collision, the distortion mode is controlled so that the trailing arm distorts toward the lower part of the vehicle.

Rear Suspension Geometry	2008 Lancer Evolution	Previous Evolution IX
Caster angle	- 1° 0.0'	- 1° 0.0'
Toe-in	3 mm	3 mm
Wheel stroke (jounce/rebound) mm	110/85	100/85
Track mm	1,545 mm	1,515 mm

Quick Steering

The Lancer Evolution needed little improvement for its quick steering response, and the 2008 model reflects this. Steering remains very quick, with a 13.3:1 ratio and 2.27 turns lock to lock. The turning circle is 38.7 ft. Rack diameter is up slightly (28 mm vs. 27.7 mm). The biggest change is in the mounting method, which uses **press-fit bushings** vs. bolts before. In addition, the tie rod attachments use larger studs (M12 vs. M10).

Steering rack mount:



The hydraulic system is optimized for greater efficiency, reliability and reduced pump noise. A variable-flow pump contributes to better fuel efficiency.

The optimized steering column layout features joint friction-reduction parts that improve steering feel (reduced torque fluctuation). Support stiffness at the steering wheel end of the steering column is increased by 20 percent, reducing steering wheel vibration. Dampers used on the intermediate shaft help reduce shimmy.

Two Types of Brembo Brakes

Like its predecessor model, the 2008 Lancer Evolution uses a Brembo brake system. Both the MR and GSR models employ the same size rotors (13.8-in diameter in front and 13.0-in diameter in the rear), and the MR uses new two-piece rotor construction to reduce weight. Both models use 4-piston calipers in front and 2-piston calipers in the rear.

On the Lancer Evolution MR, the 2-piece disc is 2.9 lbs. (per wheel) lighter than the 1-piece disc used on the GSR. In addition, both models use a 15/16" long-stroke master cylinder and a 10-in. through-hole type single vacuum booster that improved effectiveness and rigidity and reduces weight. The single booster is 1.9 lbs. lighter than the previous tandem setup.



Note: the high friction coefficient brake pads are optimized to ensure fade resistance and effectiveness. Under certain conditions, the brakes may squeal, but this is not a quality issue.

Sports Antilock Braking System (S-ABS)

As in the previous model, Sports Antilock Braking System (S-ABS) is standard on Lancer Evolution for 2008. The ECU uses information from a steering wheel sensor that detects steering inputs as well as lateral-G and vehicle speed sensors to apportion pressure to each of the four wheels independently. The result is improved steering response while braking.

Mitsubishi's Electronic Brake force Distribution (EBD) system, an integral part of Sports-ABS, optimizes allocation of braking force between the front and rear wheels. Increasing the pressure applied to the rear wheels when braking close to the limit, EBD reduces the load acting on the front wheels for better anti-fade performance. The system also compensates for changes in surface and vehicle load conditions to ensure predictable and consistent stopping performance at all times.

Wheels and Tires

BBS forged alloy wheels on the Lancer Evolution MR weigh 19.95 lbs. each, vs. 22.0 lbs. each for the Enkei cast-alloy wheels used on the GSR model.

Enkei cast-alloy wheel
(Lancer Evolution GSR)



BBS forged alloy wheel
(Lancer Evolution MR)

Both Evolution models use a new type of tire for 2008, the Yokohama ADVAN A13C asymmetrical, replacing the ADVAN A046D directional tires used on the Evolution IX. The new tires provide better cornering performance, improved wet weather handling and can be rotated for improved service life.

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