■ENGINE CONTROL SYSTEM

1. General

The engine control system of the 2JZ-GE engine in the IS300/IS300 SportCross and GS300 are compared below.

System	Outline		IS300/IS300 SportCross	GS300
EFI (Electronic Fuel Injection)	An L-type EFI system directly detects the intake air mass with a hot wire type air flow meter.		○	○
	The fuel injection system is a sequential multiport fuel injection system.		○	○
ESA (Electronic Spark Advance)	Ignition timing is determined by the engine ECU based on signals from various sensors. The engine ECU corrects ignition timing in response to engine knocking.		○	○
	2 knock sensors are used to improve knock detection.		○	○
	The torque control correction during gear shifting has been used to minimize the shift shock.		○	○
VVT-i (Variable Valve Timing-intelligent) (Refer to 45)	Controls the intake camshaft to an optimal valve timing in accordance with the engine condition.		○	○
ETCS-i (Electronic Throttle Control System-intelligent) (Refer to 46)	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, cruise control, TRC and VSC systems.		○	○
ACIS (Acoustic Control Induction System) (Refer to 48)	The intake air passages are switched according to the engine speed and throttle valve angle to increase performance in all speed ranges.		○	○
Fuel Pump Control (Refer to 51)	Under light engine loads, pump speed is low to reduce electric power loss.	2-Step Control	○	—
		3-Step Control	—	○
	A fuel cut control is adopted to stop the fuel pump when the airbag is deployed at the front or side collision.		○	○
Oxygen Sensor Heater Control	Maintains the temperature of the oxygen sensor at an appropriate level to increase accuracy of detection of the oxygen concentration in the exhaust gas.		○	○
Air Conditioning Cut-Off Control	By controlling the air conditioning compressor ON or OFF in accordance with the engine condition, drivability is maintained.		○	○

(Continued)

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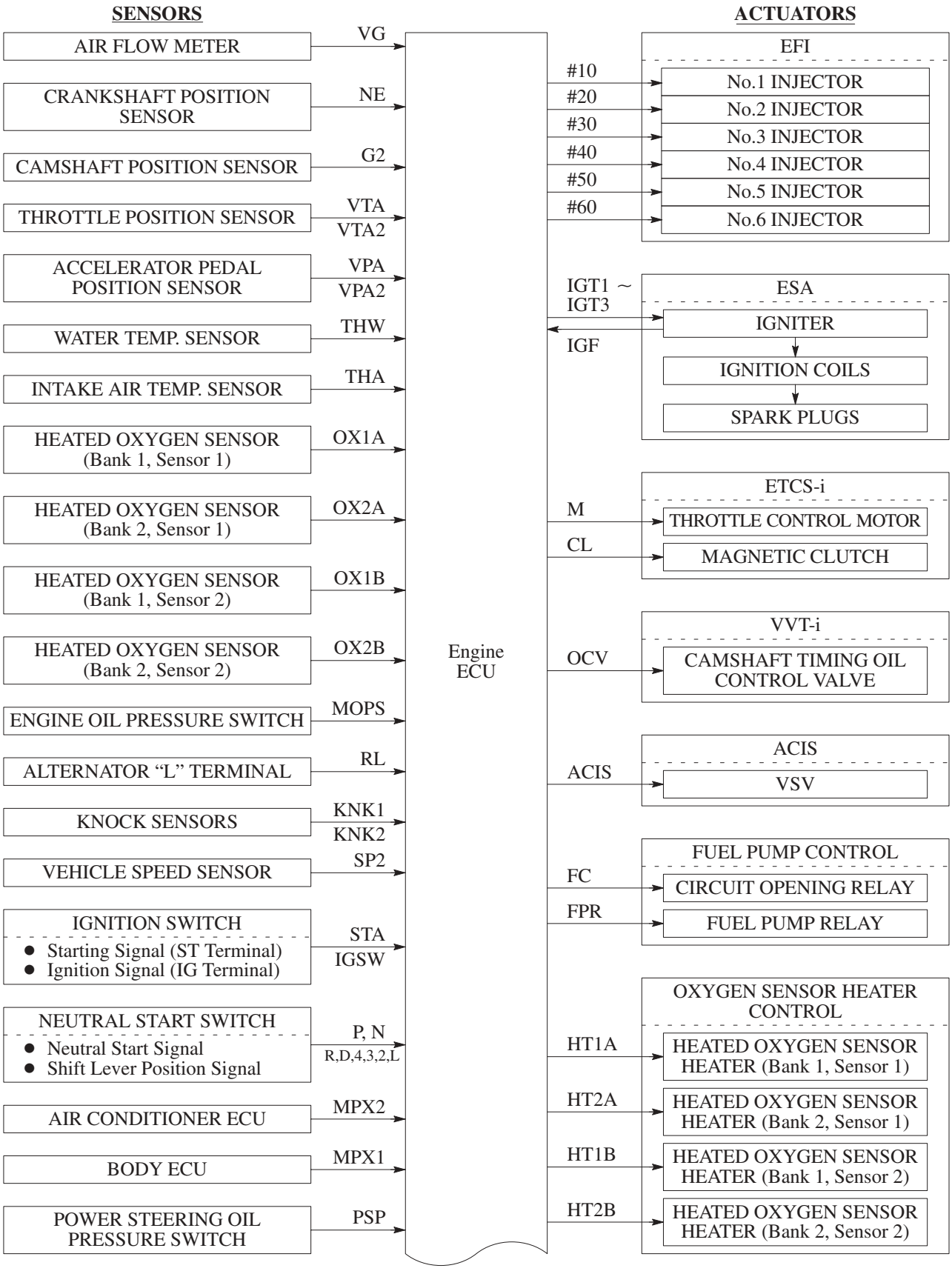
System	Outline	IS300/IS300 SportCross	GS300
Evaporative Emission Control	The engine ECU controls the purge flow of evaporative emissions (HC) in the charcoal canister in accordance with engine conditions.	○	○
Engine Immobiliser	Prohibits fuel delivery and ignition if an attempt is made to start the engine with an invalid ignition key.	○	○
Function to communicate with multiplex communication system	Communicates with the body ECU, A/C ECU, etc., on the body side, to input/output necessary signals.	○	○
Diagnosis (Refer to 52)	When the engine ECU detects a malfunction, the engine ECU diagnoses and memorizes the failed section.	○	○
Fail-Safe (Refer to 54)	When the engine ECU detects a malfunction, the engine ECU stops or controls the engine according to the data already stored in the memory.	○	○

2. Construction

The configuration of the engine control system in the 2JZ-GE engine is shown in the following chart.



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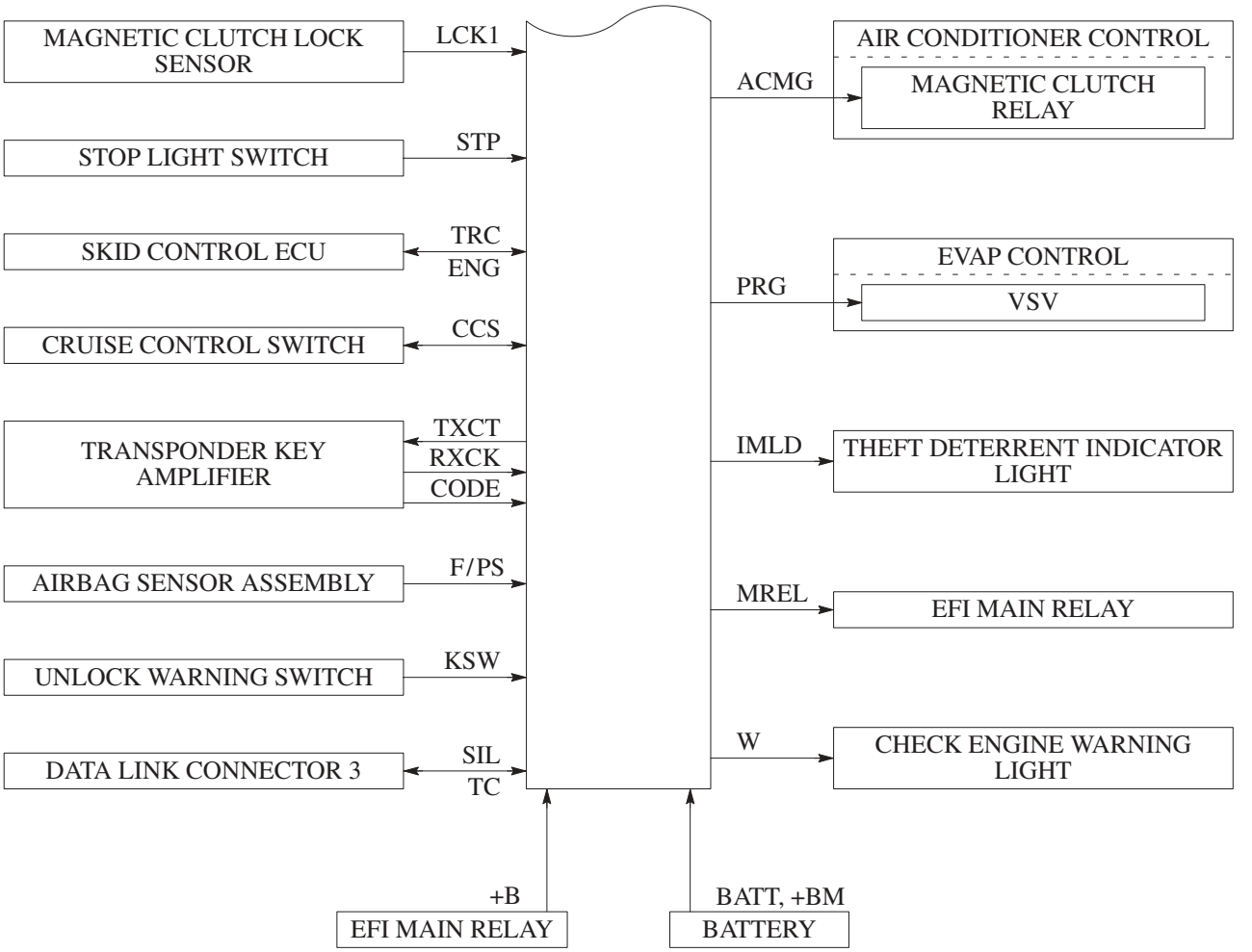
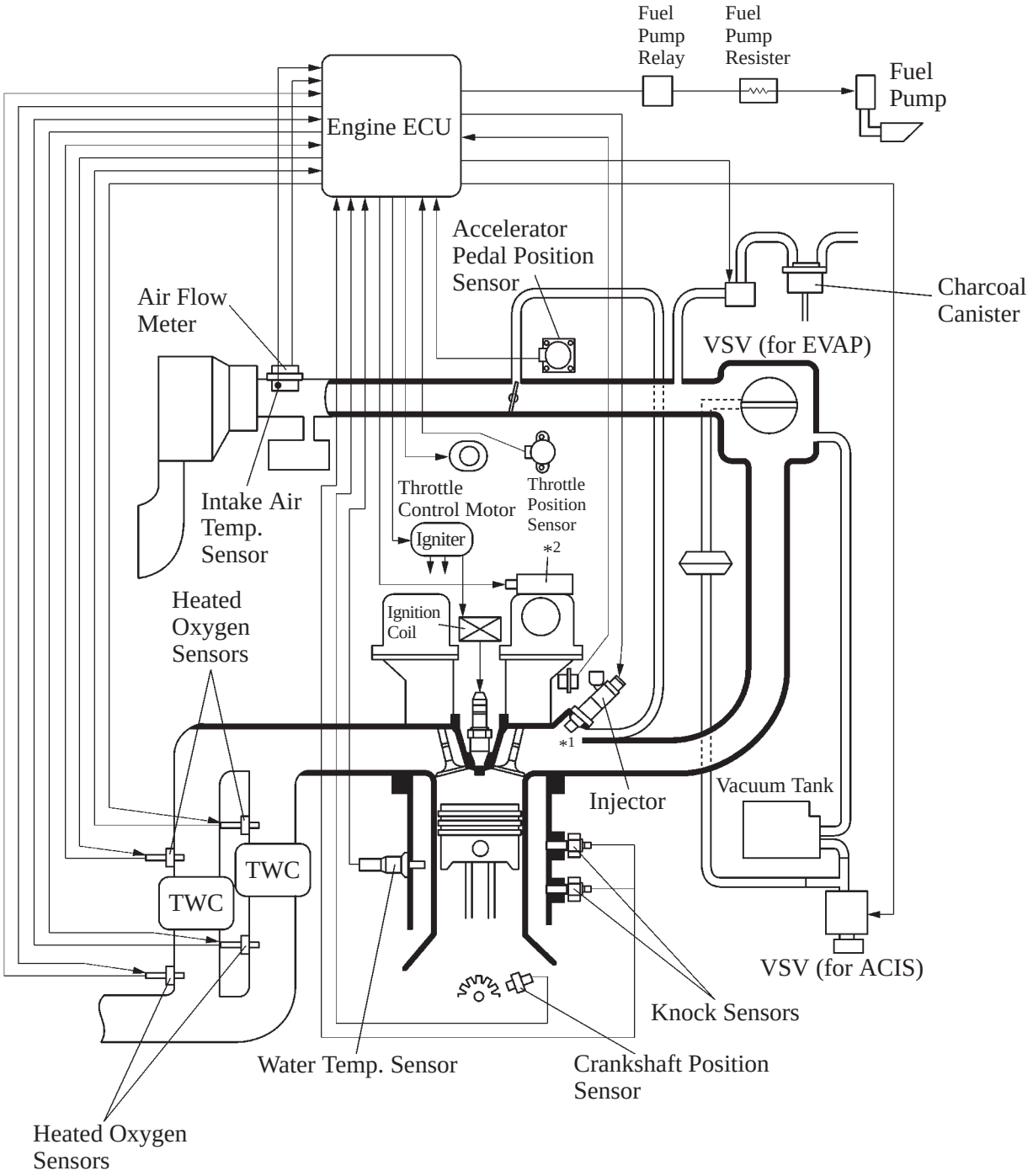

MAGNETIC CLUTCH LOCK SENSOR
LCK1
STOP LIGHT SWITCH
STP
SKID CONTROL ECU
TRC
ENG
CRUISE CONTROL SWITCH
CCS
TRANSPONDER KEY AMPLIFIER
TXCT
RXCK
CODE
AIRBAG SENSOR ASSEMBLY
F/PS
UNLOCK WARNING SWITCH
KSW
DATA LINK CONNECTOR 3
SIL
TC
+B
EFI MAIN RELAY
BATT, +BM
BATTERY
ACMG
AIR CONDITIONER CONTROL
MAGNETIC CLUTCH RELAY
PRG
EVAP CONTROL
VSV
IMLD
THEFT DETERRENT INDICATOR LIGHT
MREL
EFI MAIN RELAY
W
CHECK ENGINE WARNING LIGHT

3. Engine Control System Diagram



204EG32

∗1: Camshaft Position Sensor
∗2: Camshaft Timing Oil Control Valve

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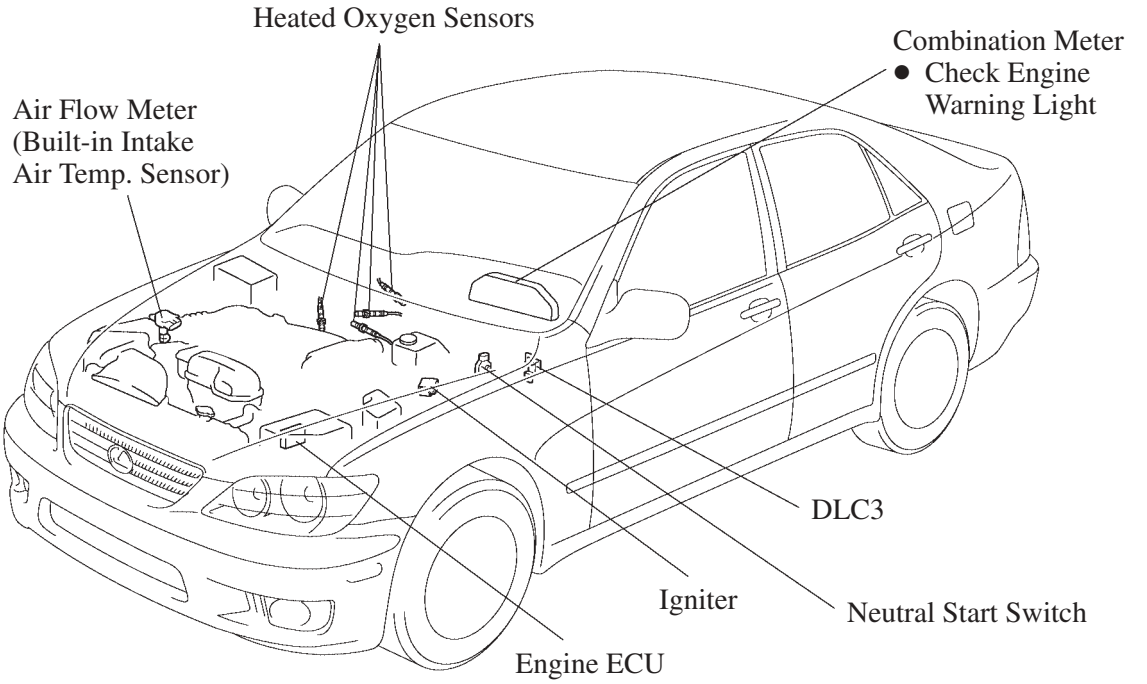
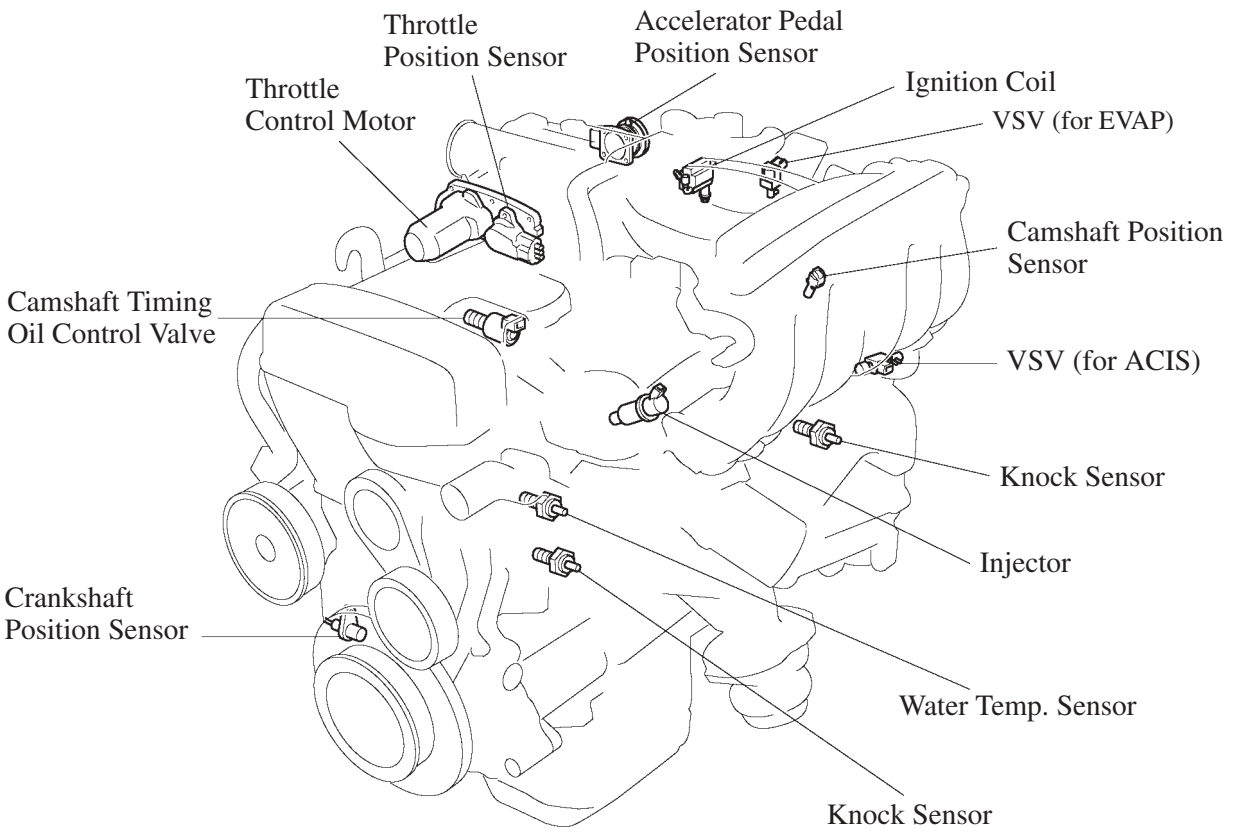
4. Layout of Main Components



204EG33



204EG42

5. Main Components of Engine Control System

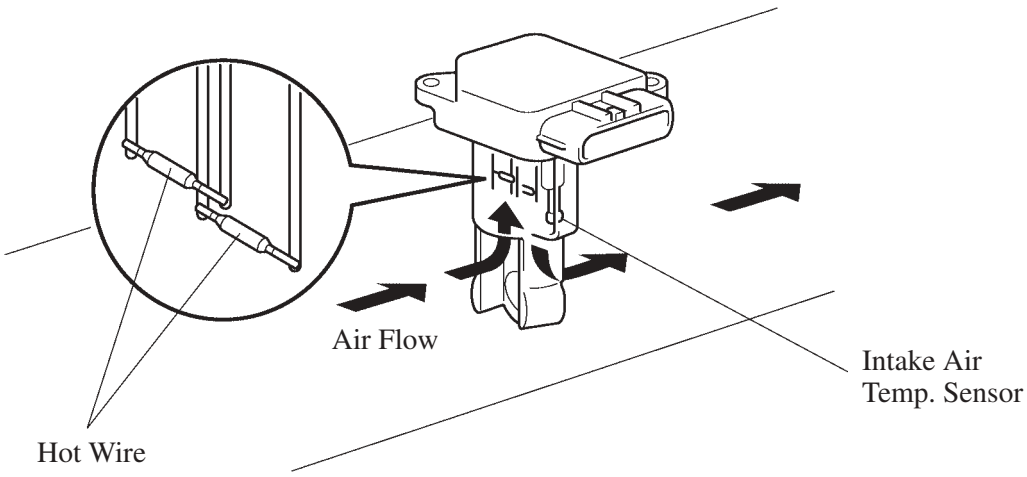
General

The following table compares the main components of the 2JZ-GE engine in the IS300/IS300 SportCross and GS300 models.

Components	IS300/IS300 SportCross	GS300
Air Flow Meter	Hot-Wire Type	←
Throttle Position Sensor	Linear Type, 2	←
Accelerator Pedal Position Sensor	Linear Type, 2	←
Crankshaft Position Sensor	Pick-Up Coil Type, 1	←
Camshaft Position Sensor	Pick-Up Coil Type, 1	←
Knock Sensor	Built-In Piezoelectric Element Type, 2	←
Oxygen Sensor (Bank 1, Sensor 1) (Bank 1, Sensor 2) (Bank 2, Sensor 1) (Bank 2, Sensor 2)	with Heater Type	←
Injector	4-Hole Type with Air Assist	←
Engine ECU	32-bit CPU	←

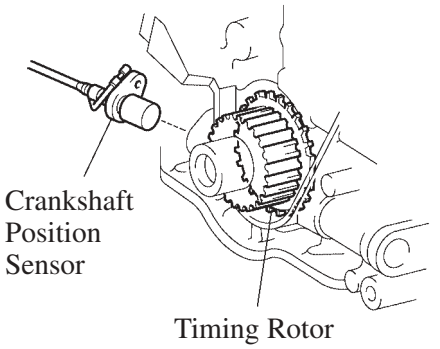
Air Flow Meter

- This air flow meter, which is a plug-in type, allows a portion of the intake air to flow through the detection area. By directly measuring the mass and the flow rate of the intake air, the detection precision has been improved and the intake air resistance has been reduced.
- This air flow meter has a built-in intake air temperature sensor.

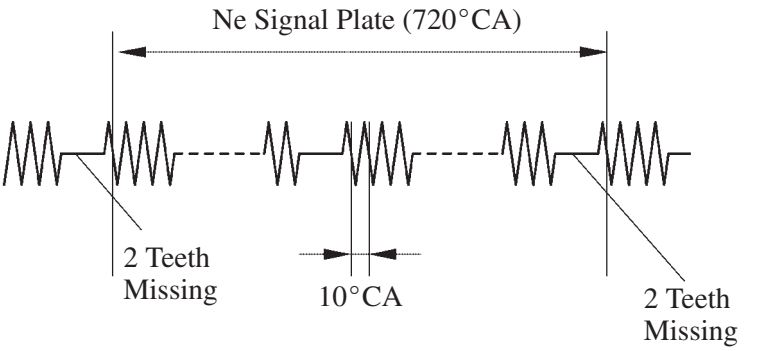


Crankshaft Position Sensor

The timing rotor of the crankshaft consists of 34 teeth, with 2 teeth missing. The crankshaft position sensor outputs the crankshaft rotation signals every 10°, and the missing teeth are used to determine the top-dead-center.



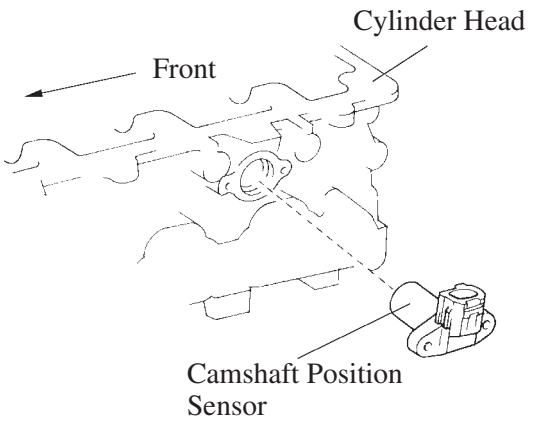
204EG34



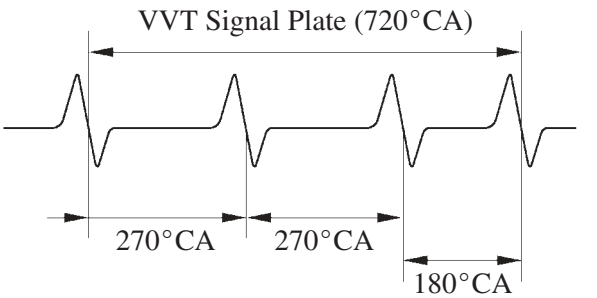
199EG36

Camshaft Position Sensor

A camshaft position sensor is mounted on the intake side of each cylinder head. To detect the camshaft position, a timing rotor that is provided on the intake camshaft is used to generate 3 pulses for every 2 revolutions of the crankshaft.



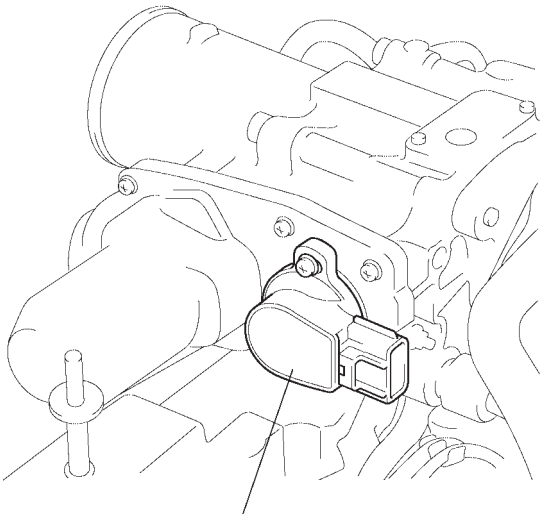
150EG23



199EG38

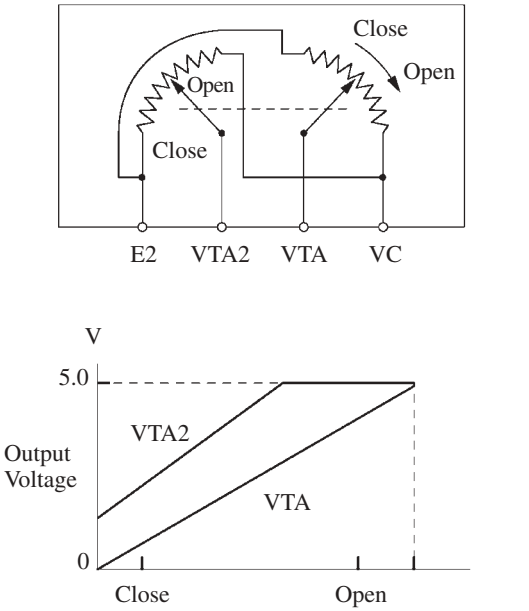
Throttle Position Sensor

This sensor converts the throttle valve opening angles into electronic signals with two differing characteristics and outputs them to the engine ECU. One is the VTA signal that linearly outputs the voltage along the entire range of the throttle valve opening angle. The other is the VTA2 signal that outputs an offset voltage.



Throttle Position Sensor

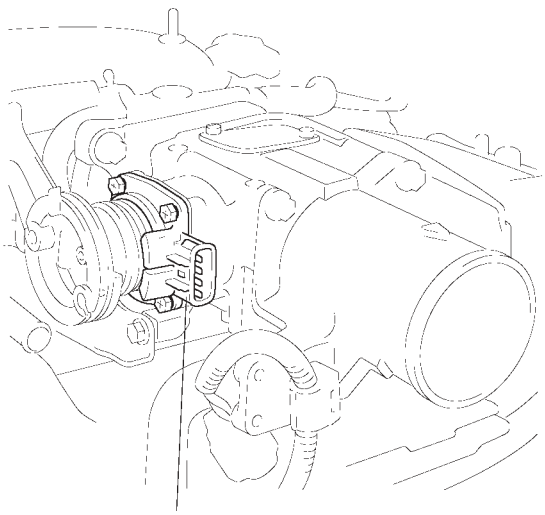
204EG41



199EG39

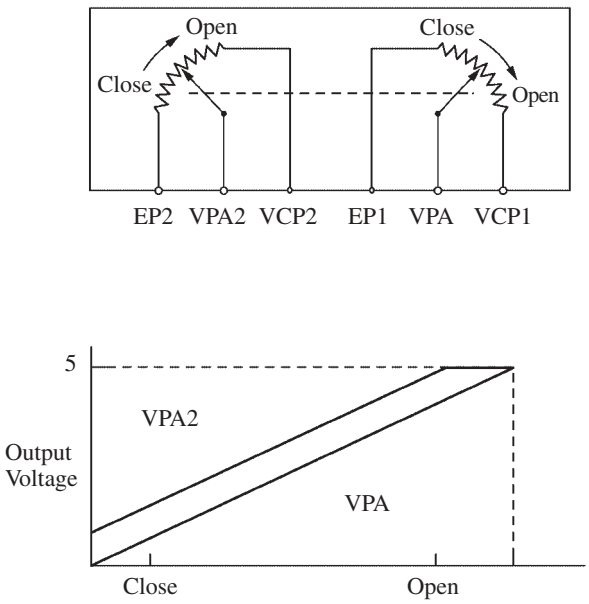
Accelerator Pedal Position Sensor

This sensor converts the accelerator pedal depressed angles into electric signals with two differing characteristics and outputs them to the engine ECU. One is the VPA signal that linearly outputs the voltage along the entire range of the accelerator pedal depressed angle. The other is the VPA2 signal that outputs on offset voltage.



Accelerator Pedal Position Sensor

204EG40

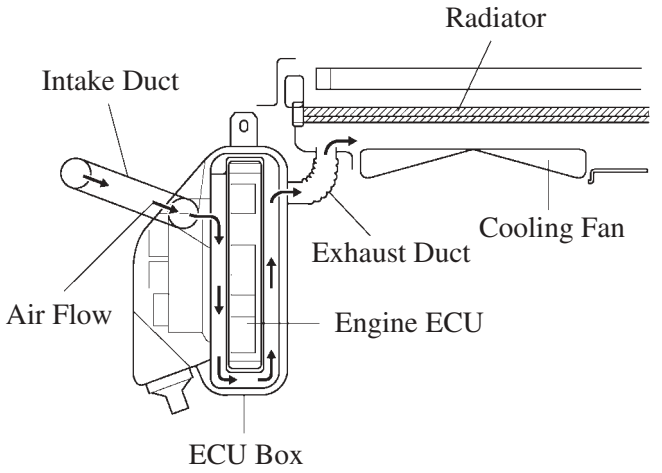


Accelerator Pedal Depressed Angle

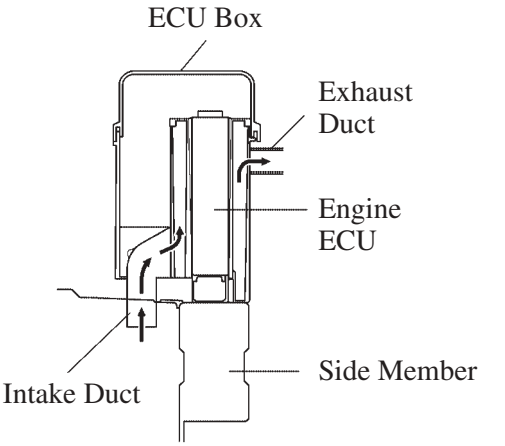
199EG40

Engine ECU

- The engine ECU is installed in the ECU box in the engine compartment.
- Utilizing the vacuum that is generated by the radiator cooling fan, airflow is introduced through the ECU box to restrain the increase in the temperature in the ECU box.



152EG09



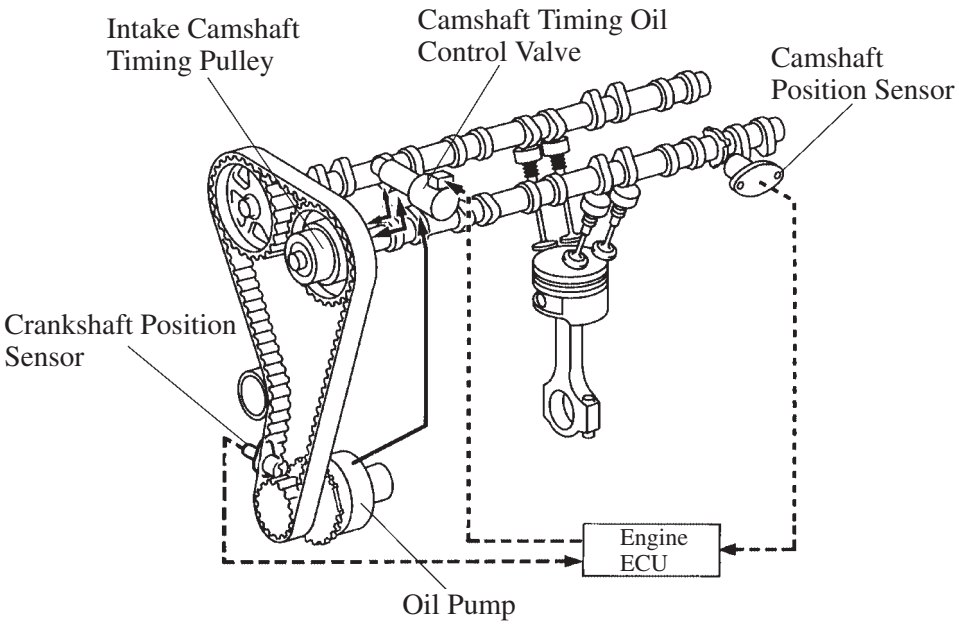
152EG10

- The engine ECU has used the 32-bit CPU to increase the speed for processing the signals.

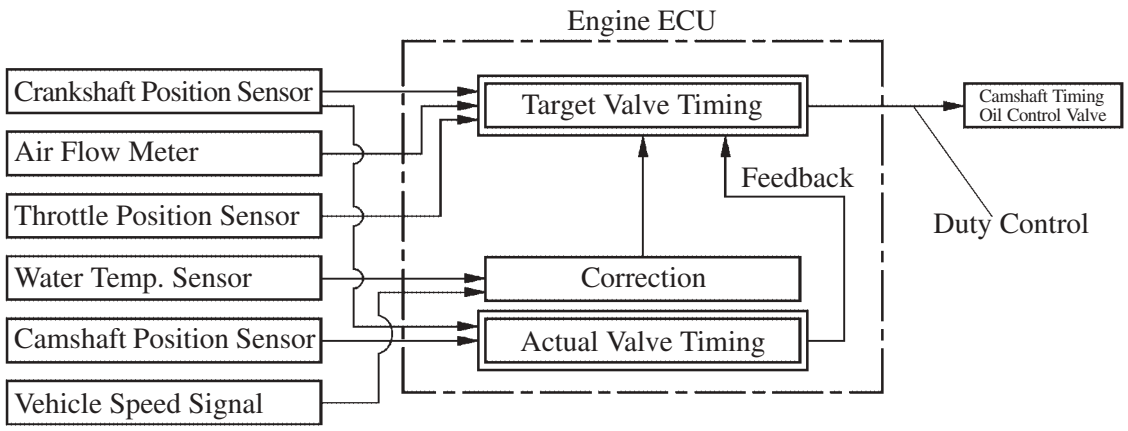
6. VVT-i (Variable Valve Timing-intelligent) System

General

The VVT-i system is designed to control the intake camshaft within a wide range of 47° (of crankshaft angle) to provide a valve timing that is optimally suited to the engine condition, thus realizing improved torque in all the speed ranges and fuel economy, and reduce exhaust emissions. The actual intake valve timing is feedback by means of the camshaft position sensor for constant control to the target valve timing.



150EG26

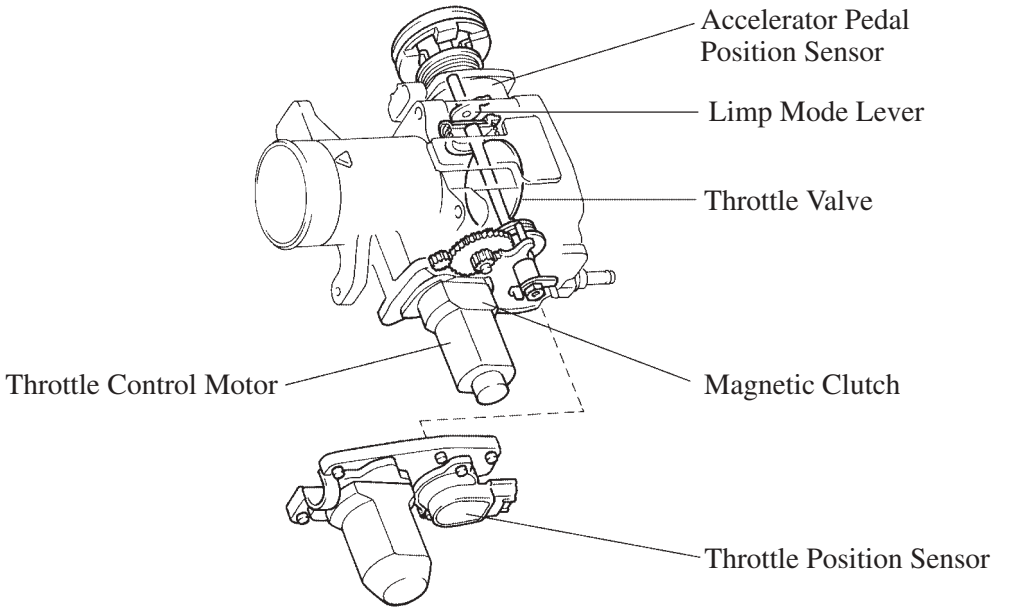


172CR07

7. ETCS-i (Electronic Throttle Control System-intelligent)

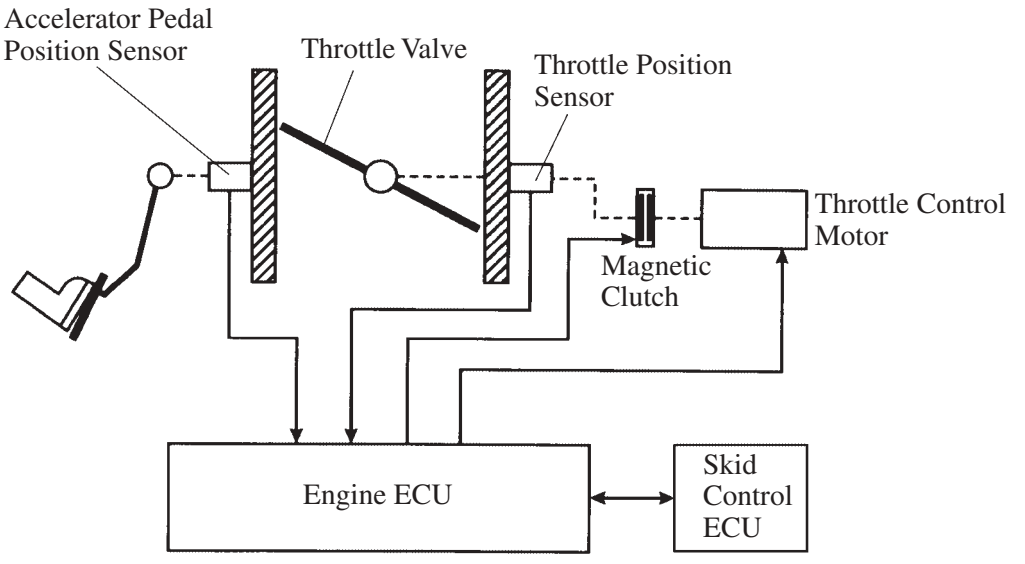
General

- The ETCS-i uses the engine ECU to calculate the optimal throttle valve opening that is appropriate for the respective driving condition and uses a throttle control motor to control the opening.
- The ETCS-i controls the ISC (Idle Speed Control) system, the cruise control system, TRC (Traction Control) system and the VSC (Vehicle Stability Control).
- 2JZ-GE engine on IS300/IS300 SportCross uses the same type ETCS-i with the accelerator cable and link as of GS300.
- A duplicate system is provided to ensure a high level of reliability, and the system shuts off in case of an abnormal condition. Even when the system is shut off, the accelerator pedal can be used to operate the vehicle in the limp mode. For details, refer to page 55.



150EG36

▶ System Diagram ◀



150EG41

Operation

1) General

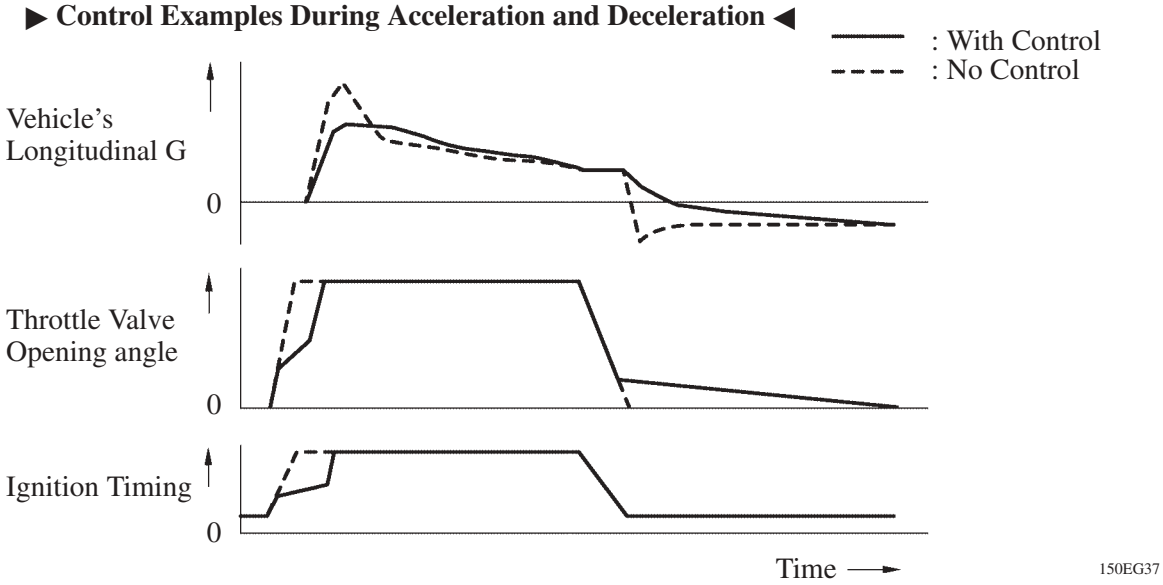
The engine ECU drives the throttle control motor by determining the target throttle valve opening in accordance with the respective operation condition.

- Non-linear Control
- Idle Speed Control
- Shift Shock Reduction Control
- TRC Throttle Control
- VSC Coordination Control
- Cruise Control

2) Non-linear Control

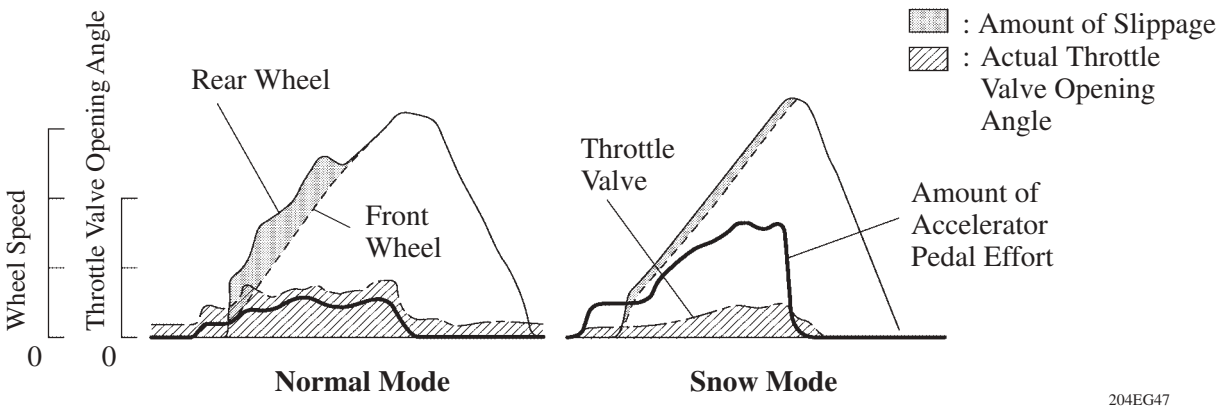
- Controls the throttle to an optimal throttle valve opening that is appropriate for the driving condition such as the amount of the accelerator pedal effort and the engine speed in order to realize excellent throttle control and comfort in all operating ranges.

▶ Control Examples During Acceleration and Deceleration ◀



- In situations in which low-μ surface conditions can be anticipated, such as when driving in the snow, the throttle valve can be controlled to help vehicle stability while driving over the slippery surface. This is accomplished by turning ON the SNOW switch, which, in response to the amount of the accelerator pedal effort that is applied, reduces the engine output from that of the normal driving level.

▶ Control Example During Startoff Acceleration in 1st Gear on Packed Snow Surface (TRC OFF) ◀



3) Idle Speed Control

Previously, a step motor type ISC valve was used to perform idle speed control such as fast idle during cold operating conditions and idle-up. In conjunction with the adoption of the ETCS-i, idle speed control is now performed by the throttle control motor, which controls the throttle valve opening.

4) Shift Shock Reduction Control

The throttle control is synchronized to the ECT (Electronically Controlled Transmission) control during the shifting of the transmission in order to reduce the shift shock.

5) TRC Throttle Control

As part of the TRC system, the throttle valve is closed by a demand signal from the skid control ECU if an excessive amount of slippage is created at a driving wheel, thus facilitating the vehicle in ensuring stability and driving force.

6) VSC Coordination Control

In order to bring the effectiveness of the VSC system control into full play, the throttle valve opening angle is controlled by effecting a coordination control with the skid control ECU.

7) Cruise Control

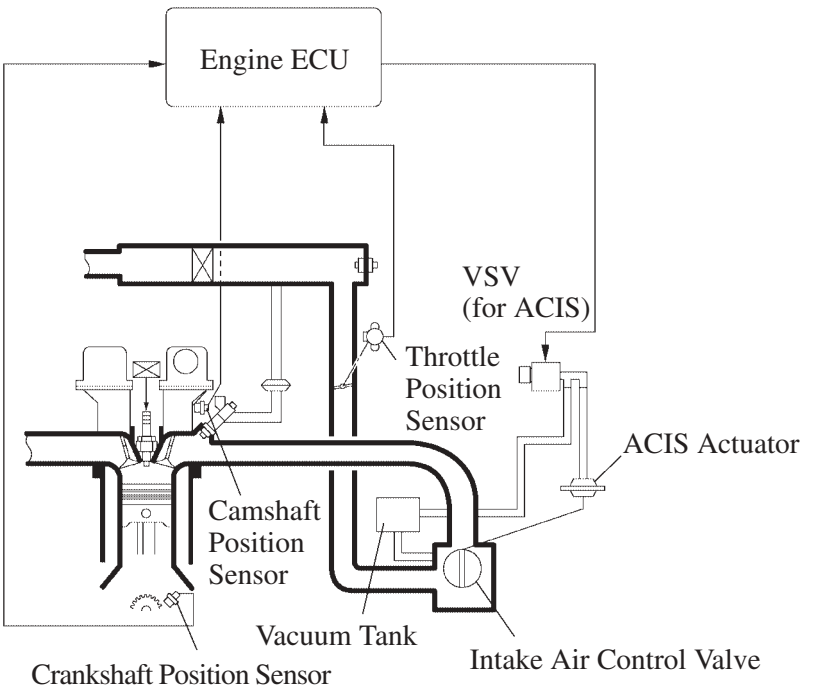
Previously, the vehicle speed was controlled by the cruise control actuator, which opened and closed the throttle valve. Along with the adoption of the ETCS-i, the vehicle speed is now controlled by the throttle control motor, which controls the throttle valve.

8. ACIS (Acoustic Control Induction System)

General

The ACIS (Acoustic Control Induction System) is realized by using a bulkhead to divide the intake manifold into 2 stages, with an intake air control valve in the bulkhead being opened and closed to vary the effective length of the intake manifold in accordance with the engine speed and throttle valve opening angle. This increases the power output in all ranges from low to high speed.

▶ System Diagram ◀

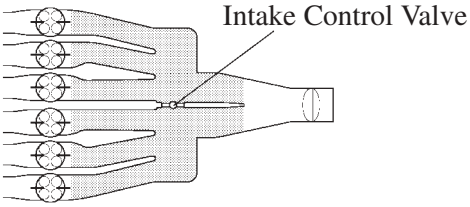


204EG35

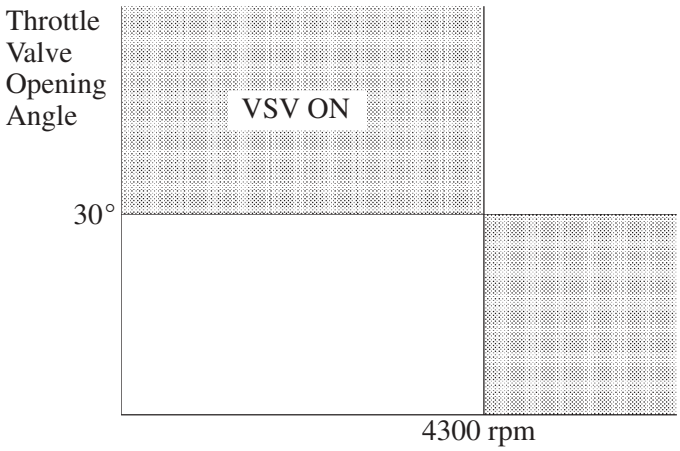
Operation

1) When the Intake Control Valve Closes (VSV ON)

The engine ECU activates the VSV to match the longer pulsation cycle so that the negative pressure acts on the actuator. This closes the control valve. As a result, the effective length of the intake manifold is lengthened and the intake efficiency in the medium speed range is improved due to the dynamic effect of the intake air, thereby increasing the power output.



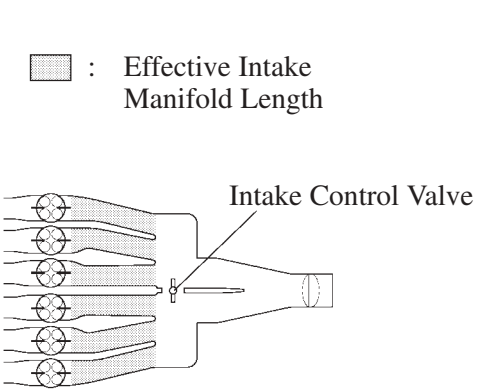
204EG36



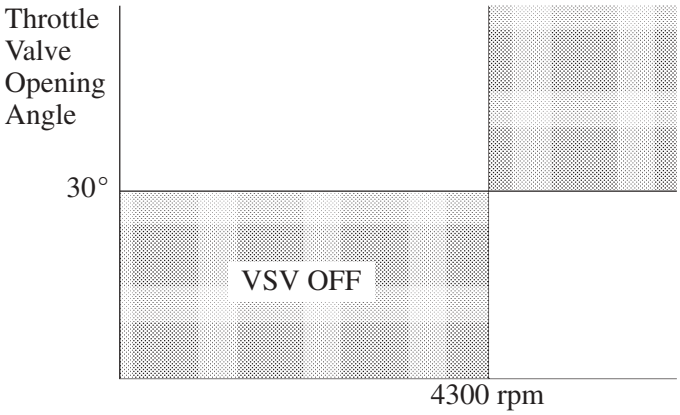
204EG38

2) When the Intake Control Valve Open (VSV OFF)

The engine ECU deactivates the VSV to match the shorter pulsation cycle so that atmospheric air is led into the actuator and opens the control valve. When the control valve is open, the effective length of the air intake chamber is shortened and peak intake efficiency is shifted to the low-to-high engine speed range, thus providing greater output at low-to-high engine speeds.



204EG37



204EG39

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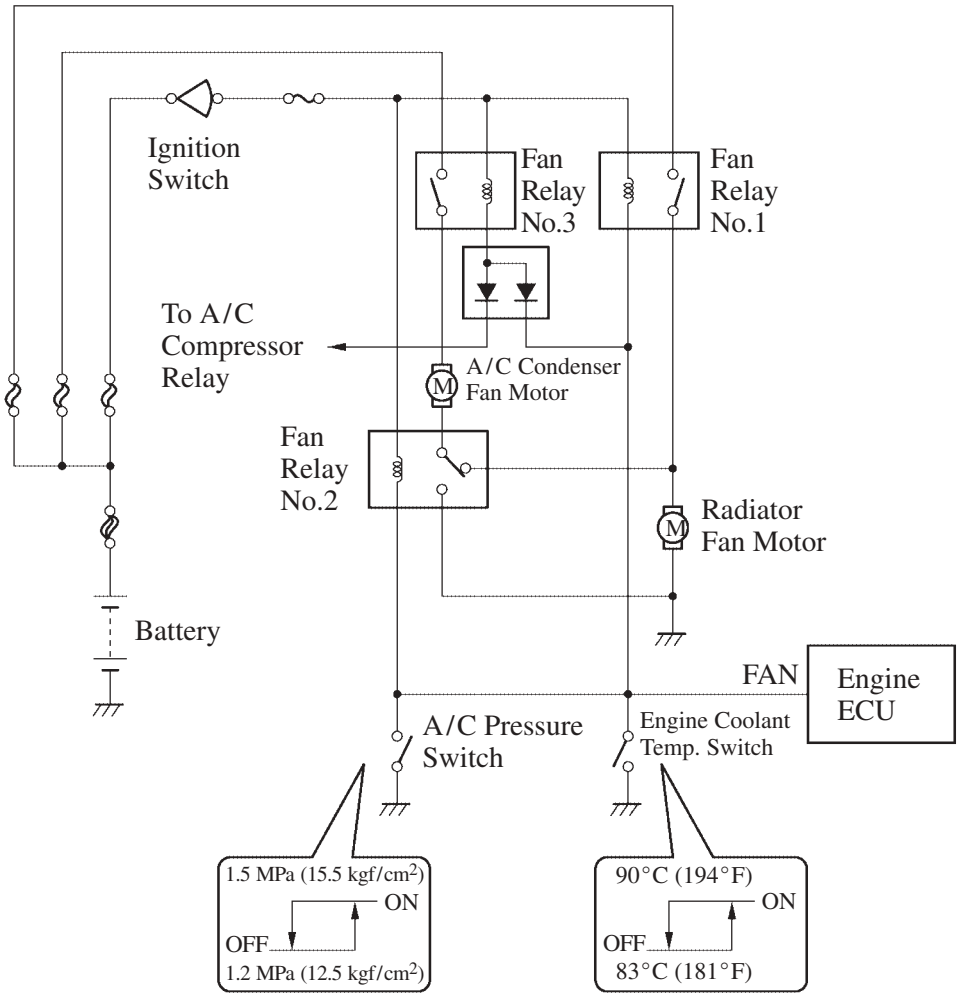
9. Cooling Fan Control

- The cooling fan controls the fan speed in 3 steps (OFF, Low, High) by using the engine coolant temperature switch in accordance with the engine coolant temperature and the operating condition of the air conditioner and by turning the 3 fan relays ON and OFF and connecting 2 fan motors in a series or parallel circuit.
- If the temperature sensor that is built into the engine ECU determines that the temperature of the engine ECU is higher than a prescribed value, the condenser fan and the radiator fan operate at high speeds to cool down the engine ECU in order to protect the engine ECU.

▶ Wiring Diagram ◀



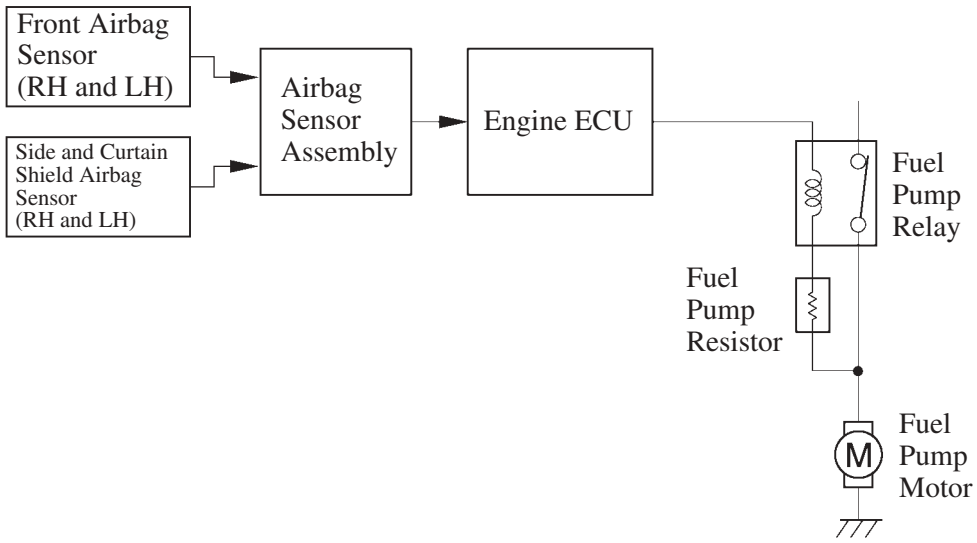
204EG48

▶ Cooling Fan Operation ◀

Air Conditioning Condition		Engine Coolant Temp.		Engine ECU Temp.
Compressor	Refrigerant Pressure	83°C (181°F) or Lower	90°C (194°F) or Higher	Higher than a prescribed value
OFF	1.2 MPa (12.5 kgf/cm^2) or Lower	OFF	High	High
ON	1.2 MPa (12.5 kgf/cm^2) or Lower	Low	High	
	1.5 MPa (15.5 kgf/cm^2) or Higher	High	High	

10. Fuel Pump Control

A fuel cut control has been adopted to stop the fuel pump when the SRS airbag is deployed, thus minimizing fuel leakage. In this system, the airbag deployment signal from the airbag sensor assembly is detected by the engine ECU, which turns OFF the circuit opening relay.
After the fuel cut control has been activated, turning the ignition switch from OFF to ON cancels the fuel cut control.



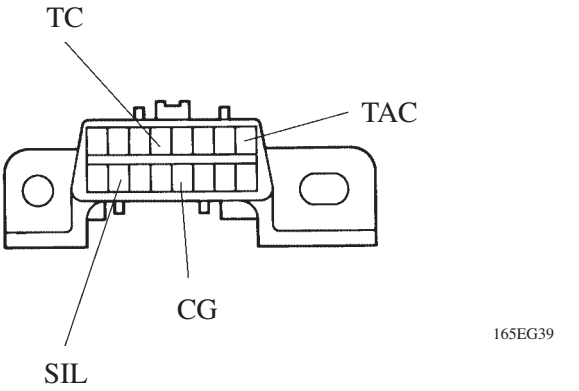
204EG43

11. Diagnosis

When the engine ECU detects a malfunction, the engine ECU makes a diagnosis and memorizes the failed section. Furthermore, the check engine warning light in the combination meter illuminates or blinks to inform the driver. The engine ECU will also store the DTCs of the malfunctions. The DTCs can be accessed the use of the hand-held tester or SST (09843-18040)*. For details, see the LEXUS IS300/200 Repair Manual Supplement (Pub. No. RM870E).

*: Only for Australian Model

- The diagnosis system of the Europe model has adopted the EURO-OBD (Europe On-Board Diagnosis) that complies with European regulations.
- The diagnosis system of the Australia model has adopted the M-OBD (Multiplex On-Board Diagnosis).

Item	EURO-OBD, M-OBD
Data Link Connector	▶ **DLC3** ◀  CG: Chassis Ground SIL: Provides communication between the engine ECU and the hand-held tester. TAC: Outputs the engine speed signal. TC: Provides the same function as the previous TE1 and Tc terminals.
Diagnostic Trouble Code Check Method	The diagnostic trouble codes can be displayed by connecting a hand-held tester to the DLC3. For Australian model, after terminals TC and CG of the DLC3 are connected, the codes are displayed on the check engine warning light in the combination meter.

Service Tip

The length of time to clear the DTC via the battery terminal has been changed from the previous 10 seconds to 1 minute.

- Furthermore, the functions listed below can be utilized by connecting the hand-held tester to the DLC3. The diagnosis system of the EURO-OBD system and M-OBD system are compared below.

Function	Details	EURO -OBD	M-BOD
Diagnostic Trouble Code	The system can output 5-digit diagnostic trouble code to the tester, which are more detailed than the previous 2-digit diagnostic trouble codes, thus making if easier to identify the location of the problem. Example: Code 28 (Oxygen Sensor) → P0130 (Oxygen Sensor) → P0135 (Oxygen Sensor Heater) However, in the EURO-OBD system, the diagnostic trouble codes that are not output by the M-OBD, such as misfires, are also output. Refer to the LEXUS IS300/200 Repair Manual Supplement (Pub. No. RM870E).	○	○
Continuous Test Results	A diagnostic trouble code may require a condition to be present for several drive cycles, while the equivalent continuous test code may be set with the first occurrence of the condition.	○	—
Freeze-Frame Data	The system can output freeze-frame data to the tester. This data (while depicts the condition of the engine control system and the vehicle) is stored in the engine ECU at the very moment when the engine ECU has detected its last data of malfunction.	○	○
Output Engine ECU Data	The engine ECU's control data can be output. Output Data Speed: 9.6 kbps	○	○
Active Test	Through the use of the tester, the actuators (VSV, fuel pump, VVT-i system, etc.) can be activated to a desired state.	○	○
Trouble Code Clear	Through the use of the tester, trouble codes that are stored in the engine ECU can be cleared.	○	○
Check Engine Warning Light Clear	If the engine ECU detects the malfunction of the vehicle, it makes the check engine warning light come on. Later, if that malfunction will not occur again, it automatically turns off the check engine warning light.	—	○
	If the engine ECU detects the malfunction of the vehicle, it makes the check engine warning light come on. Later, if the same malfunction will not occur again during 3 trips continuously, it automatically turns off the check engine warning light.	○	—

- For details on the diagnostic trouble codes, active test, etc. described above, refer to the LEXUS IS300/200 Repair Manual Supplement (Pub., No. RM870E).
- For details of the hand-held tester, refer to the Hand-Held Tester Operator's Manual.

12. Fail-Safe

General

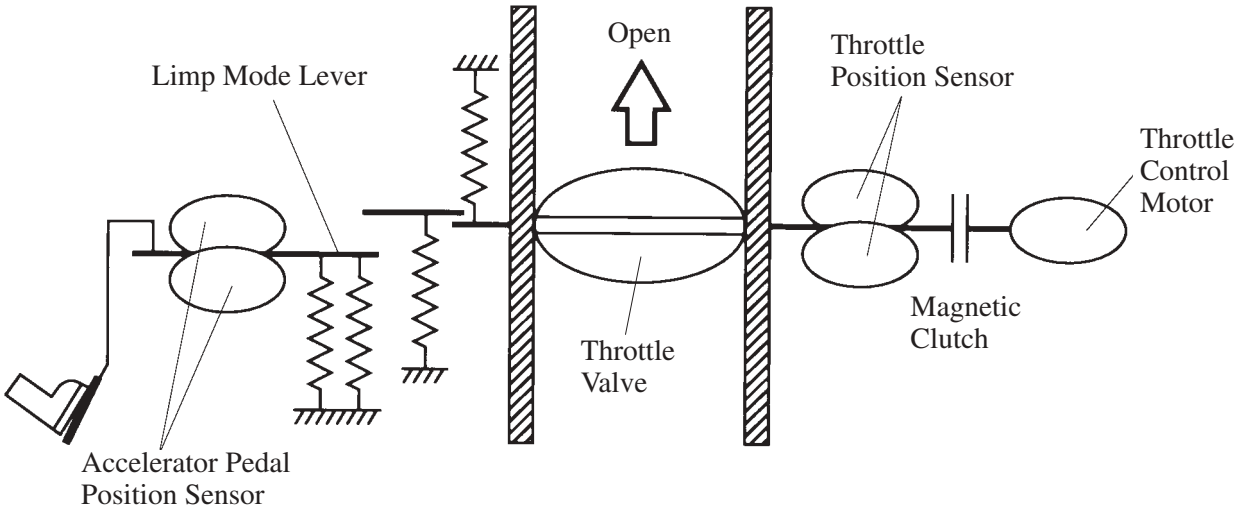
When the engine ECU detects a malfunction, the engine ECU stops or controls the engine according to the data already stored in the memory.

▶ Fail-Safe Control List ◀

Location of Malfunction	Description of Control
Air Flow Meter	In case of a signal malfunction, the engine could operate poorly or the catalyst could overheat if the engine continues to be controlled with the signals from the sensors. Therefore, the engine ECU effects control by using the values in the engine ECU or stops the engine.
Accelerator Pedal Position Sensor and Throttle Position Sensor (Refer to page 43)	In case of a signal malfunction, the engine ECU cuts off the current to the throttle control motor and magnetic clutch in order not to operate the ETCS-i. This enables the return spring to close the throttle valve.
Water Temp. Sensor and Intake Air Temp. Sensor	In case of a signal malfunction, the use of the values from the sensors will make the air-fuel ratio become too rich or too lean, which could cause the engine to stall or to run poorly during cold operation. Therefore, the engine ECU fixes the air-fuel ratio to the stoichiometric ratio and uses the constant values of 80°C engine coolant temperature and 20°C intake air temperature to perform the calculation.
Knock Sensor	In case of a malfunction in the knock sensor or in the knocking signal system (open or short circuit), the engine could become damaged if the timing is advanced despite the presence of knocking. Therefore, if a malfunction is detected in the knock sensor system, the engine ECU turns the timing retard correction of the knock sensor into the maximum retard value.
Ignition Coil (with Igniter)	In case of a malfunction in the ignition system, such as an open circuit in the ignition coil, the catalyst could become overheated due to engine misfire. Therefore, if the (IGf) ignition signal is not input twice or more in a row, the engine ECU determines that a malfunction occurred in the ignition system and stops only the injection of fuel into the cylinder with the malfunction.
Camshaft Position Sensor	In case of a signal malfunction (open or short circuit) or a mechanical malfunction, the engine ECU stops the VVT-i control.

Fail-Safe of ETCS-i

If an abnormal condition occurs with the ETCS-i, the Check Engine Lamp illuminates to alert the driver. At the same time, the current to the throttle control motor and magnetic clutch are cut off in order not to operate the ETCS-i. This enables the return spring to close the throttle valve.
Even in this situation, the accelerator pedal can be used to operate the limp mode lever, which operates the throttle valve to enable the vehicle to be driven in the limp mode.



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