DTC	P0011	CAMSHAFT POSITION ”A” −TIMING OVER−ADVANCED OR SYSTEM PERFORMANCE (BANK 1)

DTC	P0012	CAMSHAFT POSITION ”A” −TIMING OVER−RETARDED (BANK 1)

CIRCUIT DESCRIPTION

Refer to DTC P0010 on page 05−59.

DTC No.	DTC Detection Condition	Trouble Area
P0011	After engine is warmed up and engine speed is at 550 to 4,000 rpm condition (a) continues (1 trip detection logic) (a) Valve timing does not change from current valve timing (Problem of advanced valve timing)	• Valve timing • OCV • VVT controller assembly • ECM
P0012	After engine is warmed up and engine speed is at 550 to 4,000 rpm condition (a) continues. (2 trip detection logic) (a) Valve timing does not change from current valve timing (Problem of retarded valve timing)	• Same as DTC No. P0011

MONITOR DESCRIPTION

The ECM optimizes the valve timing using the Variable Valve Timing (VVT) system to control the intake valve camshaft. The 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. The VVT controller can advance or retard the intake valve camshaft.

Example:

A DTC will set if 1) the difference between the targeted and actual valve timing is more than 5 degrees of the camshaft angle (CA) and the condition continues for more than 4.5 seconds; or 2) the OCV is forcibly activated 63 times or more.

Advanced cam DTCs are subject to ”1 trip” detection logic.

Retarded cam DTCs are subject to ”2 trip” detection logic.

MONITOR STRATEGY

Related DTCs	P0011: Advance Camshaft Timing P0012: Retarded Camshaft Timing
Required sensors/ components (Main)	VVT OCV, VVT Actuator
Required sensors/ components (Related)	ECT sensor, Crankshaft position sensor, Camshaft position sensor
Frequency of operation	Once per driving cycles
Duration	Within 10 seconds
MIL operation	P0011: Immediate P0012: 2 driving cycles
Sequence operation	None

TYPICAL ENABLING CONDITIONS

The monitor will run whenever these DTCs are not present	See page 05−16
Battery voltage	11 V or more
Engine RPM	550 to 4,000 rpm
ECT	75 to 100°C (167 to 212°F)

TYPICAL MALFUNCTION THRESHOLDS

P0011 (Intake valve timing advance):

Deviation of valve timing	More then 5°CA (Crankshaft angle)
Valve timer	No change at advanced valve timimg

P0012 (Intake valve timing retard):

Deviation of valve timing	More then 5°CA (Crankshaft angle)
Valve timing	No change at retarded valve timimg

If the difference between ”target” and ”actual” camshaft timing is larger than the specified value, the ECM operates the VVT actuator.
Then, the ECM monitors the camshaft timing change for 5 seconds.

WIRING DIAGRAM

Refer to DTC P0010 on page 05−59.

INSPECTION PROCEDURE

HINT:

Abnormal bank	Problem of advanced OCV	Problem of retarded OCV
Bank 1	P0011	P0012

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, 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	**CHECK VALVE TIMING (See page 14−75)**

(a) Check for loose or jumped tooth of timing chain.

OK: The matchmarks of crankshaft pulley and camshaft pulley are aligning.

NG → **ADJUST VALVE TIMING (See page 14−75)**

OK

2	**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) Enter the following menus: DIAGNOSIS / ENHANCED OBD II / ACTIVE TEST / VVT CTRL B1.
(e) 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

NG → **Go to step 4**

OK

3	CHECK IF DTC OUTPUTS REOCCUR

(a) Erase the DTC(s) using one of the following methods: 1) use the hand−held tester, 2) disconnect the battery terminals for more than 60 seconds, or 3) remove the EFI and ETCS fuses for more than 60 seconds.

HINT:

After disconnecting the battery terminals, perform the ”INITIALIZE” procedure (see page 05−1123).

(b) Start and warm up the engine.

(c) Drive the vehicle for 10 minutes or more.

(d) Read output DTC using the hand−held tester.

OK: No DTC output.

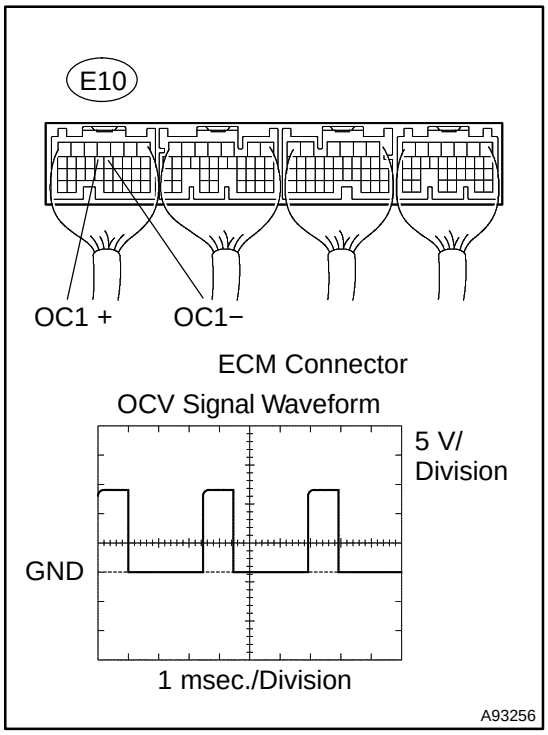
OK → **VVT SYSTEM OK**

HINT:

*: DTCs P0011 and P0012 are output when a foreign object in the engine oil enters the system. These codes will stay even if the system returns to normal after a short time. Foreign objects are filtered out by the oil filter.

NG

4	CHECK ECM (OCV SIGNAL)



(a) During idling, check the waveform of the E10 ECM connector using the oscilloscope.

Standard:

Tester Connection	Specified Condition
E10−13 (OC1+)− E10−12 (OC1−)	Correct waveform is as shown

NG → **REPLACE ECM (See page 10−9)**

OK

5	CHECK OIL CONTROL VALVE FILTER

OK: The filter is not clogged.

NG → REPLACE OIL CONTROL VALVE FILTER

OK

6	CHECK CAMSHAFT TIMING OIL CONTROL VALVE ASSY (OCV) (See page 10−2)

OK: OCV has no contamination and moves smoothly.

OK → Go to step 8

NG

7	REPLACE CAMSHAFT TIMING OIL CONTROL VALVE ASSY (OCV)

GO

8	CHECK CAMSHAFT TIMING GEAR ASSY (See page 14−89)

OK → Go to step 10

NG

9	REPLACE CAMSHAFT TIMING GEAR ASSY (See page 14−89)

GO

10	CHECK FOR BLOCKAGE (OCV, OIL CHECK VALVE AND OIL HOLE)

OK: No blockage.

NG → REPAIR OR REPLACE

OK

11	CHECK IF DTC OUTPUTS REOCCUR

(a) Erase the DTC(s) using one of the following methods: 1) use the hand−held tester, 2) disconnect the battery terminals for more than 60 seconds, or 3) remove the EFI and ETCS fuses for more than 60 seconds.

HINT:

After disconnecting the battery terminals, perform the ”INITIALIZE” procedure (see page 05−1123).

(b) Start and warm up the engine.

(c) Drive the vehicle for 10 minutes or more.

(d) Read output DTC using the hand−held tester.

OK: No DTC output.

OK → **VVT SYSTEM OK**

HINT:

*: DTCs P0011 and P0012 are output when a foreign object in the engine oil enters the system. These codes will stay even if the system returns to normal after a short time. Foreign objects are filtered out by the oil filter.

NG

REPLACE ECM (See page 10−9)

OBD II scan tool (excluding hand−held tester):

1	CHECK VALVE TIMING (See page 14−75)

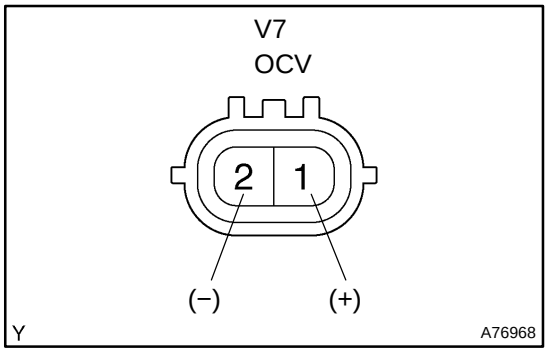
(a) Check for loose or jumped tooth of timing chain.

OK: The matchmarks of crankshaft pulley and camshaft pulley are aligning.

NG → **ADJUST VALVE TIMING (See page 14−757)**

OK

2	INSPECT OPERATION OF OCV



(a) Start the engine.

(b) Check the engine speed with (1) and (2).

(1) Disconnect the V7 OCV connector.

(2) Apply battery positive voltage between the terminals of the OCV.

Result:

Proceed to	Check (1)	Check (2)
A	Normal engine speed	Rough idle or engine stall
B	Conditions other than A	Conditions other than A

B → **Go to step 4**

A

3 CHECK IF DTC OUTPUTS REOCCUR

(a) Erase the DTC(s) using one of the following methods: 1) use the hand−held tester, 2) disconnect the battery terminals for more than 60 seconds, or 3) remove the EFI and ETCS fuses for more than 60 seconds.

HINT:

After disconnecting the battery terminals, perform the ”INITIALIZE” procedure (see page 05−1123).

(b) Start and warm up the engine.

(c) Drive the vehicle for 10 minutes or more.

(d) Read output DTC using the hand−held tester.

OK: No DTC output.

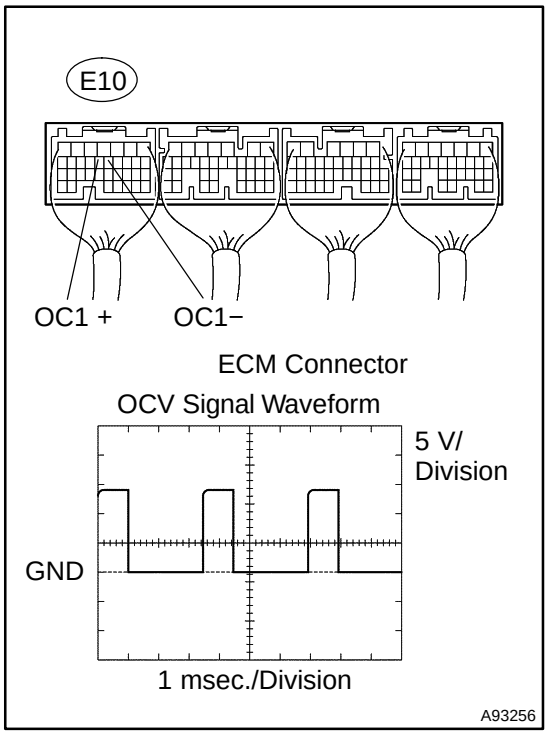
OK → **VVT SYSTEM OK**

HINT:

*: DTCs P0011 and P0012 are output when a foreign object in the engine oil enters the system. These codes will stay even if the system returns to normal after a short time. Foreign objects are filtered out by the oil filter.

NG

4 CHECK ECM (OCV SIGNAL)



(a) During idling, check the waveform of E10 ECM connector using the oscilloscope.

Standard:

Tester Connection	Specified Condition
E10−13 (OC1+)− E10−12 (OC1−)	Correct waveform is as shown

NG → **REPLACE ECM (See page 10−9)**

OK

5	CHECK OIL CONTROL VALVE FILTER

OK: The filter is not clogged.

NG → REPLACE OIL CONTROL VALVE FILTER

OK

6	CHECK CAMSHAFT TIMING OIL CONTROL VALVE ASSY (OCV) (See page 10−2)

OK: OCV has no contamination and moves smoothly.

OK → Go to step 8

NG

7	REPLACE CAMSHAFT TIMING OIL CONTROL VALVE ASSY

GO

8	CHECK CAMSHAFT TIMING GEAR ASSY (See page 14−89)

OK: Camshaft timing gear rotate smoothly when apply pressure.

OK → Go to step 10

NG

9	REPLACE CAMSHAFT TIMING GEAR ASSY(See page 14−89)

GO

10	CHECK FOR BLOCKAGE (OCV, OIL CHECK VALVE AND OIL HOLE)

OK: No blockage.

NG → REPAIR OR REPLACE

OK

11	CHECK IF DTC OUTPUTS REOCCUR

(a) Erase the DTC(s) using one of the following methods: 1) use the hand−held tester, 2) disconnect the battery terminals for more than 60 seconds, or 3) remove the EFI and ETCS fuses for more than 60 seconds.

HINT:

After disconnecting the battery terminals, perform the ”INITIALIZE” procedure (see page 05−1123).

(b) Start and warm up the engine.

(c) Drive the vehicle for 10 minutes or more.

(d) Read output DTC using the hand−held tester.

OK: No DTC output.

OK → **VVT SYSTEM OK**

HINT:

*: DTCs P0011 and P0012 are output when a foreign object in the engine oil enters the system. These codes will stay even if the system returns to normal after a short time. Foreign objects are filtered out by the oil filter.

NG

REPLACE ECM (See page 10−9)