3UZ-FE ENGINE

■ DESCRIPTION

On '01 LS430, base on the 1UZ-FE engine adopted on '00 LS400, 3UZ-FE engine of V8, 4.3-liter, 32-valve DOHC with the enlarged bore has been adopted.

This engine has adopted the VVT-i (Variable Valve Timing-intelligent) system, ACIS (Acoustic Control Induction System) and ETCS-i (Electronic Throttle Control System-intelligent), and these control functions have been optimized in order to realize the further improvement of the engine performance, fuel economy and to reduce exhaust emissions.
### Engine Specifications

<table>
<thead>
<tr>
<th></th>
<th>3UZ-FE</th>
<th>1UZ-FE</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Engine Type</strong></td>
<td>8-Cylinder, V Type</td>
<td></td>
</tr>
<tr>
<td><strong>No. of Cyls. &amp; Arrangement</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Valve Mechanism</strong></td>
<td>32-Valve DOHC, Belt &amp; Gear Drive</td>
<td></td>
</tr>
<tr>
<td><strong>Combustion Chamber</strong></td>
<td>Pentroof Type</td>
<td></td>
</tr>
<tr>
<td><strong>Manifolds</strong></td>
<td>Cross-Flow</td>
<td></td>
</tr>
<tr>
<td><strong>Fuel System</strong></td>
<td>SFI</td>
<td></td>
</tr>
<tr>
<td><strong>Displacement</strong></td>
<td>4293 (261.9) cm³ (cu. in.)</td>
<td>3969 (242.1) cm³ (cu. in.)</td>
</tr>
<tr>
<td><strong>Bore × Stroke</strong></td>
<td>91.0 × 82.5 (3.58 × 3.25) mm (in.)</td>
<td>87.5 × 82.5 (3.44 × 3.25) mm (in.)</td>
</tr>
<tr>
<td><strong>Compression Ratio</strong></td>
<td>10.5 : 1</td>
<td></td>
</tr>
<tr>
<td><strong>Max. Output [SAE-NET]</strong></td>
<td>216 kW @ 5600 rpm (290 HP @ 5600 rpm)</td>
<td>216 kW @ 6000 rpm (290 HP @ 6000 rpm)</td>
</tr>
<tr>
<td><strong>Max. Torque [SAE-NET]</strong></td>
<td>434 N·m @ 3400 rpm (320 ft·lb @ 3400 rpm)</td>
<td>407 N·m @ 4000 rpm (300 ft·lb @ 4000 rpm)</td>
</tr>
<tr>
<td><strong>Intake Valve Timing</strong></td>
<td>Open –14° ~ 31° BTDC</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Close 64° ~ 19° ABDC</td>
<td>64° ~ 14° ABDC</td>
</tr>
<tr>
<td><strong>Exhaust Valve Timing</strong></td>
<td>Open 46° BBDC</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Close 3° ATDC</td>
<td></td>
</tr>
<tr>
<td><strong>Fuel Octane Number</strong></td>
<td>RON 95 or more</td>
<td></td>
</tr>
<tr>
<td><strong>Oil Grade</strong></td>
<td>API SJ, EC or ILSAC</td>
<td></td>
</tr>
</tbody>
</table>

### Performance Curve

![Performance Curve Graph](image)
The major differences between the new 3UZ-FE engine on the ’01 LS430 and the 1UZ-FE engine on the ’00 LS400 are the following:

<table>
<thead>
<tr>
<th>System</th>
<th>Features</th>
</tr>
</thead>
</table>
| **Engine Proper**       | • The water passage outside of the cylinder head bolts has been changed to improve the flow of the water around the valve seats, thus reducing the temperature of the combustion chamber.  
                          • The cylinder bore has been increased in size, and the thickness of the liner has been decreased.  
                          • The shape of the cylinder head gasket has been changed in conjunction with the increase in the size of the cylinder bore.  
                          • The material strength of the cylinder head bolts has been changed to increase their axial tension. As a result, the head gaskets tightening has been improved.  
                          • The piston diameter has been increased in size, and its shape has been optimized to achieve weight reduction.  
                          • The material of the inner surface of the bushing in the small end of the connecting rod has been changed from lead bronze alloy to phosphor bronze alloy.  
                          • The material of the sliding surface of the crankshaft bearing has been changed from kelmet to aluminum alloy. |
| **Cooling System**      | • An electric cooling fan system has been adopted.  
                          • The shape of the water inlet housing has been optimized to increase the water flow and to achieve weight reduction. |
| **Intake and Exhaust System** | • A resonator and a tuning hole have been provided in the air cleaner inlet to reduce the amount of intake air sound.  
                          • The air cleaner case has been increased in size to reduce the amount of intake air sound, and the construction of the air cleaner element has been optimized to achieve weight reduction.  
                          • A stainless steel exhaust manifold with a single-pipe construction has been adopted. As a result, the warm-up performance of the TWC (Three-way Catalytic Converter) has been improved.  
                          • Two TWCs (Three-way Catalytic Converters) have been provided in the front, and one in the center.  
                          • Ultra thin-wall, high-cell ceramic type TWCs have been adopted.  
                          • A link-less type throttle body has been adopted. |
| **Fuel System**         | • A saddle-shaped fuel tank has been adopted.  
                          • A compact fuel pump in which a fuel filter, pressure regulator and jet pump are integrated in the module fuel pump assembly has been adopted.  
                          • The charcoal canister has been relocated. |
<p>| <strong>Ignition System</strong>     | The construction of the ignition coil has been optimized to achieve a compact and lightweight configuration. |</p>
<table>
<thead>
<tr>
<th>Engine Control System</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>• Torque activated power train control has been newly adopted for the control of ETCS-i. Also, the fail-safe control has been reconsidered with the adoption of the link-less type throttle body.</td>
<td></td>
</tr>
<tr>
<td>• The ECM steplessly controls the speeds of the two fans along with the adoption of an electric cooling fan system.</td>
<td></td>
</tr>
<tr>
<td>• A fuel cut control is adopted to stop the fuel pump when the airbag is deployed at the front or side collision.</td>
<td></td>
</tr>
<tr>
<td>• A DTC (Diagnostic Trouble Code) has been newly adopted for indicating a thermostat malfunction.</td>
<td></td>
</tr>
<tr>
<td>Others</td>
<td>The ECM has been installed in the engine compartment for improved serviceability.</td>
</tr>
</tbody>
</table>
ENGINE — 3UZ-FE ENGINE

1. Cylinder Head

- The cylinder head is made of aluminum and has intake and exhaust ports in a cross-flow arrangement. The intake ports are on the inside and the exhaust ports on the outside of the left and right banks respectively.
- The pitch of the intake and exhaust camshafts is shortened and the valve angle is narrowed to 21° 33’.
- The left and right banks of cylinder heads are common in configuration.

**NOTICE**

When the cylinder heads are disassembled for servicing, be sure to assemble each cylinder head to the correct right or left bank. The camshaft may seize if they are assembled incorrectly.

![Diagram of Cylinder Head](image)

2. Cylinder Head Gasket

The same type of (4-layer) steel laminate cylinder head gasket used in the 1UZ-FE engine on the ’00 LS400 is used in the 3UZ-FE engine on the ’01 LS430, except that its shape has been slightly changed in accordance with the increased cylinder displacement of the new engine.

![Diagram of Cylinder Head Gasket](image)
38. Cylinder Block

- The cylinder block has a bank angle of 90°, a bank offset of 21 mm (0.827 in.) and a bore pitch of 105.5 mm (4.15 in.), resulting in a compact block in its length and width even for its displacement.

- Light weight aluminum alloy is used for the cylinder block.

- In contrast to the 1UZ-FE engine on the ’00 LS400, the liner thickness in the 3UZ-FE engine on the ’01 LS430 has been changed from 2 mm (0.08 in.) to 1.5 mm (0.06 in.) to achieve weight reduction and improved cooling performance. It is not possible to bore this liner due to its thinness. The thickness of the wall has been changed from 5.5 mm (0.22 in.) to 6.5 mm (0.26 in.), and the shape of the water passage between the bores has been optimized to improve both cooling performance and rigidity.
Bank Angle 90°

Front

Bore Offset 21.0 mm (0.827 in.)

Bore Pitch 105.5 mm (4.15 in.)

Front

1.5 mm (0.06 in.)
6.5 mm (0.26 in.)
5.5 mm (0.22 in.)
2.0 mm (0.08 in.)

A – A Cross Section

'01 3UZ-FE  
'00 1UZ-FE

A – A Top View
40. Piston

- The piston head portion has adopted a taper squish shape to improve the fuel combustion efficiency.
- The sliding surface of the piston skirt has been coated with resin to reduce the amount of friction loss.
- Full floating type piston pins are used.
- By increasing the machining precision of the cylinder bore diameter, the outer diameter of the piston has been made into one type.
- In contrast to the 1UZ-FE engine on the '00 LS400, the placement position of the piston rings has been slightly raised in the 3UZ-FE engine on the '01 LS430 in order to reduce the area in which unburned fuel is likely to accumulate during the combustion process. Furthermore, the squish area in the thrust direction of the piston head has been discontinued and the combustion chamber has been made shallower in order to further improve the combustion efficiency, thus improving fuel economy.
5. Connecting Rod

- The sintered and forged connecting rod is highly rigid and has little weight fluctuation.

- A weight-adjusting boss is provided at the big end to reduce fluctuation of weight and balance the engine assembly.

- In contrast to the 1UZ-FE engine on the ’00 LS400, the material of the inner surface of the bushing in the small end of the connecting rod in the 3UZ-FE engine on the ’01 LS430 has been changed from lead bronze alloy to phosphor bronze alloy to reduce the lead quantity and to further improve the wear resistance.

- The connecting rod cap is held by plastic region tightening bolts.

NOTE: When reusing the connecting rod cap bolts, if the diameter at the thread is less than 7.0 mm (0.275 in.), it is necessary to replace them with new ones.

- The connecting rods for the right and left banks are placed in opposite directions with the outer marks facing the crankshaft.
45. Crankshaft and Crankshaft Bearings

- A forged crankshaft with five main journals, four connecting rod pins and eight balance weights is used.
- Connecting rod pins and journals are induction-hardened to ensure an added reliability.

- In contrast to the 1UZ-FE engine on the '00 LS400, the material of the sliding surface of the crankshaft bearing in the 3UZ-FE engine on the '01 LS430 has been changed from kelmet to aluminum alloy to discontinue the use of lead and to further enhance the engine’s quiet operation.

- Crankshaft bearings are selected carefully according to the measured diameters of the crank journal and cylinder block journal holes.

**NOTE:** The diameter of the crank journal and the cylinder block journal hole is indicated at the places shown below.
NOTE: Numbers of the crankshaft and pistons are shown on the right side.

Crankshaft angles and engine strokes (intake, compression, combustion and exhaust) are shown in the table below. The firing order is 1 - 8 - 4 - 3 - 6 - 5 - 7 - 2.
ENGINE — 3UZ-FE ENGINE

VALVE MECHANISM

1. General

- Each cylinder has 2 intake valves and 2 exhaust valves. Intake and exhaust efficiency has been increased due to the larger total port areas.

- The valves are directly opened and closed by 4 camshafts.

- The intake camshafts are driven by a timing belt, while the exhaust camshafts are driven through gears on the intake camshafts.

- The VVT-i (Variable Valve Timing-intelligent) system is used to improve fuel economy, engine performance and reduce exhaust emissions. For details, see page 69.

- In contrast to the 1UZ-FE engine on the '00 LS400, an automatic timing belt tensioner with optimized construction and body material that has been changed to aluminum has been adopted in the 3UZ-FE engine on the '01 LS430.
2. Camshaft

- The exhaust camshafts are driven by gears on the intake camshafts. The scissors gear mechanism has been used on the exhaust camshaft to control backlash and reduce gear noise.
- A VVT-i controller has been installed on the front of the intake camshafts to vary the timing of the intake valves.
- In conjunction with the adoption of the VVT-i system, an oil passage is provided in the intake camshaft in order to supply engine oil to the VVT-i system.
- The intake camshaft is provided with timing rotor to trigger the VVT sensor.
4. Intake and Exhaust Valve and Valve Lifter

- An inner shim type valve adjusting shim has been adopted as well as the 1UZ-FE engine on the '00 LS400.
- The valve lifter, which has been made lighter and thinner.
- High-strength, heat-resistant steel is used in both the intake and exhaust valves, and soft nitriding treatment has been applied to the stem and the face areas of the valves.
- Carbon steel with a round-shaped cross section has been adopted for the valve spring, which is used for both the intake and exhaust valves.

#### Specifications

<table>
<thead>
<tr>
<th>Item</th>
<th>Intake Valve</th>
<th>Exhaust Valve</th>
</tr>
</thead>
<tbody>
<tr>
<td>Face Diameter</td>
<td>34.5 (1.36)</td>
<td>29.0 (1.14)</td>
</tr>
<tr>
<td>Stem Diameter</td>
<td>5.5 (0.22)</td>
<td>5.5 (0.22)</td>
</tr>
</tbody>
</table>

4. Timing Pulleys, Automatic Tensioner and Timing Belt Cover

- In contrast to the 1UZ-FE engine on the '00 LS400, an automatic timing belt tensioner with optimized construction and body material that has been changed to aluminum has been adopted in the 3UZ-FE engine on the '01 LS430.
- The timing belt cover No. 3 is made of aluminum to reduce noise.
- The timing belt cover No. 1 and No. 2 are composite formed with a gasket to improve serviceability.
LUBRICATION SYSTEM

- The lubrication circuit is fully pressurized and oil passes through an oil filter.
- The trochoid gear type oil pump is directly driven by the crankshaft.
- Along with the adoption of the VVT-i (Variable Valve Timing-intelligent), right bank and left bank cylinder heads are provided with VVT-i controllers and camshaft timing oil control valves. This system is operated by the engine oil.
Camshaft Timing
Oil Control Valves

VVT-i Controllers

Oil Pump

MAIN OIL HOLE

BYPASS VALVE

OIL FILTER

RELIEF VALVE

OIL PUMP

OIL STRAINER

SCISSORS GEAR MECHANISM

CYLINDER HEAD (FOR LEFT BANK)

EXHAUST CAMSHAFT JOURNALS

INTAKE CAMSHAFT JOURNALS

CAMSHAFT TIMING OIL CONTROL VALVE FILTER (FOR LEFT BANK)

CAMSHAFT TIMING OIL CONTROL VALVE FILTER (FOR RIGHT BANK)

CRANKSHAFT JOURNALS

CRANKSHAFT PINS

OIL JETS

PISTONS

SCISSORS GEAR MECHANISM

CYLINDER HEAD (FOR RIGHT BANK)

INTAKE CAMSHAFT JOURNALS

EXHAUST CAMSHAFT JOURNALS

VVT-i CONTROLLER (FOR LEFT BANK)

VVT-i CONTROLLER (FOR RIGHT BANK)

OIL PAN
COOLING SYSTEM

1. General

- The cooling system is a pressurized, forced-circulation type.
- A thermostat, having a by-pass valve, is located on the water pump inlet side of the cooling circuit. As the coolant temperature rises, the thermostat opens and the by-pass valve closes, so the system maintains suitable temperature distribution in the cylinder head.
- In contrast to the 1UZ-FE engine on the ’00 LS400, the shape of the water inlet housing has been optimized in the 3UZ-FE engine on the ’01 LS430 to achieve the smooth flow of the engine coolant.
- In contrast to the 1UZ-FE engine on the ’00 LS400, in which a fluid coupling type cooling fan was used, the 3UZ-FE engine on the ’01 LS430 has adopted an electric cooling fan system.
- The ECM is installed in the ECM box in the engine compartment. As a result, the wiring harness has been shortened, thus realizing weight reduction.
2. Water Pump

- The water pump has two volute chambers, and circulates coolant uniformly to the left and right banks of the cylinder block.
- The water pump is driven by the back of the timing belt.
- The rotor is made of resin.

3. Water Inlet Housing

In contrast to the 1UZ-FE engine on the '00 LS400, the shape of the water inlet housing has been optimized in the 3UZ-FE engine on the '01 LS430 to achieve the smooth flow of the engine coolant.
52. Cooling Fan System

- This system consists of 2 fans with a different number of blades. The main fan contains 5 blades and the sub fan contains 7 blades. These fans are actuated by the cooling fan ECU in accordance with the signals from the ECM.

A simplified sealing type reservoir tank has been provided for the fan shroud.

- The ECM is installed in the ECM box in the engine compartment. As a result, the wiring harness has been shortened, thus realizing weight reduction.
1. Air Cleaner

- A resonator and a tuning hole have been provided in the air cleaner inlet to reduce the amount of intake air sound.
- The air cleaner case has been increased in size to reduce the amount of intake air sound, and the construction of the air cleaner element has been optimized to achieve weight reduction.

2. Intake Manifold

- The low-to mid-speed range torque has been improved by increasing the length of the intake manifold port.
- The air intake chamber consists of upper and lower sections and contains an intake air control valve. This valve is activated by ACIS (Acoustic Control Induction System) and is used to alter the intake pipe length to improve the engine performance in all speed ranges. For details, see page 80.
Intake Air Control Valve

Actuator (for ACIS)

Front
3. Intake Manifold Gasket

- A heat-barrier gasket has been adopted for use between the cylinder head and the intake manifold. This gasket, which restrains the heat transfer from the cylinder head to the intake manifold, helps restrain the intake air temperature and improve the charging efficiency.

- The construction of the gasket consists of resin that is sandwiched between metal gaskets.

4. Exhaust Manifold

- The front exhaust pipe has been shortened and the warm-up performance of the TWC (Three-Way Catalytic Converter) has been improved.

- Cooling holes have been provided in the heat insulator for cooling the exhaust manifold.
56. Exhaust Pipe

Two TWCs (Three-way Catalytic Converters) have been provided in the front, and one in the center.

6. Three Way Catalytic Converter

An ultra thin-wall, high-cell ceramic type TWC has been adopted. This TWC enables to optimize the cells density and to reduce wall thickness.
1. General

- A saddle-shaped fuel tank has been adopted.
- A compact fuel pump in which a fuel filter, pressure regulator and jet pump are integrated in the module fuel pump assembly has been adopted.
- The charcoal canister, which was provided in the luggage compartment of the '00 LS400, has been relocated outside, underneath the luggage compartment on the '01 LS430.
- A fuel returnless system has been used to reduce evaporative emissions.
- An air-assist system has been adopted to improve the atomization of fuel, thus improving the performance of the evaporative emissions.
- A compact 4-hole type fuel injector has been used.
- The ORVR (On-Board Refueling Vapor Recovery) system has been used.

2. Fuel Returnless System

- The fuel returnless system has been used to reduce evaporative emissions. With the pressure regulator and the fuel filter-integrated fuel pump are housed inside the fuel tank, this system eliminates the return of fuel from the engine area. This helps prevent the internal temperature of the fuel tank from rising, and reduces evaporative emissions.
- 2 pulsation dampers are used to realize a quieter operation.
3. Air-Assist System

This system is designed to regulate air intake (atmospheric side) using the throttle valve, and direct it to the nozzle of the fuel injector inside the intake manifold (negative pressure side). This promotes atomization of the fuel while reducing emissions and improving fuel economy and idle stability.

4. Fuel Injector

- A compact 4-hole type fuel injector has been used.
- Air introduced from the throttle body and air gallery flows through the air chamber formed by the O-ring and insulator under the fuel injector and then is mixed with the fuel. This design promotes atomization of the fuel.
5. Fuel Tank

- The fuel tank adopts a saddle shape to allow the propeller shaft to pass through its center portion. Also, a jet pump is provided to transfer the fuel from the side of the tank without the fuel pump to the side with the fuel pump.

- Two sender gauges, the main and sub sender gauges, are provided to improve the accuracy of the fuel gauge.

Jet Pump

A jet pump is adopted in the fuel tank. Since the propeller shaft is located below its center bottom, the fuel tank of the new LS430 is shaped as indicated below. A fuel tank with such a shape tends to cause the fuel to be dispersed into both chamber A and chamber B when the fuel level is low, stopping the fuel in chamber B from being pumped out. To prevent this from occurring, a jet pump has been provided to transfer the fuel from chamber B to chamber A. This is accomplished by utilizing the flow of the fuel, so that the vacuum created by the fuel, as it passes through the venturi is used to suck the fuel out of chamber B and send it to chamber A.

![Jet Pump Diagram](image1)

Fuel Sender Gauge

Two sender gauges, the main and sub, are provided to improve the accuracy of the fuel gauge. These sender gauges, which are provided inline in chambers A and B, send the signals representing the residual volume of fuel in both chambers via the luggage room junction block ECU to the meter ECU. Based on the signals from the 2 sender gauges and the fuel injection volume data from the ECM, the meter ECU calculates the residual volume of fuel and actuates the fuel gauge in the combination meter.

![System Diagram](image2)
6. Module Fuel Pump Assembly

The main sender gauge, fuel pump, fuel filter, pressure regulator and jet pump have been integrated.

7. ORVR System

General

The ORVR (On-Board Refueling Vapor Recovery) is a system that uses a charcoal canister, which is provided onboard, to recover the fuel vapor that is generated during refueling. This reduces the discharge of fuel vapor into the atmosphere.
When the fuel tank cap is removed, atmosphere applies to the fuel tank over fill check valve’s chamber A. Refueling causes the internal pressure of the fuel tank to increase, the vapor flows to the charcoal canister while maintaining valve B pressed, thus allowing the vapor to become absorbed by the charcoal canister. When the tank is full, valve C closes, thus shutting off the passage to the charcoal canister.

**Fuel Tank Over Fill Check Valve**
IGNITION SYSTEM

1. General

- A DIS (Direct Ignition System) has been adopted. The DIS improves the ignition timing accuracy, reduces high-voltage loss, and enhances the overall reliability of the ignition system by eliminating the distributor. The DIS in this engine is an independent ignition system which has one ignition coil (with igniter) for each cylinder.

- Iridium-tipped spark plugs have been adopted.

- In contrast to the 1UZ-FE engine on the '00 LS400, compact and lightweight ignition coils with an optimized construction have been adopted in the 3UZ-FE engine on the '01 LS430.
2. Spark Plug

Iridium-tipped spark plugs have been adopted to realize a 120,000-mile (192,000 km) maintenance-free operation. Their center electrode is made of iridium, which excels in wear resistance. As a result, the center electrode is made with a smaller diameter and improved the ignition performance.

3. Ignition Coil (with Igniter)

The DIS provides 8 ignition coils, one for each cylinder. The spark plug caps, which provide contact to the spark plugs, are integrated with an ignition coil. Also, an igniter is enclosed to simplify the system. However, in contrast to the 1UZ-FE engine on the '00 LS400, compact and lightweight ignition coils with an optimized construction have been adopted in the 3UZ-FE engine on the '01 LS430.
SERPENTINE BELT DRIVE SYSTEM

1. General

- Accessory components are driven by a serpentine belt consisting of a single V-ribbed belt. It reduces the overall engine length, weight and number of engine parts.

- An automatic tensioner eliminates the need for tension adjustment.

2. Automatic Tensioner

The automatic tensioner, which mainly consists of an idler pulley, an arm, a spring case, and a torsion spring, maintains the tension of the V-ribbed belt constant through the force of the torsion spring.
The engine control system of the 3UZ-FE engine on the '01 LS430 is basically same in construction and operation as that of the 1UZ-FE engine for the '00 LS400. The engine control system of the 3UZ-FE engine in the '01 LS430 and 1UZ-FE engine in the '00 LS400 are compared below.

<table>
<thead>
<tr>
<th>System</th>
<th>Outline</th>
<th>3UZ-FE</th>
<th>1UZ-FE</th>
</tr>
</thead>
<tbody>
<tr>
<td>SFI (Sequential Multiport Fuel Injection)</td>
<td>An L-type SFI system directly detects the intake air mass with a hot wire type air flow meter.</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>ESA (Electronic Spark Advance)</td>
<td>Ignition timing is determined by the ECM based on signals from various sensors. The ECM corrects ignition timing in response to engine knocking.</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>ESA (Electronic Spark Advance)</td>
<td>2 knock sensors are used to improve knock detection.</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>ESA (Electronic Spark Advance)</td>
<td>The torque control correction during gear shifting has been used to minimize the shift shock.</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>VVT-i (Variable Valve Timing-intelligent)</td>
<td>Controls the intake camshaft to an optimal valve timing in accordance with the engine condition. For details, see page 69.</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>VVT-i (Variable Valve Timing-intelligent)</td>
<td>Optimally controls the throttle valve opening in accordance with the amount of accelerator pedal effort and the condition of the engine and the vehicle. In addition, comprehensively controls the ISC, snow mode control, cruise control, VSC system and TRAC systems. For details, see page 74.</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>ETCS-i (Electronic Throttle Control System-intelligent)</td>
<td>Controls the throttle valve opening to effect adaptive laser cruise control.*</td>
<td>☐</td>
<td>—</td>
</tr>
<tr>
<td>ETCS-i (Electronic Throttle Control System-intelligent)</td>
<td>Torque activated power train control has been adopted. Also, the fail-safe control has been reconsidered with the adoption of the link-less type throttle body. For details, see page 74.</td>
<td>☐</td>
<td>—</td>
</tr>
<tr>
<td>ACIS (Acoustic Control Induction System)</td>
<td>The intake air passages are switched according to the engine speed and throttle valve angle to increase performance in all speed ranges. For details, see page 80.</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Fuel Pump Control</td>
<td>The fuel pump speed is controlled by the fuel pump relay and the fuel pump resistor.</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Fuel Pump Control</td>
<td>The operation of the fuel pump will stop when the airbag is deployed at the front or side collision. For details, see page 84.</td>
<td>☐</td>
<td>—</td>
</tr>
<tr>
<td>Oxygen Sensor Heater Control</td>
<td>Maintains the temperature of the oxygen sensor at an appropriate level to increase accuracy of detection of the oxygen concentration in the exhaust gas.</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Cooling Fan Control</td>
<td>An electric cooling fan system has been adopted. The ECM steplessly controls the speed of the fans in accordance with the engine coolant temperature, vehicle speed, engine speed, and air conditioning operating conditions. As a result, the cooling performance has been improved.</td>
<td>☐</td>
<td>—</td>
</tr>
</tbody>
</table>

*: with Adaptive Laser Cruise Control
<table>
<thead>
<tr>
<th>System</th>
<th>Outline</th>
<th>3UZ-FE</th>
<th>1UZ-FE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Air Conditioning Cut-Off Control</td>
<td>By controlling the air conditioning compressor ON or OFF in accordance with the engine condition, drivability is maintained.</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Evaporative Emission Control</td>
<td>The ECM controls the purge flow of evaporative emissions (HC) in the charcoal canister in accordance with engine conditions.</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td></td>
<td>Using 3 VSVs and a vapor pressure sensor, the ECM detects any evaporative emission leakage occurring between the fuel tank and the charcoal canister through the changes in the tank pressure. For details, see page 85.</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Engine Immobiliser</td>
<td>Prohibits fuel delivery and ignition if an attempt is made to start the engine with an invalid ignition key.</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Function to communicate with multiplex communication system</td>
<td>Communicates with the meter ECU, A/C ECU, etc., on the body side, to input/output necessary signals.</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Diagnosis</td>
<td>When the ECM detects a malfunction, the ECM diagnoses and memorizes the failed section.</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td></td>
<td>The diagnosis system includes a function that detects a malfunction in the thermostat.</td>
<td>○</td>
<td>—</td>
</tr>
<tr>
<td>Fail-Safe</td>
<td>When the ECM detects a malfunction, the ECM stops or controls the engine according to the data already stored in the memory.</td>
<td>○</td>
<td>○</td>
</tr>
</tbody>
</table>