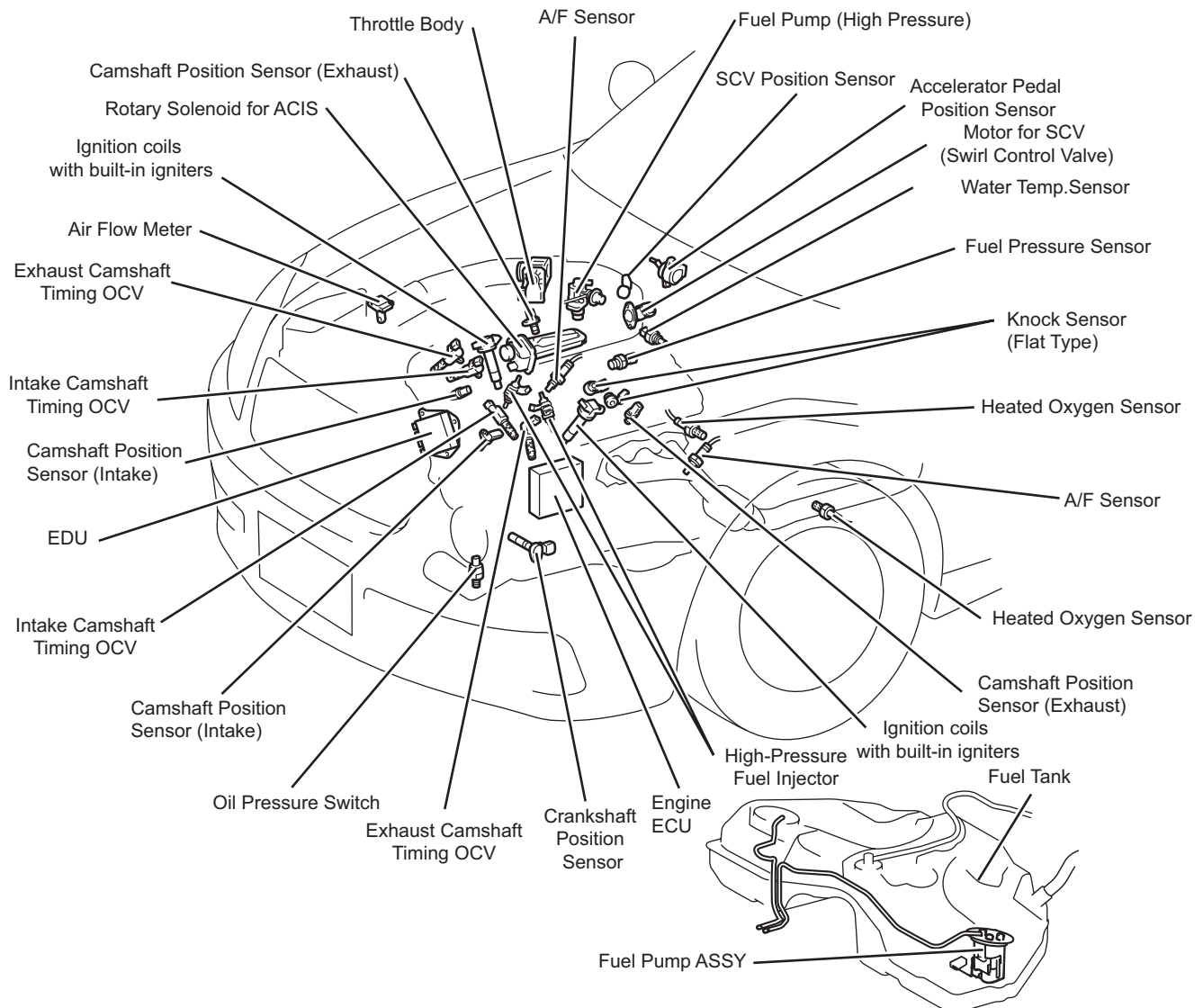


3GR-FSE ENGINE CONTROL SYSTEM

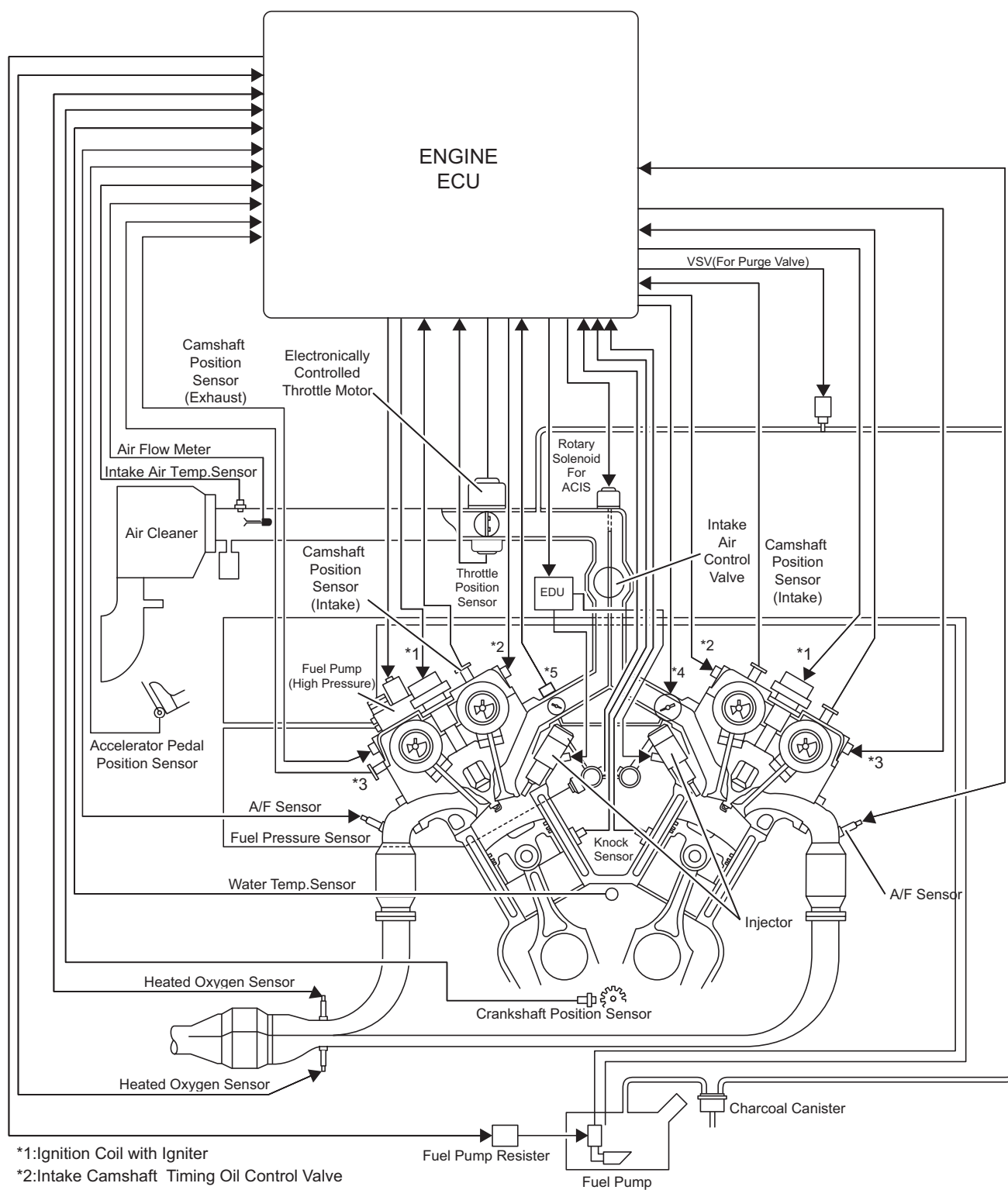
Engine Control System Description

EG

- This engine controls the following systems in a highly accurate manner: Electronic Fuel Injection (EFI), Electronic Spark Advance (ESA), Electronic Throttle Control System-intelligent (ETCS-i), and Dual Variable Valve Timing-intelligent (Dual VVT-i). As a result, high performance, high power output, fuel economy, and improved exhaust emission performance have been achieved.
- A D-4 (Direct injection 4-stroke gasoline engine) system is used. The engine ECU effects centralized control to achieve an optimal state of combustion that suits the driving conditions, in order to realize fuel economy and a high power output in the practical range.
- CAN (Controller Area Network) communication is used to exchange data with other ECUs.
- The electronic SCV (Swirl Control Valve) control stabilizes combustion when the water temperature is low, and the electronic ACIS (Acoustic Control Induction System) control generates high torque in the practical speed range.
- A diagnosis and a failsafe function are provided to ensure serviceability and safety.



Engine Control System Diagram



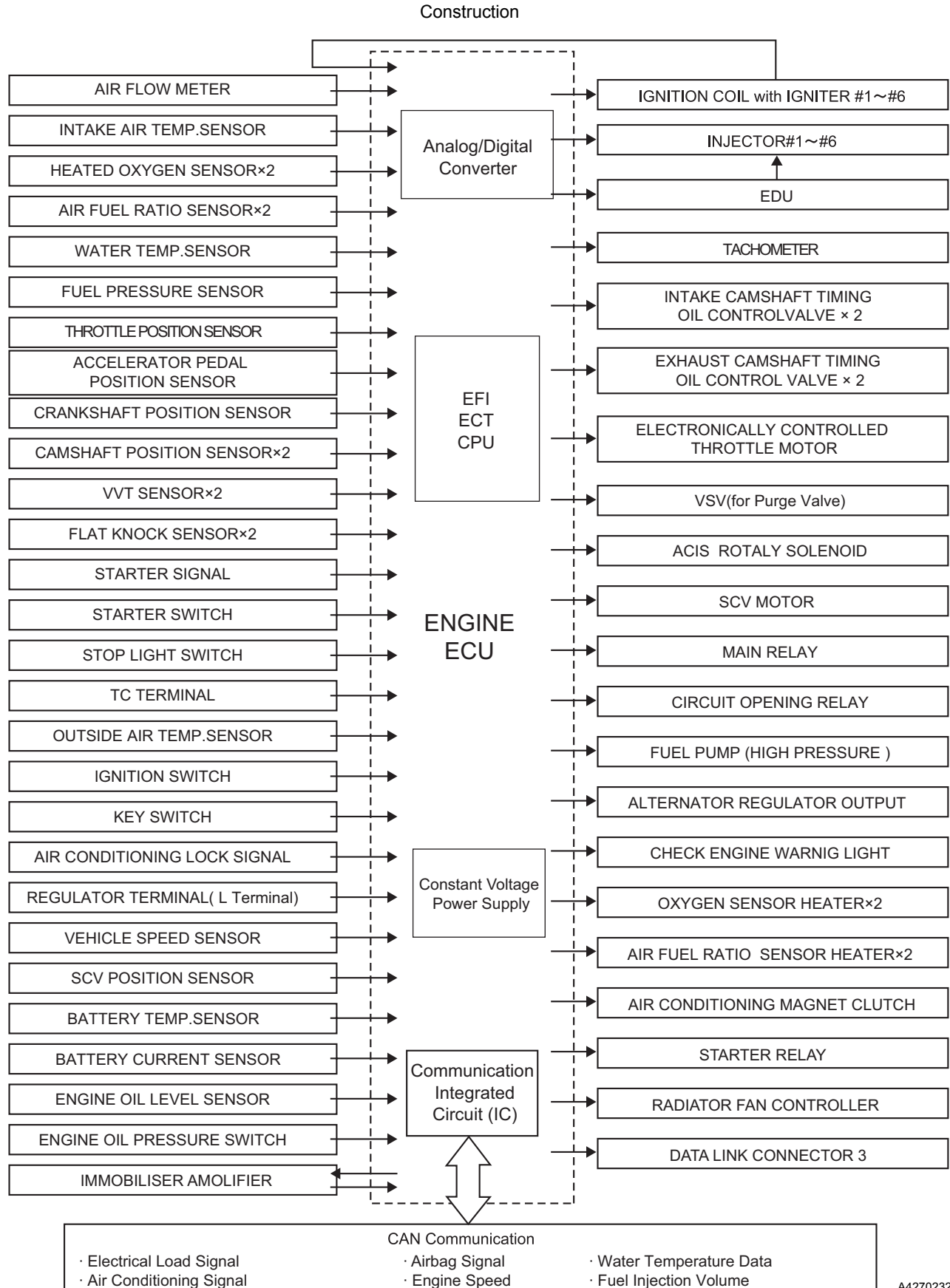
*1: Ignition Coil with Igniter

*2: Intake Camshaft Timing Oil Control Valve

*3: Exhaust Camshaft Timing Oil Control Valve

*4: SCV (Swirl Control Valve) Motor

*5: SCV Position Sensor



Control List

System	Outline	
D-4 EFI (Electronic Fuel Injection)	An L-type EFI system directly detects the intake air mass with a hot wire type mass air flow meter.	
ESA (Electronic Spark Advance)	An L-type EFI system directly detects the intake air mass with a hot wire type mass air flow meter.	
	Ignition timing is determined by the engine ECU based on signals from various sensors. Corrects ignition timing in response to engine knocking.	
	Knocking Judgment Control(KCS)	2 knock sensors are used to improve knock detection.
ETCS-i (Electronic Throttle Control System-intelligent)	Based on the signals provided by the sensors, this system applies corrections to the throttle position that has been calculated in accordance with the condition of the engine, in order to achieve an appropriate throttle position.	
	VSC Control	Controls the throttle valve position when the VSC is operating.
	Maximum Speed Control	When the vehicle speed reaches 240 km/h, this control closes the throttle valve to suppress the increase in vehicle speed.
	Idle Speed Control(ISC)	Controls the fast idle speed in accordance with the water temperature, and the idle speed after the engine has been warmed up. It controls the idle speed by regulating the fuel injection volume and the throttle position.
Dual VVT-i Control	Controls the optimal intake and exhaust valve timing in accordance with the conditions of the engine.	
SCV(Swirl Control Valve) Control	Optimally controls the air current in the combustion chamber by closing one of the independent intake ports in accordance with the water temperature and engine condition, in order to stabilize the combustion and improve performance.	
ACIS (Acoustic Control Induction System) Control	Varies the intake manifold length to suit the conditions of the engine.	
Fuel Pump Control (For High Pressure Side)	Controls the discharge pressure of the high-pressure fuel pump in accordance with the conditions of the engine.	
Fuel Pump Control	Turns the fuel pump ON/OFF in accordance with the starter signal and the engine speed signal. Stops the operation of the fuel pump in accordance with the signals from the airbag ECU.	
Alternator Charging Control	Controls the charging voltage of the alternator in accordance with the driving conditions, thus reducing the charging load and contributing to fuel economy.	
Cranking Hold Control	After the starter starts to crank the engine, this control continues to apply current to the starter until the engine starts. Thus, it prevents the failure of the engine to start when the driver inadvertently turns the ignition switch to OFF just before the engine fires.	
Air-Fuel Ratio Sensor Heater Control	Turns the air-fuel ratio sensor heater ON/OFF in accordance with the water temperature and the driving conditions.	
Heated Oxygen Sensor Heater Control	Maintains the temperature of the heated oxygen sensor at an appropriate level to increase accuracy of detection of the oxygen concentration in the exhaust gas.	
Evaporative Emission Control	The engine ECU controls the purge flow of evaporative emissions (HC) in the charcoal canister in accordance with engine conditions.	

System	Outline
Air ConditioningCut-Off Control	By controlling the air conditioning compressor ON or OFF in accordance with the engine condition, drivability is maintained.
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 meter ECU, A/C ECU, etc., on the body side, to input/output necessary signals.
Diagnosis	Enables the accurate and detailed diagnosis of malfunctions through the use of the intelligent Tester II diagnostic tool to access the SAE-prescribed DTC (Diagnostic Trouble Code) and data, as well as to perform active tests.
Fail-Safe	When the engine ECU detects a malfunction, the engine ECU stops or controls the engine according to the data already stored in the memory.

■ Service Tip ■

The uses the CAN protocol for diagnostic communication. Therefore, a intelligent Tester II and a dedicated adapter [CAN VIM (Vehicle Interface Module)] are required for accessing diagnostic data. For details, see the 2005 Lexus GS430/300 Repair Manual(Pub. No. RM1168E)

Sensor List

Name	Function and Construction	EFI	ES A	ISC	VVT-i
Air Flow Meter	Detects the intake air volume.	○	○	○	○
Intake Air Temperature Sensor	Detects the intake air temperature.	○	○	○	○
Camshaft Position Sensor	Identifies the cylinder and detects the actual camshaft position.	○	○	○	○
Crankshaft Position Sensor	Detects the crankshaft position.	○	○	○	○
Accelerator Pedal Position Sensor	It is attached to the accelerator pedal to detect the accelerator pedal position.	○	○	○	○
Throttle Position Sensor	Detects the throttle valve position.	○	○	○	○
SCV Position Sensor	Detects the SCV position.				
Water Temp.Sensor	Detects the water Ftemperature.	○	○	○	○
Fuel Pressure Sensor	It is mounted on the fuel delivery pipe to detect fuel pressure.	○			
Air-Fuel Ratio Sensor	Detects the state of the air-fuel ratio in the exhaust gas.	○			
Heated Oxygen Sensor	Detects the oxygen concentration in the exhaust gas.	○			
Igniter	Sends the ignition verification signal.		○		
Starter Signal	Sends the starter voltage in the form of a signal when the engine is started.	○	○	○	○
Neutral Start Switch	Detects the P, N, and D positions of the automatic transmission.	○	○	○	○
Knock Sensor	Detects the knocking of the engine by way of the resonance of the piezoelectric element.		○		

Name	Function and Construction	EFI	ESA	ISC	VVT-i
Vehicle Speed Signal	Detects vehicle speed.	○	○	○	○

Actuator List

Name	Function and Construction
Main Relay	Supplies main power to the EFI, ESA system, etc.
Circuit Opening Relay	Supplies power to the fuel pump system.
High-Pressure Fuel Pump	Pressurizes fuel.
Fuel Injector	Injects an optimal volume of fuel at an optimal timing.
Air-Fuel Ratio Sensor Heater	Heats the air-fuel ratio sensor to promote feedback control when the engine is cold.
Heated Oxygen Sensor Heater	Heats the heated oxygen sensor to promote feedback control when the engine is cold.
Igniter	Turns the current to the ignition coil ON/OFF at an optimal timing.
Electronically Controlled Throttle Motor	Controls the position of the throttle valve in accordance with driving conditions.
Intake Camshaft Timing OCV	Controls the intake VVT-i at an optimal valve timing.
Exhaust Camshaft Timing OCV	Controls the exhaust VVT-i at an optimal valve timing.
Rotary Solenoid for ACIS	Opens and closes the intake air control valve in accordance with driving conditions.
Motor for SCV (Swirl Control Valve)	Opens and closes the swirl control valve in accordance with driving conditions.
Evaporative Purging VSV	Regulates the purge volume of the canister.
EDU(Electronic Driver Unit)	Converts the injection request signal from the engine ECU into a high voltage, high amperage injector actuation signal in order to actuate the high-pressure fuel injector.