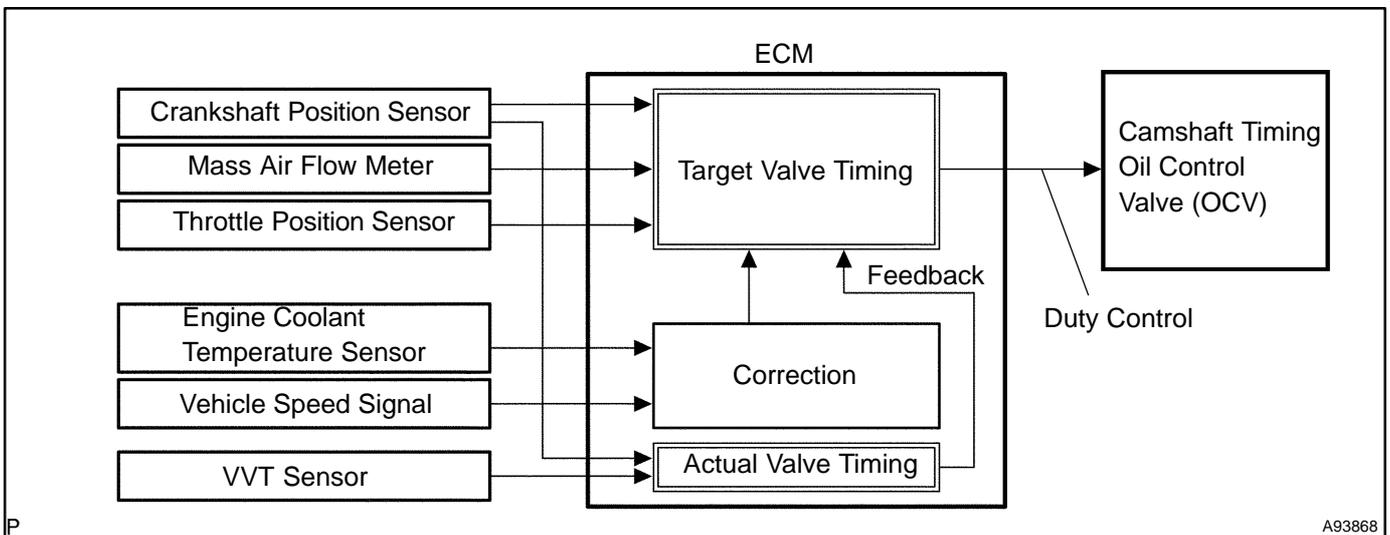


DTC	P0010	CAMSHAFT POSITION "A" ACTUATOR CIRCUIT (BANK 1)
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CIRCUIT DESCRIPTION

The Variable Valve Timing (VVT) system includes the ECM, the Oil Control Valve (OCV) and the VVT controller. The ECM sends a target "duty-cycle" control signal to the OCV. This control signal, applied to the OCV, regulates the oil pressure supplied to the VVT controller. Camshaft timing control is performed based on engine operation condition such as intake air volume, throttle position and engine coolant temperature. The ECM controls the OCV based on the signals from several sensors. The VVT controller regulates the intake camshaft angle using oil pressure through the OCV. As result, the relative position between the camshaft and the crankshaft is optimized, the engine torque and fuel economy improve, and exhaust emissions decrease. The ECM detects the actual valve timing using signals from the camshaft position sensor and the crankshaft position sensor. The ECM performs feedback control and verifies target valve timing.



DTC No.	DTC Detection Condition	Trouble Area
P0010	Open or short in oil control valve circuit	<ul style="list-style-type: none"> • Open or short in oil control valve circuit • Oil control valve • ECM

MONITOR DESCRIPTION

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 detects malfunction and sets a DTC when the actual duty-cycle ratio varies from the target duty-cycle ratio.

MONITOR STRATEGY

Related DTCs	P0010: VVT oil control valve range check
Required sensors/components	OCV
Frequency of operation	Continuous
Duration	1 second
MIL operation	Immediately
Sequence of operation	None

TYPICAL ENABLING CONDITIONS

The monitor will run whenever the following DTCs are not present	See page 05-20
Battery voltage	11 V or more, and less than 13 V
Target duty ratio	less than 70 %
Starter	OFF
Current cut status	Not cut

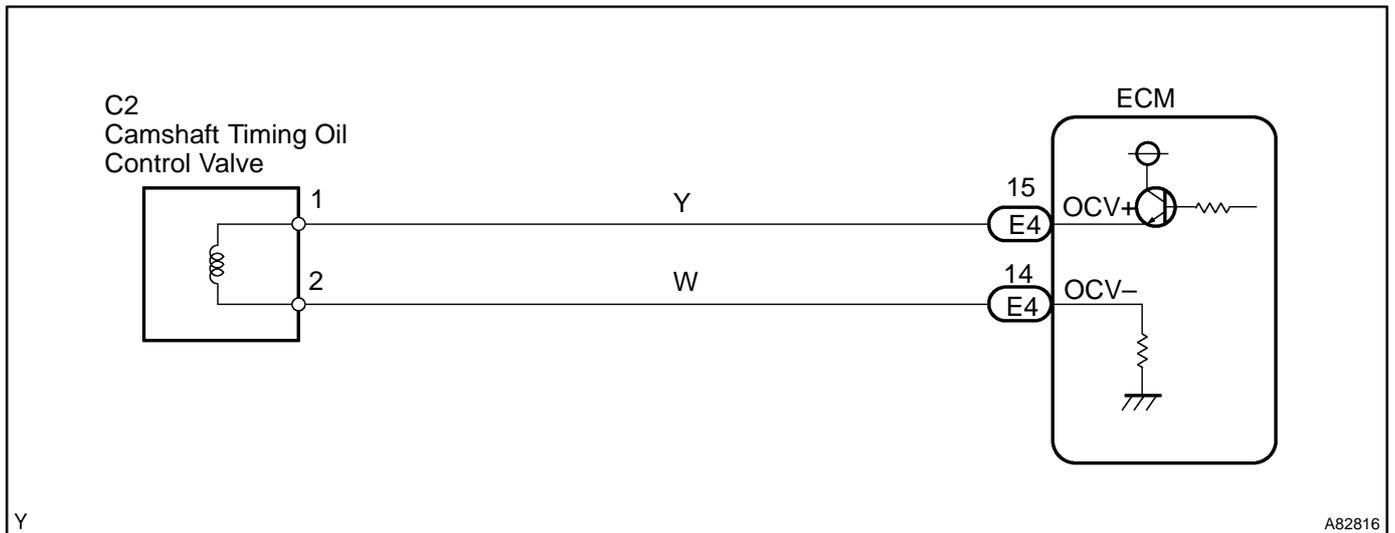
TYPICAL MALFUNCTION THRESHOLDS

Output signal duty for OCV	Output duty is 3 % or less despite the ECM supplying the current to the OCV or Output duty is 100 %
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COMPONENT OPERATING RANGE

Output signal duty for OCV	More than 3 % and less than 100 %
----------------------------	-----------------------------------

WIRING DIAGRAM



Y

A82816

INSPECTION PROCEDURE

HINT:

Read freeze frame data using the hand-held tester or the OBD II scan tool. Freeze frame data records the engine condition when malfunction is detected. When troubleshooting, freeze frame data can help determine if the vehicle was running or stopped, 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.

Hand-held tester:

1	PERFORM ACTIVE TEST BY HAND-HELD TESTER(OPERATE OCV)
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- (a) Connect the hand-held tester to the DLC3.
- (b) Turn the power switch ON (IG).
- (c) Turn the hand-held tester ON.
- (d) Put the engine in inspection mode (see page 05-1).
- (e) Start the engine and warm it up.
- (f) Select the item: DIAGNOSIS / ENHANCED OBD II / ENGINE AND ECT / ACTIVE TEST / VVT CTRL B1.
- (g) Using the hand-held tester, operate the OCV and check the engine speed.

Standard:

Tester Operation	Specified Condition
OCV is OFF	Normal engine speed
OCV is ON	Rough idle or engine stall

NOTICE:

Do not drive the vehicle without deactivating inspection mode, otherwise damaging the transaxle may result.

OK	CHECK FOR INTERMITTENT PROBLEMS (See page 05-17)
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NG

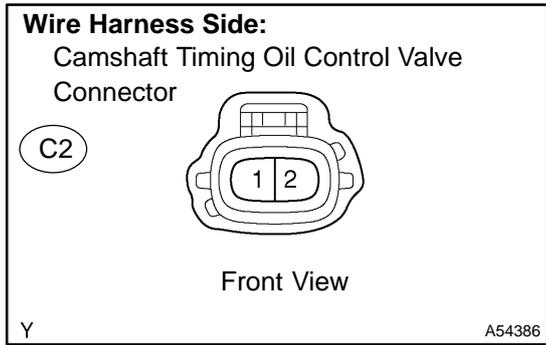
2	INSPECT CAMSHAFT TIMING OIL CONTROL VALVE ASSY(OCV) (See page 10-5)
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OK: OCV has no contamination and moves smoothly.

NG	REPLACE CAMSHAFT TIMING OIL CONTROL VALVE ASSY
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OK

3 CHECK HARNESS AND CONNECTOR(CAMSHAFT TIMING OIL CONTROL VALVE (OCV) – ECM)



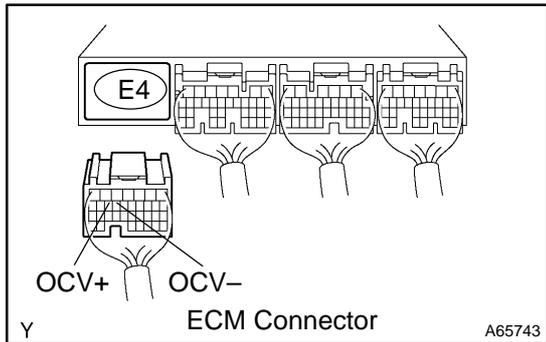
- (a) Disconnect the C2 camshaft timing oil control valve connector.
- (b) Disconnect the E4 ECM connector.
- (c) Check the resistance between the wire harness side connectors.

Standard (Check for open):

Tester Connection	Specified Condition
Oil control valve (C2-1) – OCV+ (E4-15)	Below 1 Ω
Oil control valve (C2-2) – OCV- (E4-14)	Below 1 Ω

Standard (Check for short):

Tester Connection	Specified Condition
Oil control valve (C2-1) or OCV+ (E4-15) – Body ground	10 kΩ or higher
Oil control valve (C2-2) or OCV- (E4-14) – Body ground	10 kΩ or higher

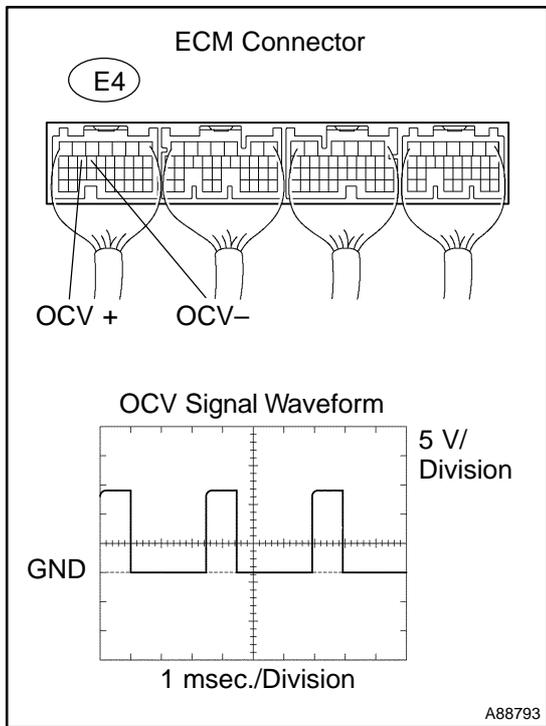


- (d) Reconnect the camshaft timing oil control valve connector.
- (e) Reconnect the ECM connector.

NG → **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK

4 INSPECT ECM(OCV SIGNAL)



- (a) Put the engine in inspection mode.
- (b) Start the engine and warm it up.
- (c) During idling, check the waveform between the specified terminals of the E4 ECM connector using an oscilloscope.

Standard:

Tester Connection	Specified Condition
OCV+ (E4-15) – OCV- (E4-14)	Correct waveform is as shown

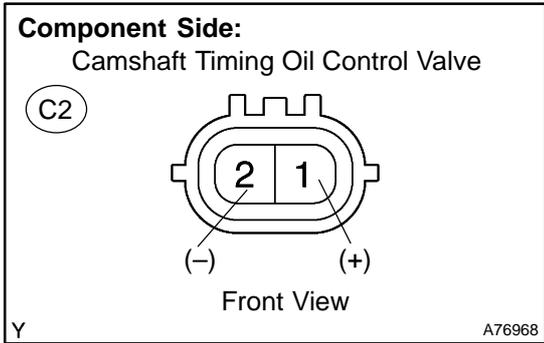
NG → **REPLACE ECM (See page 10-24)**

OK

CHECK FOR INTERMITTENT PROBLEMS (See page 05-17)

OBDII scan tool (excluding hand-held tester):

1 INSPECT CAMSHAFT TIMING OIL CONTROL VALVE ASSY(OPERATE OCV)



- (a) Disconnect the C2 camshaft timing oil control valve connector.
- (b) Put the engine in inspection mode (see page 05-1).
- (c) Apply positive battery voltage between the terminals of the camshaft timing oil control valve.
- (d) Check the engine speed.

OK:
Engine speed is rough idle or engine stalls.

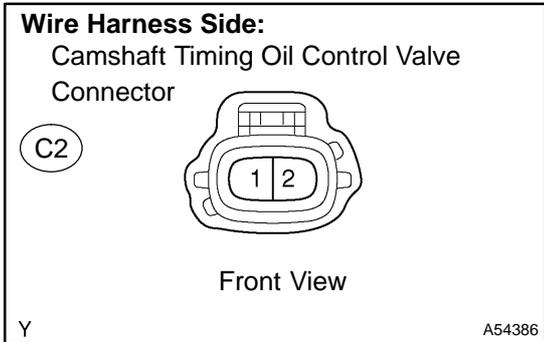
- (e) Reconnect the camshaft timing oil control valve connector.

NOTICE:
Do not drive the vehicle without deactivating inspection mode, otherwise damaging the transaxle may result.

NG → **REPLACE CAMSHAFT TIMING OIL CONTROL VALVE ASSY**

OK

2 CHECK HARNESS AND CONNECTOR(CAMSHAFT TIMING OIL CONTROL VALVE (OCV) – ECM)



- (a) Disconnect the C2 camshaft timing oil control valve connector.
- (b) Disconnect the E4 ECM connector.
- (c) Check the resistance between the wire harness side connectors.

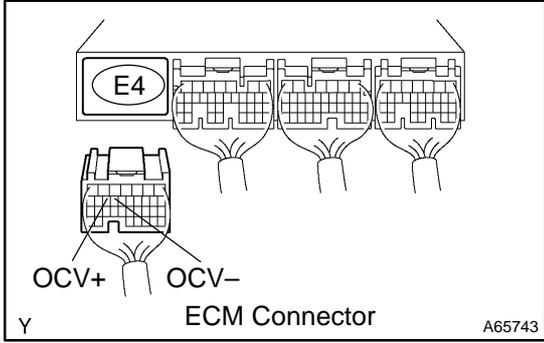
Standard (Check for open):

Tester Connection	Specified Condition
Oil control valve (C2-1) – OCV+ (E4-15)	Below 1 Ω
Oil control valve (C2-2) – OCV- (E4-14)	Below 1 Ω

Standard (Check for short):

Tester Connection	Specified Condition
Oil control valve (C2-1) or OCV+ (E4-15) – Body ground	10 kΩ or higher
Oil control valve (C2-2) or OCV- (E4-14) – Body ground	10 kΩ or higher

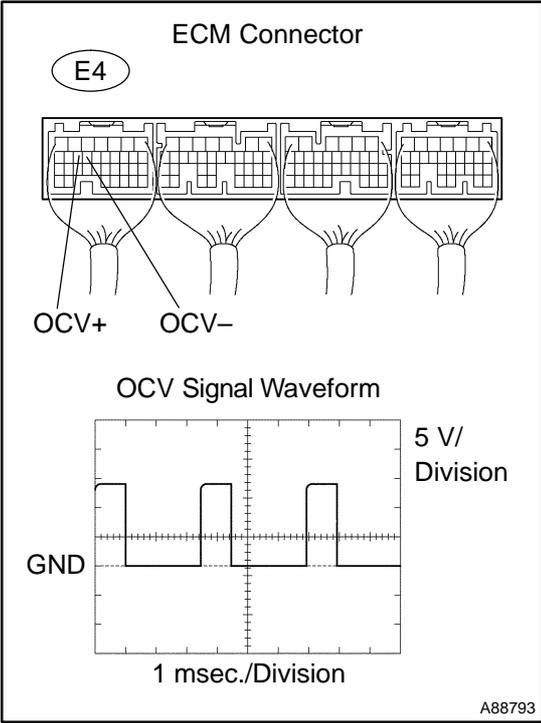
- (d) Reconnect the camshaft timing oil control valve connector.
- (e) Reconnect the ECM connector.



NG → **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK

3 INSPECT ECM(OCV SIGNAL)



- (a) Put the engine in inspection mode.
- (b) Start the engine and warm it up.
- (c) During idling, check the waveform between the specified terminals of the E4 ECM connector using an oscilloscope.

Standard:

Tester Connection	Specified Condition
OCV+ (E4-15) - OCV- (E4-14)	Correct waveform is as shown

NG → **REPLACE ECM (See page 10-24)**

OK

CHECK FOR INTERMITTENT PROBLEMS (See page 05-17)