

DTC	P0010	Camshaft Position "A" Actuator Circuit (Bank 1)
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DTC	P0020	Camshaft Position "A" Actuator Circuit (Bank 2)
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HINT:

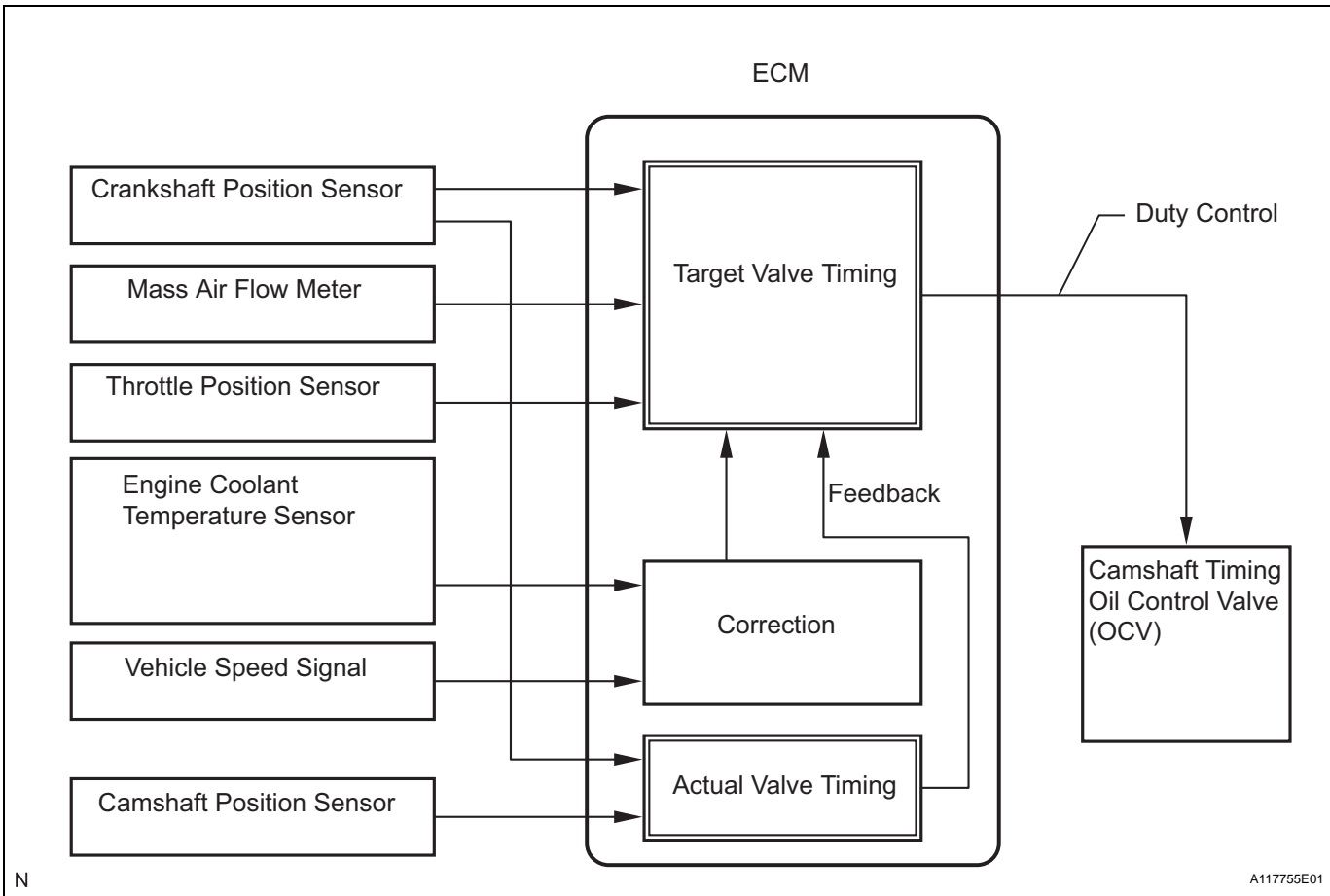
This DTC relates to the Oil Control Valve (OCV).

DESCRIPTION

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The Variable Valve Timing (VVT) system includes the ECM, OCV and VVT controller. The ECM sends a target duty-cycle control signal to the OCV. This control signal regulates the oil pressure supplied to the VVT controller. Camshaft timing control is performed according to engine operating conditions such as the intake air volume, throttle valve position and engine coolant temperature.

The ECM controls the OCV, based on the signals transmitted by several sensors. The VVT controller regulates the intake camshaft angle using oil pressure through the OCV. As a result, the relative positions of the camshaft and crankshaft are optimized, the engine torque and fuel economy improve, and the exhaust emissions decrease under overall driving conditions. The ECM detects the actual intake valve timing using signals from the camshaft and crankshaft position sensors, and performs feedback control. This is how the target intake valve timing is verified by the ECM.



DTC No.	DTC Detection Conditions	Trouble Areas
P0010	Open or short in OCV (bank 1) circuit (1 trip detection logic)	<ul style="list-style-type: none"> Open or short in OCV (bank 1) circuit OCV (bank 1) ECM

DTC No.	DTC Detection Conditions	Trouble Areas
P0020	Open or short in OCV (bank 2) circuit (1 trip detection logic)	<ul style="list-style-type: none"> • Open or short in OCV (bank 2) circuit • OCV (bank 2) • ECM

MONITOR DESCRIPTION

The ECM optimizes the valve timing using the VVT system to control the intake camshaft. The VVT system includes the ECM, the OCV and the VVT controller. The ECM sends a target duty-cycle control signal to the OCV. This control signal regulates the oil pressure supplied to the VVT controller. The VVT controller can advance or retard the intake camshaft.

After the ECM sends the target duty-cycle signal to the OCV, the ECM monitors the OCV current to establish an actual duty-cycle. The ECM determines the existence of a malfunction and sets the DTC when the actual duty-cycle ratio varies from the target duty-cycle ratio.

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MONITOR STRATEGY

Related DTCs	P0010: VVT OCV (bank 1) open/short P0020: VVT OCV (bank 2) open/short
Required Sensors/Components (Main)	VVT OCV (Variable Valve Timing Oil Control Valve)
Required Sensors/Components (Related)	-
Frequency of Operation	Continuous
Duration	1 second
MIL Operation	Immediate
Sequence of Operation	None

TYPICAL ENABLING CONDITIONS

Monitor runs whenever following DTCs not present	None
All of the following conditions are met	-
Ignition switch	ON
Starter	OFF
Time after ignition switch OFF to ON	0.5 seconds or more

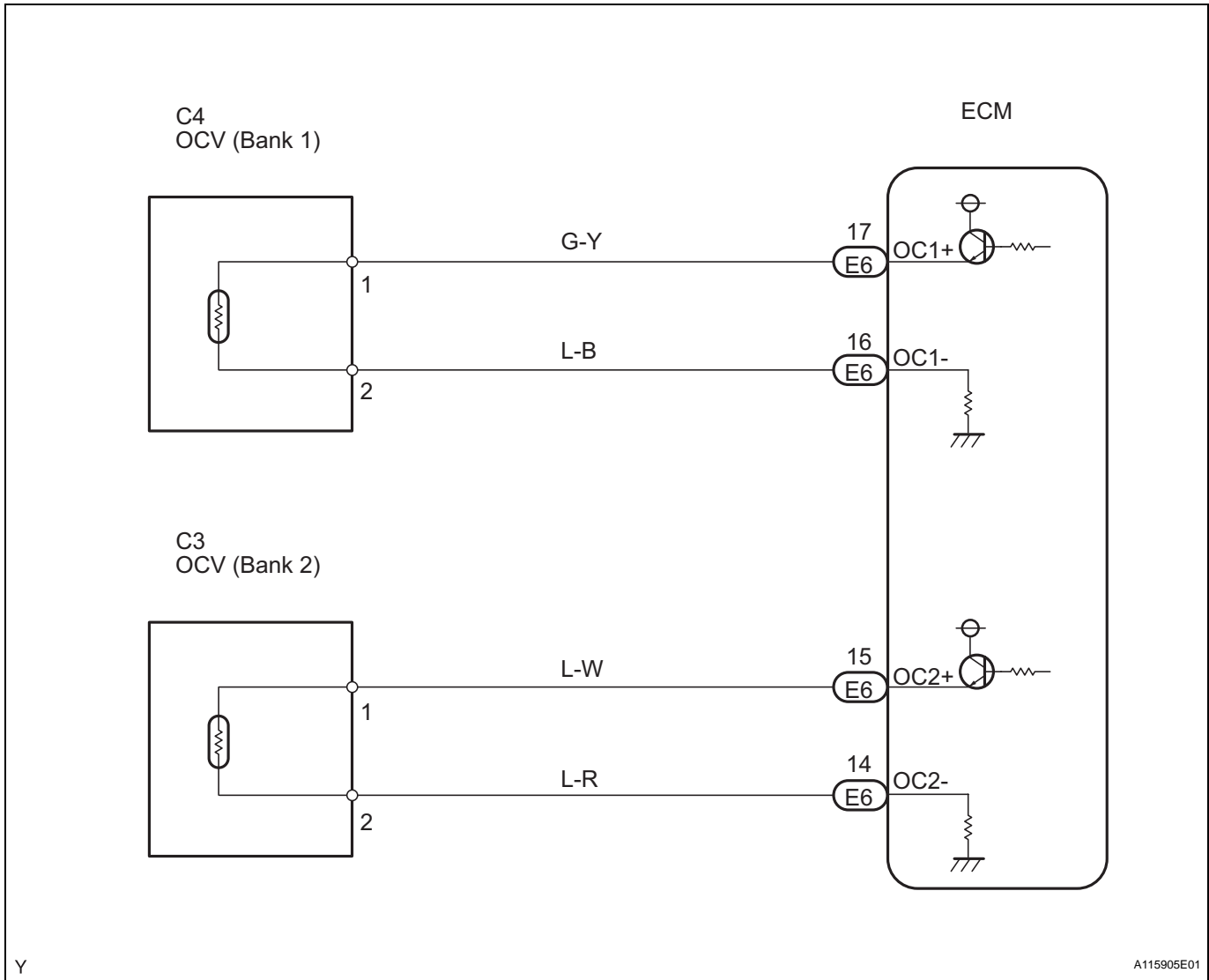
TYPICAL MALFUNCTION THRESHOLDS

One of the following conditions is met	-
A. All of the following conditions are met	-
a. Battery voltage	11 V or more, and less than 13 V
b. Target duty ratio	Less than 70 %
c. Output signal duty ratio	100 % or more
B. All of the following conditions are met	-
a. Battery voltage	13 V or more
b. Target duty ratio	Less than 80 %
c. Output signal duty ratio	100 % or more
C. All of the following conditions are met	-
a. Current cut status	Not cut
b. Output signal duty ratio	3 % or less

COMPONENT OPERATING RANGE

VVT OCV duty ratio	More than 3 %, and Less than 100 %
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WIRING DIAGRAM



HINT:

- If DTC P0010 is displayed, check the bank 1 VVT system circuit.
- Bank 1 refers to the bank that include cylinder No. 1.
- If DTC P0020 is displayed, check the bank 2 VVT system circuit.
- Bank 2 refers to the bank that does not includes cylinder No. 1.
- Read freeze frame data using an intelligent tester. Freeze frame data record the engine condition when malfunctions are detected. When troubleshooting, freeze frame data can help determine if the vehicle was moving or stationary, if the engine was warmed up or not, if the air-fuel ratio was lean or rich, and other data, from the time the malfunction occurred.

1

PERFORM ACTIVE TEST USING INTELLIGENT TESTER (OPERATE OCV)

- Connect an intelligent tester to the DLC3.
- Start the engine and turn the tester ON.
- Warm up the engine.
- Select the following menu items: DIAGNOSIS / ENHANCED OBD II / ACTIVE TEST / VVT CTRL B1 or VVT CTRL B2.

- (e) Check the engine speed while operating the Oil Control Valve (OCV) using the tester.

OK

Tester Operations	Specified Conditions
OCV OFF	Normal engine speed
OCV ON	Engine idles roughly or stalls (soon after OCV switched from OFF to ON)

OK → CHECK FOR INTERMITTENT PROBLEMS

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2 INSPECT CAMSHAFT TIMING OIL CONTROL VALVE ASSEMBLY (OCV SIGNAL)

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Wire Harness Side:

OCV Connector

(C4) Bank 1

(C3) Bank 2

1 2

Front View

OCV Signal Waveform

5 V/ Division

1 msec./Division

GND

A094633E31

- (a) Disconnect the C4 or C3 OCV connector.
- (b) While idling, check the waveform between the terminals of the C4 or C3 OCV connector using an oscilloscope.

Standard

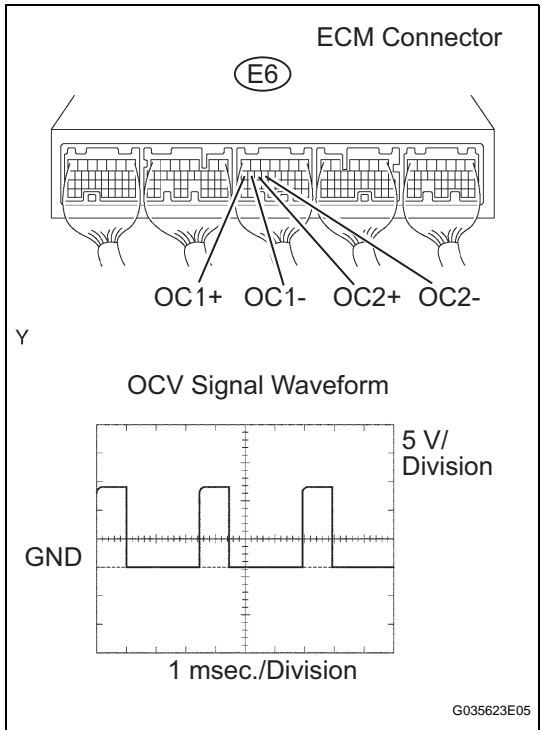
Tester Connections	Specified Conditions
+ (C4-1) -- (C4-2)	Correct waveform shown
+ (C3-1) -- (C3-2)	

- (c) Reconnect the OCV connector.

OK → REPLACE CAMSHAFT TIMING OIL CONTROL VALVE ASSEMBLY

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3 INSPECT ECM (OCV SIGNAL)



- (a) Inspect the ECM using an oscilloscope.
- (b) While idling, check the waveform between the terminals of the E6 ECM connector.

Standard

Tester Connections	Specified Conditions
OC1+ (E6-17) - OC1- (E6-16)	Correct waveform as shown in illustration
OC2+ (E6-15) - OC2- (E6-14)	

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NG → **REPLACE ECM**

OK

REPAIR OR REPLACE HARNESS OR CONNECTOR