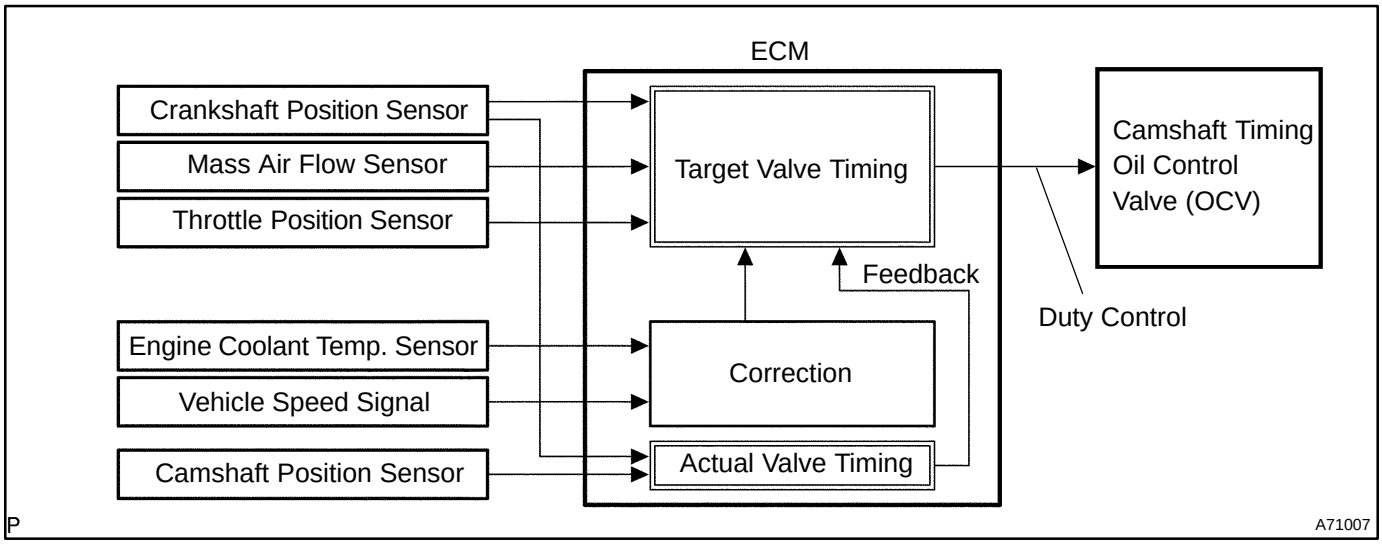
DTC	P0010	CAMSHAFT POSITION ”A” ACTUATOR CIRCUIT (BANK 1)

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 conditions such as the intake air volume, throttle position and engine coolant temperature. The ECM controls the OCV, based on the signals output from the 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, and the engine torque improves, fuel economy improves, and exhaust emissions decrease under overall driving conditions. Also, the ECM detects the actual valve timing using signals from the camshaft position sensor and the crankshaft position sensor, and performs the feedback control. This is how target valve timing is verified by the ECM.



DTC No.	DTC Detection Condition	Trouble Area
P0010	Open or short in oil control valve circuit	• 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 a 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 bank 1 range check
Required sensors/components	OCV	
Frequency of operation	Continuous	
Duration	1 seconds	
MIL operation	Immediately	
Sequence of operation	None	

TYPICAL ENABLING CONDITIONS

Item	Specification	
	Minimum	Maximum
The monitor will run whenever the following DTCs are not present	See ”List of Disable a Monitor” (On page 05–25)	
Battery voltage	11 V	13 V
Target duty ratio	–	70 %
Starter	OFF	
Current cut status	Not cut	

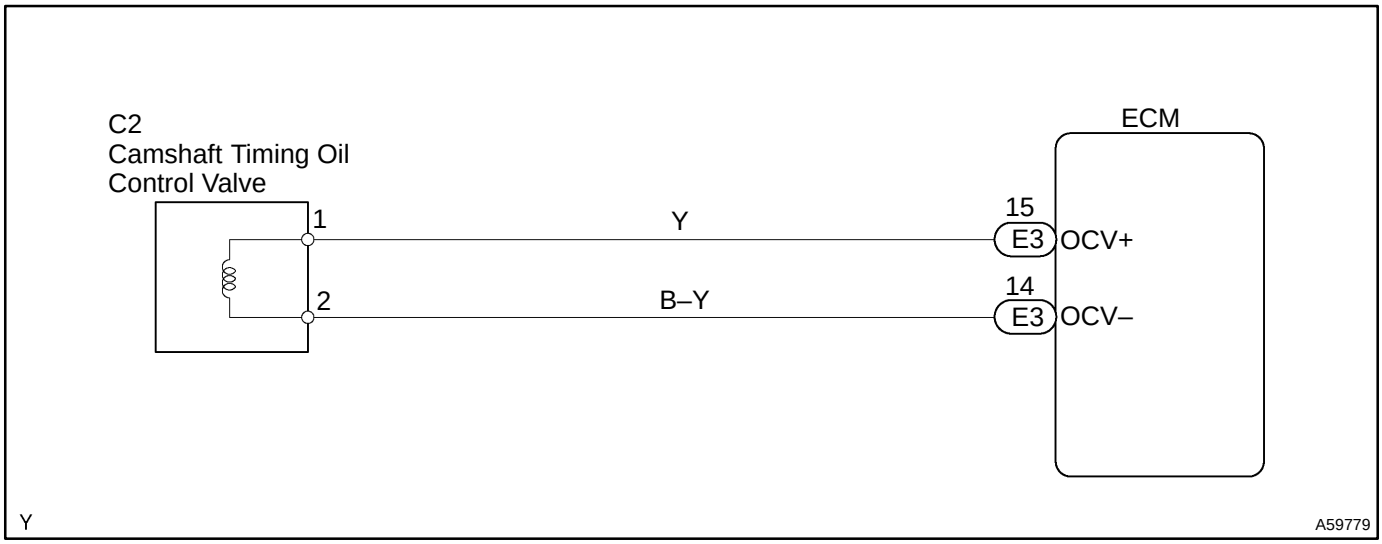
TYPICAL MALFUNCTION THRESHOLDS

Detection Criteria	Threshold
One of the following condition is met:	(a) or (b)
(a) Output signal duty for OCV	Output duty ratio is 100 % (always ON) despite the target duty ratio is less than 70 %
(b) Output signal duty for OCV	Output duty is 3 % or less despite the ECM supplying the current to the OCV

COMPONENT OPERATING RANGE

Parameter	Standard Value
Output signal duty for OCV	Between 3 % and 100 %

WIRING DIAGRAM



INSPECTION PROCEDURE

HINT:

Read freeze frame data using the hand–held tester or the OBD II scan tool. Freeze frame data records the engine conditions when a malfunction is detected. When troubleshooting, it is useful for determining whether the vehicle was running or stopped, the engine was warmed up or not, the air–fuel ratio was lean or rich, etc. at the time of the malfunction.

Hand–held tester:

1	**PERFORM ACTIVE TEST BY HAND–HELD TESTER(OPERATE OCV)**

(a) Connect the hand–held tester to the DLC3.
(b) Start the engine and warm it up.
(c) Turn the ignition switch ON and push the hand–held tester main switch ON.
(d) Select the item ”DIAGNOSIS / ENHANCED OBD II / ACTIVE TEST / VVT CTRL B1”.
(e) Check the engine speed when operating the Oil control valve (OCV) by the hand–held tester.
Standard:

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

OK → **CHECK FOR INTERMITTENT PROBLEMS (See page 05–41)**

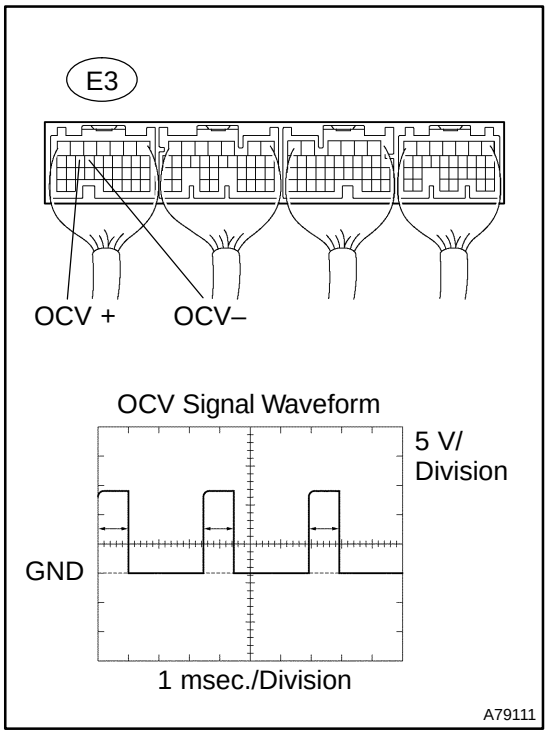
NG

2	**INSPECT CAMSHAFT TIMING OIL CONTROL VALVE ASSY(OCV) (See page 10–2)**

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

OK

3 INSPECT ECM(OCV SIGNAL)



(a) Inspection using the oscilloscope.
(b) During idling, check the waveform between the terminals of the E3 ECM connector.

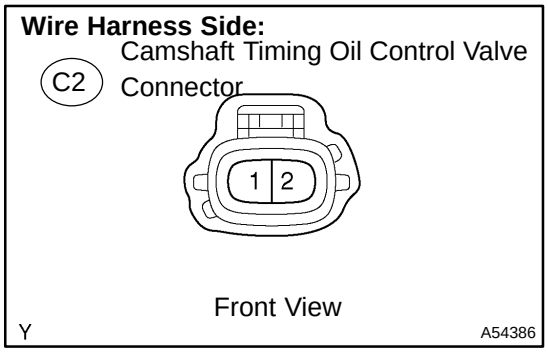
Standard:

Tester Connection	Specified Condition
OCV+ (E3–15) – OCV– (E3–14)	Correct waveform is as shown

NG → **REPLACE ECM (See page 10–11)**

OK

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



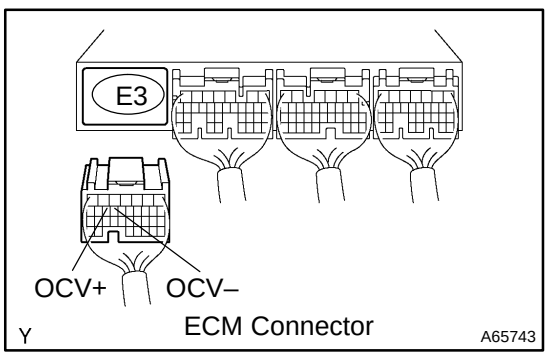
(a) Disconnect the C2 camshaft timing oil control valve connector.
(b) Disconnect the E3 ECM connector.
(c) Check the resistance between the wire harness side connectors.

Standard (Check for open):

Tester Connection	Specified Condition
Oil control valve (C2–1) – OCV+ (E3–15)	Below 1 Ω
Oil control valve (C2–2) – OCV– (E3–14)	

Standard (Check for short):

Tester Connection	Specified Condition
Oil control valve (C2–1) or OCV+ (E3–15) – Body ground	10 kΩ or higher
Oil control valve (C2–2) or OCV– (E3–14) – Body ground	



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

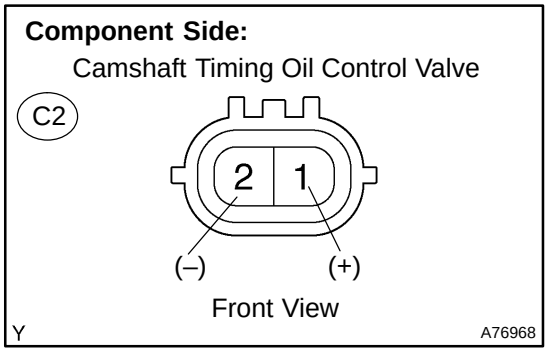
NG → **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK

CHECK FOR INTERMITTENT PROBLEMS (See page 05–41)

OBDII scan tool (excluding hand–held tester):

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

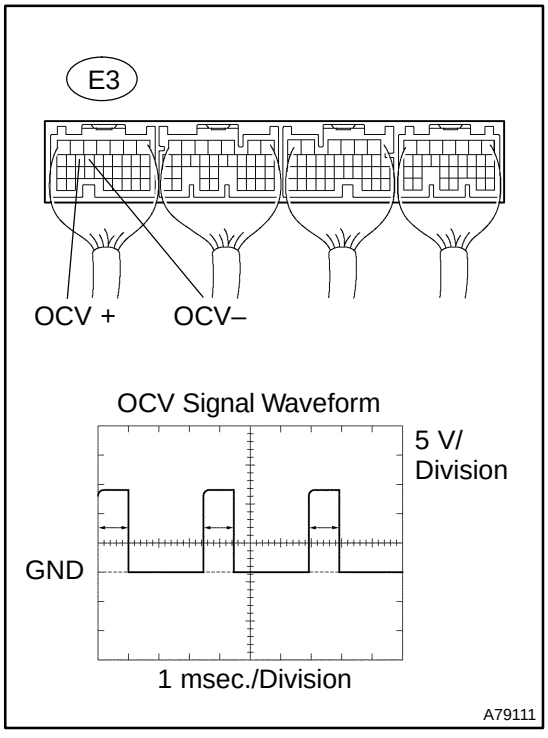


(a) Disconnect the C2 camshaft timing oil control valve connector.
(b) Apply positive battery voltage between the terminals of the camshaft timing oil control valve.
(c) Check the engine speed.
Standard:
Engine speed is rough idle or engine is stalled.
(d) Reconnect the camshaft timing oil control valve connector.

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

OK

2	INSPECT ECM(OCV SIGNAL)



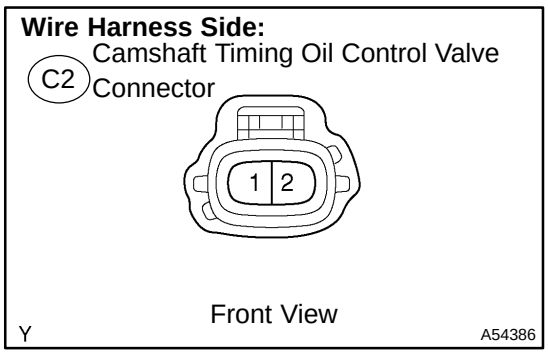
(a) Inspection using the oscilloscope.
(b) During idling, check the waveform between the terminals of the E3 ECM connector.
Standard:

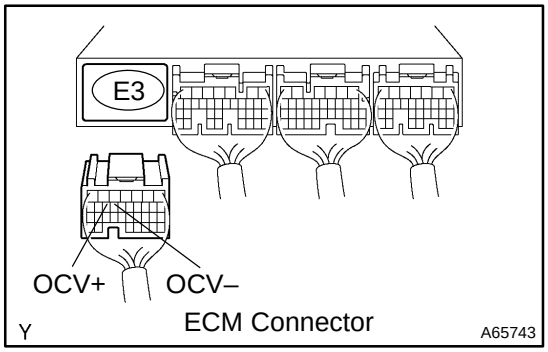
Tester Connection	Specified Condition
OCV+ (E3–15) – OCV– (E3–14)	Correct waveform is as shown

NG → **REPLACE ECM (See page 10–11)**

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 E3 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+ (E3–15)	Below 1 Ω
Oil control valve (C2–2) – OCV– (E3–14)	

Standard (Check for short):

Tester Connection	Specified Condition
Oil control valve (C2–1) or OCV+ (E3–15) – Body ground	10 kΩ or higher
Oil control valve (C2–2) or OCV– (E3–14) – Body ground	

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

(e) Reconnect the ECM connector.

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

OK

CHECK FOR INTERMITTENT PROBLEMS (See page 05–41)